



# Laser Hair Removal & Skin Rejuvenation

Licensed for use by SensualSpa Beauty Trainings LTD

All Rights Reserved

No part of this publication, document or any part thereof may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, storage in a retrieval system, or otherwise without the prior permission of the author.

The course aims to ensure you; the student understands the basics of health and safety and anatomy and physiology of the treatment. This manual covers the treatment background, benefits, consultation and contra-indications, contra-actions, aftercare and equipment and products required to perform the treatment. The practical techniques will be covered on the practical session to ensure competency in the procedure.

### **Objectives**

At the end of the course, you will be able to perform a treatment in a professional, safe and hygienic manner in a commercially acceptable time, along with experience in carrying out a thorough consultation with the knowledge of the background, benefits, consultation, contra-indications, contra-actions, aftercare, equipment and the products needed.

### **Accreditation**

This course is accredited by:

- VTCT and CPD

### **Medical Disclaimer**

It is advised that you take medical advice if you or any of your clients have a health problem. Any qualification from SensualSpa Beauty Trainings LTD will not qualify you to advise on or diagnose any medical condition.

## **Health & Safety**

You will need to maintain a high standard of hygiene as well as health and safety, not only for yourself but also for your employees, clients and any visitors to your business.

It is a legal requirement for employees to display an approved health and safety poster or to provide employees with an equivalent leaflet or information.

All businesses are required by law to comply with the following acts, which are monitored and managed by The Health & Safety Executive (HSE). You should also get copies of the following regulations from your local council or off the HSE website.

### **Health and Safety at Work Act 1974**

This protects your rights as an employer or employee. The law states that the employer must provide a safe working environment, provide health and safety training for staff, produce a written policy of the company's health and safety policy and ensure that anyone on their premises is not exposed to any health or safety risks.

### **Trade Descriptions Act (1968 and 1972)**

These Acts prohibit the use of false descriptions of goods or services. The information must always be accurate, false comparisons must not be made, and misleading price comparisons must not be made. A product may not be described as being of a 'reduced' price if it has not been available at a higher price for a minimum of 28 days.

### **General Data Protection Regulation GDPR**

If you are collecting and storing personal data as a therapist, then you will need to comply with GDPR. You will need to decide which of the six lawful bases on which you will collect and store personal data and inform your clients of how and why you will retain their data and for how long. The Independent Commissioners Office will provide you with all relevant information.

### **Sale and Supply of Goods Act 1994**

This states that goods must be as described and of satisfactory quality. They should be fit for purpose and safe for use. It is the responsibility of the retailer to correct a problem where the goods are not as described.

### **COSHH Regulations and Risk Assessment (Control of Substances Hazardous to Health)**

COSHH regulations cover the essential requirements for controlling exposure to hazardous substances, and for protecting people who may be affected by them. You should carry out a COSHH assessment to identify all chemicals, products or other substances which could cause harm.

A substance is considered to be hazardous if it can cause harm to the body. It poses a risk if it is inhaled, ingested, in contact with the skin, absorbed through the skin, injected into the body or introduced to the body through cuts.

Always check the ingredients and instructions of all products to see what they contain and ensure they are correctly stored. If the product could cause harm, it should be listed on your COSHH assessment, together with what the risk is and who is at risk from it.

Next, decide on the degree of risk and who to minimise that risk. If you can, try to replace high-risk products with lower risk ones. Never leave chemicals identified as hazardous in areas accessible to the general public. Do not forget, COSHH substances include both those used for treatments and cleaning.

#### **Local Government (Miscellaneous Provisions) Act 1982**

A special treatment licence will be required if you carry out any form of massage, electrolysis or ear piercing and tattooing as they may produce blood and body tissue fluid. Each borough council in the UK has different requirements, so you should contact them to see whether they require you to hold a licence for the treatments you offer.

#### **The Management of Health and Safety at Work Regulations 1999**

Employers should make formal arrangements for maintaining and improving safe working conditions and practices. This includes competency training and risk assessments.

#### **Management of Health and Safety at Work Regulations 1999**

Employers should make formal arrangements for maintaining and improving safe working conditions and practices. This includes competency training and risk assessments.

#### **The Manual Handling Operations Regulations 1992**

This is relevant wherever manual lifting occurs to prevent skeletal and muscular disorders. The employer should undertake a risk assessment for all activities involving manual lifting.

#### **The Personal Protective Equipment at Work Regulations 2002**

This requires employers to identify activities which require special protective clothing, which must then be made available.

#### **The Health and Safety (Display Screen Equipment) Regulations 1992**

This covers the use of display screens and computer screens. This specifies the acceptable levels of radiation emissions from the screen, as well as identifying the correct posture and the number of rest periods.

#### **The Electricity at Work Regulations 1992**

Electrical items are potentially hazardous and should be used and maintained properly. You should always ensure that you are fully trained on a piece of equipment before operating it.

All electrical equipment should be regularly PAT tested to ensure it is safe to use. If any equipment is deemed to be faulty or unsafe, you should stop using it immediately and report the problem. Make sure the equipment is clearly marked as faulty until the problem has been corrected to avoid it being used by other members of staff.

#### **Health and Safety (First Aid) Regulations 1981**

Whatever the size of your business, you should always make sure you have a First Aid kit on-site, as well as an eyewash bottle. You should ensure this is fully stocked at all times. You should have at least one 'Appointed Person' on hand to take charge in an emergency who holds an HSE-approved basic first aid qualification. You can contact the HSE on 0845 345 0055 for a list of suitable training providers.

**RIDDOR-The Reporting of Injuries, Diseases & Dangerous Occurrences Regulations 1995**

Employers should report any such cases to the HSE Incident Contact Centre. This includes loss of sight, amputation, fracture and electric shock. In all cases where a personal injury of any type occurs, it should be recorded in an accident book.

**The Regulatory Reform (Fire Safety) 2005**

All premises must have adequate means of dealing with a fire, and all members of staff should know where these are. This can include fire extinguishers and blankets; however, you should only operate a fire extinguisher if you have been properly trained to do so. All equipment should be checked and maintained regularly.

Fire Drill notices should be clearly displayed and should inform people of what to do in case of a fire. All staff should be trained in the location of alarms, exits and meeting points.

**Consumer Protection Act 1987**

This Act aims to protect the customer from unsafe or defective services or products. All staff should be trained in using and maintaining products.

**The Provision and Use of Work Equipment Regulations 1998**

This states the duties of any users of the equipment. It identifies the requirements in selecting and maintaining suitable equipment, as well as the training and safe use of it.

**Cosmetic Products (Safety) Regulations 2008**

These regulations require that cosmetics and toiletries are safe for their intended purpose and comply with labelling requirements.

**Disability Discrimination Act 1996**

These Acts prohibit the use of false descriptions of goods or services. The information must always be accurate, false comparisons must not be made, and misleading price comparisons must not be made. A product may not be described as being of a 'reduced' price if it has not been available at a higher price for a minimum of 28 days.

**The Equality Act 2010**

gives disabled people important rights of access to everyday services. Service providers have an obligation to make reasonable adjustments to premises or to the way they provide a service. Sometimes it just takes minor changes to make a service accessible. What is considered a reasonable adjustment for a large business such as a bank, may be different from what is a reasonable adjustment for a small local salon. It is about what is practical in the service provider's individual situation and what resources the business may have. They will not be required to make adjustments that are not reasonable because they are unaffordable or impractical.



### Reporting Accidents

All accidents and near misses should be recorded in an Accident Report Book, which should be kept with a first aid kit on the premises.

The following information must be recorded:

- Full name and address of the person(s) involved in the accident.
- Circumstances of the accident.
- Date and time of the accident.
- All details of what may have contributed to the accident.
- The type of injury that occurred and treatment provided on or off-site.
- Details of any witnesses.

The Personal Protective Equipment at Work Regulations 1992

This act covers your requirements under the COSHH regulations. You are required to wear or provide to your employee's protective clothing or equipment (PPE) to ensure their health and safety when handling chemicals or coming into contact with bodily fluids.

### What PPE will you need?

- Powder-free non-latex Gloves that must be changed for each new client.
- Disposable aprons.
- Face Masks
- Eyewear (optional)

Some therapists like to wear eye protection, although the risk is very low from spillages or splashes. However, a new apron, facemask and gloves should be worn before each new client.



### Salon Hygiene, Health & Safety

- The salon should be cleaned thoroughly every day.
- The working area must be cleaned before and after every client.
- Fresh towels and linen should be used for every new client that has been laundered at a minimum of 60°C.
- Couch roll, disposable plastic sheeting or waterproof bed sheets need to be used to protect the couch and keep the area as clean as possible.
- Products should be dispensed from purpose-specific pump or spray bottles. Creams can be removed from jars or bottles with clean spatulas.
- Replace all lids on products securely after use.
- All tools that are non-disposable should be sterilised prior to use.
- Bins should be metal and have foot pedal operations and be emptied every day. Bins should be collected by an appropriate commercial waste disposal company.
- All fire exits should be clearly marked and accessible at all times.
- Read all labels and follow manufactures instructions.

- Know the hazardous warning signs on products.
- Store products safely and in accordance with safety data sheets.
- Ensure equipment is placed on a sturdy surface and cannot fall off.
- Check wires and plugs regularly on any electrical equipment. Ensure electrical equipment is PAT tested annually. Faulty equipment should not be used.
- A first aid kit that complies with the Health and Safety (First Aid) Regulations 1981.

### Appearance of the Therapist

A therapist should ensure that they look well presented at all times. Therapists will be working in close contact with a client, and it is important that a professional image is observed.

A therapist should:

- Wear clean, freshly laundered and ironed uniform each day.
- Wear clean, flat, closed-toe shoes.
- Have short, clean, manicured nails.
- Have a fresh breath.
- Wear antiperspirant.
- Apply modest makeup for a natural look.
- Wear hair up and away from the face.
- Wear minimal jewellery.

### Professional Ethics and Standards of Practice

Therapists should:

- Maintain the highest possible standards of professional conduct.
- Always be courteous and show respect for clients, colleagues and other professionals.
- Never gossip or criticise another therapist, salon or brand.
- Never talk across a client to another member of staff.
- Not to engage in conversations about politics, religion or race that may cause offence.
- Maintain a good reputation by setting an example of good conduct in all your communication with clients, team members and visitors to the business.
- Ensure to make the treatment or service special for every client.
- Respect client confidentiality.
- Explain the treatment to the client and answer any questions and queries prior to carrying out the treatment.
- Treat all clients in a professional manner at all times regardless of their race, colour, religion, sexual orientation or ability.
- Not to treat minors or clients with limited mental capacities, such as those with Alzheimer's or dementia without prior written consent from a parent or carer.

Practising good ethics is essential for the reputation of the therapist and the welfare of the clients. The following is an example of standards and ethics for therapists:

- Conduct yourself in a professional, honest and ethical manner.
- Promote professionalism
- Establish a treatment plan with your client and evaluate the outcome at the end of every session.
- Truthfully represent your credentials, qualifications and education, experience, training and competence relevant to practice.
- Maintain the confidentiality of the client.
- Take a full medical history of the client and ensure that they are suitable for treatment and the treatment is the best solution for their concerns.
- Give full aftercare advice.

Precautions Taken in the Salon to Prevent Contamination and Cross-Infection



**Hands**

Wash with soap/disinfectant and warm water before and after each client—dry hands with a paper towel or blower.

**Surfaces**

Wipe over with disinfectants, e.g. Alcohol, Surgical spirits.

**Treatment of Wounds**

If the skin bruises or bleeds after the insertion of a needle, a small pad of dry cotton wool should be used over the area to cover it and apply pressure until the bleeding stops. Apply aftercare solution to the area and work in a different area. The same applies to extractions or any other form of skin piercing. Use disinfectant to clean area.

**Disposal**

Sharp metal instruments, e.g. needles, lancets, should be placed in a sharps box after use. When the box is about 3/4 full, it may be disposed of by special arrangement. Usually collected by local health office and incinerated at a local hospital.

**Metal Instruments**

Sterilised before and after each client in Autoclave or in Glass bead steriliser, and wipe with Chlorhexidine Gluconate or Methylated spirits.

**Skin Preparation**

Do not use sharp or pointed instruments on or at least near areas of a client's skin that are obviously diseased, infected or inflamed. Except in facial treatments during the extracting phase (a tile with a lancet and cotton wool dampened with methylated spirits and an antiseptic solution containing Chlorhexidine Gluconate must be prepared, hands should be washed before and after extractions and finger cots or gloves must be used).

**Cuts on your Hands**

Cover existing wounds with a waterproof dressing, wash fresh cuts and encourage bleeding under running water and then cover with a waterproof dressing. Clean with an antiseptic. Always have a box of plasters/waterproof dressing available. No salon should be without a first aid kit.

**Needles**

Do not test needles on yourself. Test needles on a damp of cotton wool held with tweezers. Needles should only be used once, and needles must not be used on more than one client.

**Creams**

Tubes are better than jars. Always use a spatula to obtain creams from containers. Never use fingers and always close a container after use. Excess product must not be returned to containers.

**Blood**

Anything that has come into contact with blood must be disposed of in the correct manner. Pay attention to the following: Hands, lancets, tweezers, surface, disposal gloves, bin liners, cotton wool or gauze and needles)

**Colds/Flu**

Wear a surgical mask. Wash your hands regularly, especially after sneezing or blowing the nose. Also, wash hands in general after touching other surface areas. General advice - stay at home when feeling ill or send employees home if they develop cold/flu symptoms at work.

**Waste Bins**

Bin liners. Emptied regularly. Bins should have lids.

**Gloves**

Surgical gloves can be used, e.g. epilation or, to prevent contamination. Used always when performing any procedure that breaks the skin and any action that may come into touch with blood.

**Instruments**

Must be cleaned, sanitised and sterilised or where appropriate disposable tools should be used.

## Sterilisation Methods

### Autoclave

- Works like a pressure cooker.
- Consists of 2 chambers. Water in the lower chamber and instruments on the upper chamber.
- The principle of sterilisation is moist heat.
- The water boils in the lower chamber and steam is released towards the upper chamber. Instruments are left in the unit for 10 - 20 min. Afterwards, instruments must be placed in a sterile and clean container.
- The moist heat autoclave operates at 121°C and is considered a very effective means of sterilisation.
- Other types available, e.g., dry heat autoclave, vacuum autoclave, flash instrument autoclave.
- The time and temperature of dry heat autoclave is 160°C (320°F) for 2 hours or 180°C (356°F) for one hour.
- Consult manufacturer's instructions and local government laws and regulations on sterilisation times and temperatures.



### Advantages of an Autoclave

- Economical and very effective
- Non-toxic on instruments
- Easy to operate

### Disadvantages of an Autoclave

- Sharp instruments can become blunt.
- Metal instruments might rust. Recommend use of stainless-steel instruments.
- Expensive
- Plastic instruments will be damaged.
- Autoclaves will need to be kept clean.
- Regular servicing and calibration are required of the device.

### Glass Bead Steriliser



- Operates at approximately 300°C.
- Metal instruments will thus be completely sterilised within minutes.
- Only the parts covered with beads will be sterilised.
- The unit takes + 20 - 30 minutes to warm up before sterilisation can take place.
- If more than one instrument is placed in the container, a longer time must be added for sterilisation.
- Consult manufacturers` instructions and local government laws and regulations on sterilisation times and temperatures

### Wet Sterilisation (Chemical)

Asepsis can be obtained by washing down all surfaces, walls, floors, treatment beds, tiles, trolleys, work surfaces, basins etc. after basic cleaning with an antiseptic solution. EG: Antiseptic solution concentrates, diluted according to manufacturers' instructions. Towels can also be disinfected in this method. If metal tools are sterilised by this method, the liquid must contain a rust inhibitor.

### UV Cabinet

- They are used for the maintenance of your sterilisation process.
- Basically, used as a storage unit.
- They are not used for sterilisation only for sanitation.
- This cabinet will keep your item as clean as it was when you first inserted it.



### Antiseptics and Disinfectants

#### Antiseptic

A diluted disinfectant that is safe to apply to the skin. Its' task is to slow down multiplication, growth and in some cases may destroy/kill micro-organisms if the strength of the solution is correct, e.g. some soaps (hands), alcohol and hydrogen peroxide etc.

#### Disinfectant

A chemical agent which destroys or kills all micro-organisms. Safe to apply on surfaces but too toxic to be applied directly onto the skin, e.g. Quaternary Ammonium compound/Quats, formalin, ethyl or grain alcohol.

#### Ergonomics

Posture is important, whether you are sitting or standing up to do a treatment. Try to find a working position that is comfortable for you and reduces the need to lean over to just one side.

Using height adjustable treatment couches and chairs. Choose a height that reduces your need for bending over the client. Ideally, your back should be at a 90-degree angle. Your chair should be comfortable to avoid pressure point sores or injury.

Try to avoid twisting the neck, keep your head upright and keep your shoulders relaxed.

Never ignore pain; look at ways to alleviate the symptoms. If you cannot take a break during treatment, then you can adopt gentle stretching techniques.

Repetitive strain injuries can be caused by using the same movements over and over again. Try to avoid repetitive flexing of the wrist and instead alternate by bending elbows or shoulders instead. Equipment should feel comfortable in your hand and have as minimal vibration as possible.

#### Storage

- Make sure you receive a copy of Material Safety Data Sheets (MSDS) from your suppliers.
- All staff must be trained on the use of products and equipment.
- Training manuals and information leaflets should be accessible to all staff.
- Store your products correctly by following the guidance on the MSDS.
- Carry out a risk assessment on each product or COSHH report if required.
- Keep products in original containers where possible and ensure any decanted products are fully labelled in smaller, purpose-built containers.
- Keep all flammable products out of direct sunlight and at room temperature or below.

- Mobile therapists must make suitable travel arrangements to avoid spillage and ensure safe working practice and be professional in appearance.

## Insurance

There are several types of insurance that are potentially relevant to you as a therapist. The most important is the 'Professional Indemnity Insurance' and 'Public Liability Insurance'. Both of these are necessary in the unlikely event that a client decided to sue you.

**Public Liability Insurance** - This covers you if a member of the public, i.e. a client or passer-by is injured on your premises or if their personal property is damaged in any way.

**Professional Indemnity Insurance** - This protects you should a client decide to sue you claiming personal injury or damage as a result of treatments carried out by you.

**Employer's Liability Insurance** - This is only necessary if you hire others to work for you. This type of insurance would cover you should a member of your staff have an injury on your premises.

**Product Liability Insurance** - This insurance is important if you plan to use, manufacture or sell products as part of your business. This will protect you in the event that a client is dissatisfied with the product or experiences a reaction to using the product.

**Car Insurance** - If a car is used for business purposes, ensure that this is covered by the policy and that theft of equipment is included.

## The Environmental Protection Act 1990

Under this act, anyone that disposes of waste has a duty of care to ensure that waste is disposed of safely. Subjects covered by the Environmental Protection Act 1990 are as follows:

- Waste management
- Noise pollution
- Neighbourhood pollution
- Radioactive substances
- Genetically Modified organisms
- Nature Conservation

Under the [Environmental Protection Act 1990](#), it is unlawful to deposit, recover or dispose of controlled (including clinical) waste without a waste management licence, contrary to the conditions of a licence or the terms of an exemption, or in a way which causes pollution of the environment or harm to human health. Contravention of waste controls is a criminal offence. [Section 34](#) of the act places people concerned with controlled (including

clinical) waste under a duty of care to ensure that the waste is managed properly, recovered or disposed of safely and is only transferred to someone who is authorised to keep it. Householders are exempt for their own household waste.

Hazardous healthcare waste is subject to the requirements of the [Hazardous Waste Regulations 2005](https://www.gov.uk/healthcare-waste). [Extract is taken from Gov.UK website <https://www.gov.uk/healthcare-waste> 30th June 2014]

All commercial businesses must have a waste removal contract with either the council or a private waste removal company. If you produce less than one bin bag full of clinical waste per collection, then you can dispose of clinical waste such as cotton wool and tissues in with a normal waste collection. If you produce more than this per collection, then a suitable clinical waste contract must be obtained.

### **The Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995**

These regulations are commonly referred to as RIDDOR, and their main purpose is to alert the enforcing authorities to incidents and causes of ill health that may need further investigation. Their second role is to collate statistics and to assist in the implementation of initiatives to reduce accidents in the workplace.

If any of your employees or trainees suffer a personal injury at work that results in either;

- Major Injury
- Death

Then you must contact the Incident Contact Centre on 0845 3009923.

Less serious injuries have to be reported using form F2508 available on the HSE website. Less serious injuries include:

- More than 24 hours in a hospital
- Incapacity for more than 7 days.

Other incidences that are reportable include:

- A member of the public or client is injured and admitted to hospital.
- Any member of staff that is injured due to an act of violence that is work-related.

All records of injuries, minor or major, must be recorded in your accident book.

Further guidance can be found on the HSE website [www.hse.gov.uk/riddor](http://www.hse.gov.uk/riddor).

### **Health & Safety (First Aid) Regulations 1981**

Your environmental health officer may ask if you have a completed First Aid training. The HSE recommends that businesses with fewer than 50 staff members should have at least one qualified and appointed First Aider. First Aid courses can last anything from half a day to 3 days. The half-day courses are not usually accredited, so it is highly recommended to at least complete a full day of First Aid training.

These regulations also require that every employer provides equipment or facilities for providing First Aid to their employees. Even if you do not have employees, having a First Aid Kit to hand when required is good practice.

A First Aid box and an eyewash station with single-use pods should be enough, with extra items kept aside for restocking.

Your First Aid box should contain the following:

Number of Employees	1-5	6-10	11-50
---------------------	-----	------	-------

Contents	QTY	QTY	QTY
First Aid Guidance Notes	1	1	1
Individually wrapped sterile adhesive dressings	20	20	40
Sterile Eye Pads, with attachment	1	2	4
Sterile triangular bandages	1	2	4
Safety Pins	6	6	12
Medium sized sterile unmedicated dressings	3	6	8
Large sterile unmedicated dressings	1	2	4
Extra Large sterile unmedicated dressings	1	2	4

First Aid boxes must not include any form of medication. Such as Paracetamol or Ibuprofen

### Anaphylaxis

Some allergies can lead to a severe allergic reaction - known as anaphylaxis. Anaphylaxis can be life-threatening.

Symptoms can occur quickly or within hours following contact with an allergen. Prompt treatment can save a life. If you have an adrenaline auto-injector - use it immediately.

### Common causes

Common causes of anaphylaxis are **wasp and bee stings** as well as **food**, such as peanuts, nuts, sesame seed, fish and shellfish, dairy products and egg. Other causes include **latex, penicillin and some other medications**.

For some, fatigue or exercise may cause anaphylaxis - alone or in combination with other triggers like food or medication. Cold can also be a cause. In rare cases, a reaction can occur without apparent cause.

### Symptoms

- Itching, especially under the feet, in the hands or on the head
- A stinging feeling in the mouth
- Swelling in the mouth, throat, lips or eyes
- Itching, redness or nettle-rash anywhere on the body
- Dizziness, anxiety, cold sweating
- Abdominal pain, nausea or vomiting
- Shortness of breath or asthma symptoms
- Sudden fatigue, decreased blood pressure or fainting
- Disorientation or loss of consciousness

**Critical symptoms:** difficulty to breath, mouth and throat swell, sudden fatigue or dizziness, experiencing a steady worsening of symptoms.

If your client experiences these critical symptoms, inject adrenaline immediately. Call 999 and say "anaphylaxis".

### Treatment

**Adrenaline** is the first-line treatment for anaphylaxis. If you have an adrenaline auto-injector - use it immediately. Adrenaline injected into the outer mid-thigh muscle works rapidly to reduce throat swelling, open up the airways and maintain heart function and blood pressure. It is the only medication available for the immediate treatment of severe allergic reactions.

**Antihistamine and steroid tablets.** Antihistamine reduces hives, itching and irritation. Cortisone reduces the risk of late-onset reactions that can occur some hours following contact with allergens.

### Who is at risk of anaphylaxis?

A person who has previously experienced anaphylaxis - irrespective of cause - is at risk in the future.

If the reaction was caused by peanuts, shellfish or fish, it should not be ignored, even if mild. This is especially important if the reaction was caused by peanuts. This is also the case for certain drugs, insect stings or latex. Your doctor will give you essential information and prescribe suitable medication.

### **When your client suffers from anaphylaxis**

Do not underestimate the severity of an allergic reaction. Use your adrenaline auto-injector according to its instructions. **If in doubt, use your adrenaline auto-injector** - it can save their life. Then lay them down with their legs slightly elevated.

Call 999 and say, "anaphylaxis." State your name, location and telephone number.

If possible, someone should wait outside to show the ambulance crew where you are.

Let ambulance personnel know about the client's medical history and treatment undertaken.

### **Managing Complications**

Anyone working in aesthetics or undertaking treatments that break the skin, i.e. injectables or involve the injection of application of a product that could cause an allergic reaction, should undertake appropriate training in managing complications. Training should be taken regularly to ensure you stay up to date with current regulations and feel confident in dealing with any issues that should arise.

Complications training is usually in addition to first aid and anaphylaxis training.

Understanding the array of issues that could be presented from aesthetic procedures will allow you to confidently provide treatments to your clients.

Invasive procedures always carry more risk than other treatments in a salon, and it is important that we are able to identify risk and know how to avoid it.

### **Electrical safety**

Electrical appliances, if not used correctly, can be dangerous and cause harm. Hazards include:

- **Electrocution:** the main electricity supply (230 volts) Will deliver a large enough current through the body to injure or kill someone. A current as low as 0.1 amps can be fatal.
- **Electrical fires:** overloaded sockets, extension leads or faulty appliances can lead to overheating and fires.
- **Explosions:** in the event of a gas leak, a spark from an electrical switch is all that is needed to create an explosion.
- **Tripping:** trailing wires or badly positioned appliances can be a tripping hazard.

Medical employers and employees have responsibilities on the electricity at work regulations (1989) to ensure that all electrical equipment is used safely. The following rules should be observed:

- Equipment should be stored in the correct place when not in use and all the wires and attachments securely fixed.
- Any equipment with twisted, frayed or worn wires or with cracked or loose plugs should not be used.
- Plug sockets should not be overloaded by using multiple adapters.
- Check that plugs have the correct fuse.
- Whilst using electrical equipment, ensure that it is on a stable surface, come away from water and with the leads safely tucked away.
- Do not operate electrical equipment with wet hands.
- Always read and follow the manufactures instructions.

### **Safety features**

All electrical equipment has a number of Safety features:

#### **Fuses**

A fuse is a deliberate weak spot in a circuit that is designed to 'blow' if the current flowing through it is too large. All three-pin plugs have fuses fitted, whilst some appliances may have fuses fitted to them.

Blown fuses should be replaced with a fuse of the correct rating. If fuses on the appliance or plug keep blowing, the appliance is faulty and should be checked by an electrician before further use. Fuses will not protect against electrocution but will offer protection from overheating.

#### **Earthing**

The largest pin on a three-pin plug is known as the earth pin. No current flows through this pin if the appliance is working correctly. If a fault occurs a current flows through the earth pin and allows the fuse to blow. Since they give protection against electrocution, the earth pin and its connections are an important safety feature.

Metal water pipes must also be earthed. This is done by using wires with green and yellow striped plastic coating. This is designed to help prevent electrocution; if a live wire accidentally touches the pipe. If the pipe is connected to the earth, a current will flow to the earth through the wires, and the fuse will blow.

#### **Double insulated appliances**

As the name implies, this simply means that electrical mechanisms are protected by two layers of insulating material and are not earthed. Appliances such as hairdryers are double insulated. Double insulated appliances do not need anything. They usually have a plug with a rigid plastic pin rather than a metal one.

#### **Residual current circuit breaker**

Besides the earth pin on a three-pin plug, there are two smaller pins called the live pin and the neutral pin. When the appliance is working correctly, the current flowing in the two pins will be equal. Should a fault develop and the current starts to flow through you, less current will be coming out of the appliance through the neutral pin that is going into the appliance through the live pin is (because some of this current is going out through you). A residual current circuit breaker is created to detect the currents flowing in the two pins and turn off the circuit if the flow is not equal before you are electrocuted.

#### **Cost of electricity**

Electricity is measured in kilowatt-hours (sometimes called units). When calculating the cost of running an appliance, multiply the power of the appliance (measured in kilowatts) by the length of time of use (Measured in hours). This will give you the number of units used. Multiply this figure by the cost of each unit to get the total cost. For example, if you run a 3 kilowatts wax pot for six hours, we will have used  $3 \times 6 = 12$ -kilowatt hours. If the cost of one unit is 8p, that this will cost  $12 \times 8 = 96$ p.



## Anatomy and Physiology

### Skin Anatomy

The skin makes up around 12% of an adult's body weight. The skin has several important functions which include:

---

S	<b>Sensation</b>	The main sensory organ for temperature control, pressure, touch and pain.
H	<b>Heat Regulation</b>	The skin helps to regulate the bodies temperature by sweating to cool the body down when it overheats and shivering when the body is cold.

---

<b>A</b>	<b>Absorption</b>	Some creams, essential oils and even much-needed water can be absorbed through the skin.
<b>P</b>	<b>Protection</b>	Overexposure to UV light may harm the skin; the skin protects itself by producing a pigment, called melanin, which we see when we tan. Bacteria and germs are also prevented from entering the skin by a protective barrier called the Acid Mantle. This barrier also helps to protect against moisture loss.
<b>E</b>	<b>Excretion</b>	Waste products and toxins are eliminated from the body through sweat glands.
<b>S</b>	<b>Secretion</b>	Sebum and sweat are secreted onto the skin's surface. The sebum keeps the skin lubricated and soft, and the sweat combines with the sebum to form the acid mantle.
<b>V</b>	<b>Vitamin D Production</b>	Absorption of UV rays from the sun helps with the formation of Vitamin D, which is needed by the body for the formation of strong bones and good eyesight.

Skin is made up of 3 major layers known as the Epidermis, Dermis and the Subcutaneous.

### The Epidermis

This is the outermost layer of the skin. There are various layers of cells within the epidermis, the outermost of which is called the stratum corneum (or horny layer). The layers can be seen clearly in the diagram of the skin. The surface layer is composed of twenty-five to thirty sub-layers of flattened scale-like cells, that are continually being exfoliated off by friction and replaced by the cells beneath.

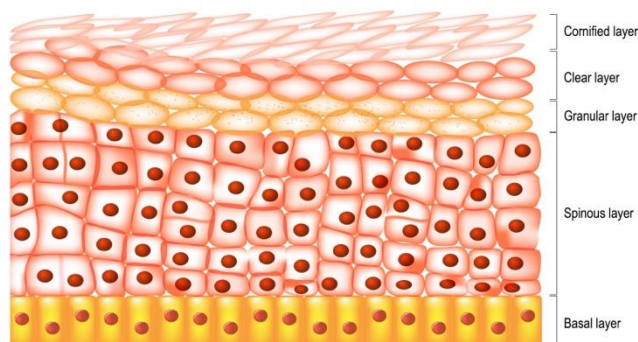
The surface layer is considered the real protective layer of the skin. Cells are called keratinised cells because the living matter within the cell (protoplasm) has changed to form a protein (keratin) which helps to give the skin its protective properties.

New skin cells are formed in the deepest layer of the epidermis. This layer is known as the stratum basale. New cells being to gradually move from this layer towards the stratum corneum to be shed. As they move towards the surface, the cells undergo a process of change from a round, living cell to a flat, hardened cell.

The layers of the epidermis from top to bottom are known as:

- Stratum Corneum/Horny Layer
- Stratum Lucidum/Clear Layer (only found in the palms on the hands and soles of the feet)
- Stratum Granulosum/Granular Layer
- Stratum Spinosum/Prickle Cell Layer
- Stratum Basale/Basal or Germinative Layer

## LAYERS OF EPIDERMIS



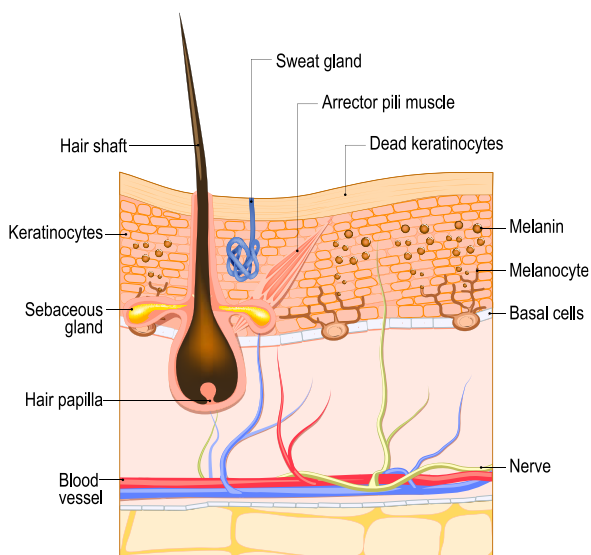
### Dermis Layer

The dermis is a tough and elastic layer containing white fibrous tissue interlaced with yellow elastic fibres.

The dermis is an expanse layer and contains:

- Blood vessels
- Lymphatic capillaries and vessels
- Sweat glands and their ducts
- Sebaceous glands
- Sensory nerve endings
- The erector pili – which involuntarily activates tiny muscles attached to the hair follicle in cold weather to trap heat.
- Hair follicles, hair bulbs and hair roots

## Structure of the skin



### Subcutaneous Layer

This is the deepest layer of the skin and located beneath the dermis. It connects the dermis to the underlying organs. The subcutaneous layer is mainly composed of loose fibrous connective tissue and fat (adipose) cells interlaced with blood vessels. This layer is generally around 8% thicker in females than in males. The functions of this layer include insulation, storage of lipids, cushioning of the body and temperature regulation.

### The Skin

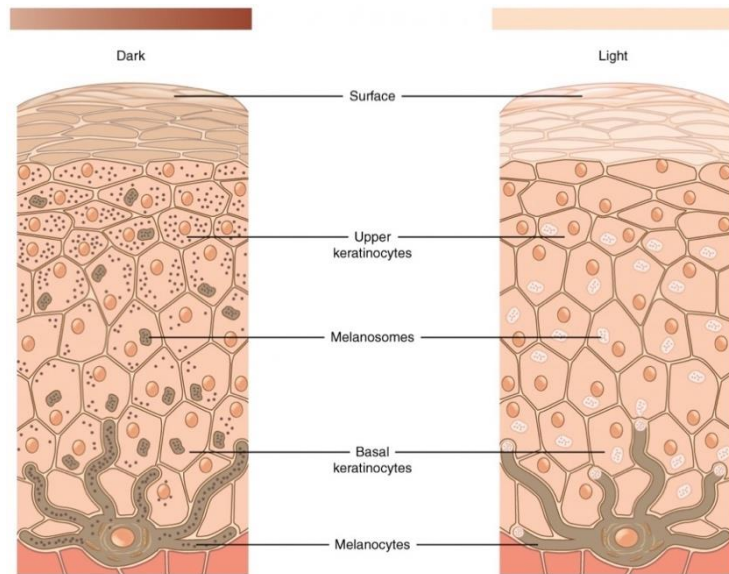
The skin comprises of 3 layers, the epidermis, the dermis and the subcutaneous layer.

The epidermis is the outermost layer of the skin and comprises of four cell types, keratinocytes, melanocytes, Langerhans cells and Merkel cells. The epidermis is also divided into layers comprising of living and non-living cells comprising of the stratum corneum, stratum granulosum, stratum spinosum and stratum basale.

The stratum corneum is made up of corneocytes and lipids and referred to as the epidermal barrier. It functions as an evaporative barrier that maintains the skin's hydration and suppleness and protects the body from microbes, trauma, irritants and UV radiation by acting as a physical barrier. Corneocytes contain the skin's natural

moisturising factor (NMF), which maintains the hydration of the stratum corneum. Corneocytes are bound together to each other by corneodesmosomes. A lipid bilayer surrounds the corneocytes, which comprise two layers of phospholipids that have hydrophilic heads and two hydrophobic tails. The epidermis requires a constant cell turnover to maintain its integrity and to function effectively. Young, healthy skin renews every 28 days, which is the time it takes for the keratinocyte to migrate from the living basal layer of the epidermis to the stratum corneum's surface and desquamate during the renewal process.

Melanin pigment, which determines the skin's colour and causes hyperpigmentation, is primarily concentrated within the epidermis and, in some conditions, is found within the dermis (in cases of melasma). There are two types of melanin pigment, pheomelanin and eumelanin. Pheomelanin is yellow to red in colour and is found in lighter skin tones. Eumelanin is brown to black in colour and is the predominant type of melanin in darker skin types. Melanin synthesis (melanogenesis) occurs when melanocytes in the basal layer of the epidermis. The key regulatory step is the initial enzymatic conversion of tyrosine to melanin by tyrosinase. Melanin is packaged into melanosomes, intracellular organelles within the melanocyte; these are then distributed to surrounding epidermal keratinocytes. Melanin has a protective physiologic role in the skin to protect the nuclei of the keratinocytes by absorbing harmful UV radiation: and eumelanin has the greatest UV absorption capabilities. When the skin is exposed to UV radiation, melanin synthesis is upregulated, which is observed by the darkening of the skin as we tan. The number of melanocytes for both light and dark skin tones are similar; however, the quantity and distribution of melanin within the epidermis differ. Lighter skin tones have less melanin per square centimetre and smaller melanosomes that are closely aggregated in membrane-bound clusters. Darker skin tones have more melanin and larger melanosomes that are distributed singularly.



The dermis lies beneath the epidermis and divided into the more superficially dermis and deeper reticular dermis.

SKIN TYPE	DETAILS
I	Skin burns very easily and doesn't tan. Likely to have light blonde or red hair.
II	Skin will usually burn in the sun, and has difficulty tanning.
III	Skin will sometime burn and will tan gradually.
IV	Skin will tan easily and rarely burn.
V	Skin will tan without burning.
VI	Skin never burns and will tan very quickly.

The most predominant cell in the dermis is the fibroblast, which is abundant in the papillary dermis and sparse in the reticular layer. Fibroblasts synthesize most components of the dermal extracellular matrix (ECM), which includes structural proteins such as collagen and elastin, glycosaminoglycans such as hyaluronic acid, and adhesive proteins such as fibronectin and laminins.

Beneath the dermis and above the underlying muscle is the subcutaneous layer or superficial fascia. This layer mainly comprises both fatty and fibrous components.

### Glycosaminoglycans

Glycosaminoglycans (GAGs), also known as mucopolysaccharides, are polysaccharides that deal with the support and maintenance of skin structural proteins such as collagen and elastin. Frequently occurring glycosaminoglycans include hyaluronan and chondroitin sulfate, which function as water-binding molecules that can hold nearly 1000 times their own weight. This ability may serve to provide moisture for other skin components

(i.e., collagen and elastin). For this reason, the use of glycosaminoglycans in skincare are renowned for being excellent ingredients for increasing overall hydration. Lastly, glycosaminoglycans may also inadvertently supply anti-ageing benefits.

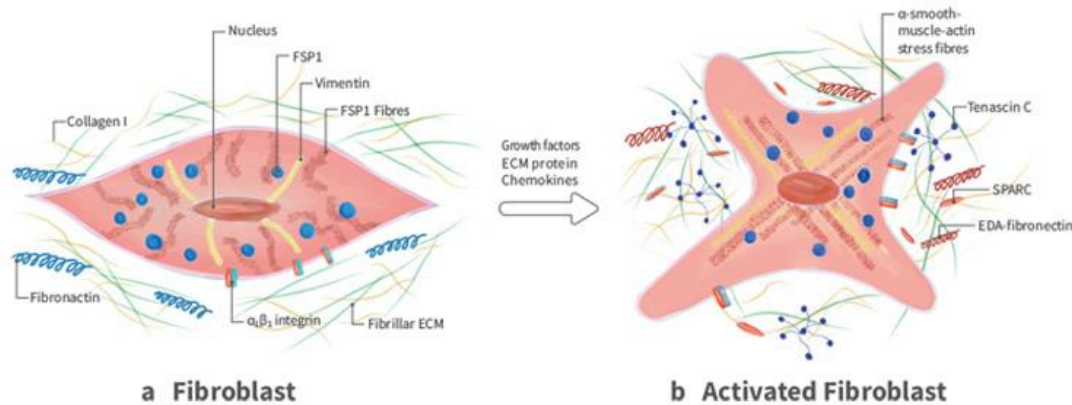
Examples of common glycosaminoglycans are chondroitin 6-sulfate, keratan sulfate, heparin, dermatan sulfate, and hyaluronate.

Glycosaminoglycans (GAGs) have widespread functions within the body. They play a crucial role in the cell signalling process, including regulation of cell growth, proliferation, promotion of cell adhesion, anticoagulation, and wound repair.

The GAG's retain water and form a gel substance through which ions, hormones and nutrients can freely move.

The main component of this gel is hyaluronic acid, which is a large polysaccharide made of glucuronic acid and glucosamine that attract water and is increased in tissues under repair or growth.

### Fibroblast



A fibroblast is a type of cell that is responsible for making the extracellular matrix and collagen. Together, this extracellular matrix and collagen form the structural framework of tissues in humans and plays an important role in tissue repair. Fibroblasts are the main connective tissue cells present in the body.

### Elastin

The same as collagen, elastin is present in many structures in the body, not just in the skin. Elastin makes up only around 3% of the skin, whereas collagen makes up 70% of the dry mass of skin. Degradation of elastic fibres is associated with UV exposure, and elastosis is one of the key features of photo-aged skin.

The fact that new elastin fibres are not produced is a challenge in the aesthetic industry.

### Collagen

Collagen is an abundant protein; it is the main component of connective tissue and is found not only in fibrous tissue like the skin but also in tendons, ligaments, cartilage, bones, corneas and blood vessels.

There are 18 collagen subtypes, 11 of which are in the dermis of the skin.

### Types of collagen

The basal lamina serves as structural support for tissues and as a permeable barrier to regulate movement of both cell and molecules.

The dermal-epidermal junction contains type IV collagen, laminin and highly specialised type VII collagen.

During wound healing, type III collagen appears in the wound about four days after the injury. Wound collagen or type III is immature collagen tissue and does not provide a great deal of tensile strength. It is initially deposited in the wound in a seemingly random fashion.

It will take approximately three months for type III collagen to mature into type I collagen.

As skin ages, reactive oxygen species, associated with many aspects of ageing, lead to increased production of the enzyme collagenase, which breaks down collagen. Then fibroblasts, the critical players in firm, healthy skin, lose their normal stretched state. They collapse, and more breakdown enzymes are produced. People in their 80s have four times more broken collagen than people in their 20s.

### **Immune functions of the skin**

Langerhan cells are 'guard' cells, found mainly in the Stratum Filamentosum (Spinosum) but start in the dermis.

They move across the skin and are stimulated to action by the entry of foreign materials, acting as macrophages to engulf bacteria.

If someone has a bad immune system, any micro wound treatment will not be as effective.

### **The Lymphatic System: A system of fluid balance and immune defence**

When plasma passes out of capillary walls into the surrounding tissues, it is called interstitial fluid and provides the necessary nourishing substances for cellular life.

This interstitial fluid contains proteins that help draw fluid across the capillary wall.

Here, it will be drawn to the hyaluronic acid content of the glycosaminoglycans gel, aiding the support of collagen, elastin fibrils and the many other cells that reside in the dermis. Some fluid will move up through the dermal/epidermal junction towards the epidermis to aid the hydration of the epidermal cells and become part of the trans-epidermal water loss (TEWL) of the epidermis.

After bathing the cells, 90-98% of the interstitial fluid re-enters the capillaries, returning to the heart through the veins. The other 2-10% returns via the lymph capillary system, which is a system of dead-end capillaries that extend into most tissues, paralleling the blood capillaries.

Lymph fluid is the nourishing fluid of the cells. The lymphatic system is not only a reservoir of organic fluids and defence system against microbial invasion. Lymph fluid is the healer of wounds, the builder of tissues and regenerator for the body.

### **Nutritional Function**

It is in the lymphatic system that the daily metabolism, the combustion and absorption of nourishing elements coming from the intestine happen. Lymph fluid carries lipids and lipid-soluble vitamins absorbed from the gastrointestinal tract. This is one of the next most important functions of the lymphatic system.

The absorption of fats and fat-soluble vitamins from the digestion system and the subsequent transport of these substances to the venous circulation makes the lymphatic system invaluable to the health of the body and, of course, the skin. Particularly the absorption of beta-carotene (Vit A)

### **Metabolism of the Lymphatic System**

Lymph flows slowly; there is no 'pump' to accelerate the flow, and it relies on body movement (like walking) to help with transportation. If the lymph flow is steady and regular, the result is a balanced metabolism. When we

sleep or are sedentary for long periods of time, the lymphatic circulation becomes partly stopped. It has also been found fatigue, cold, over-exertion, and nervous tension will also slow it down.

When the lymph circulation slows down, waste products accumulate, and the lymph becomes viscous, with one of the first signs of an impaired lymphatic system is swelling in the hands and feet after periods of standing or sitting. Another indication is puffy eyes in the morning.

Because there are lymphatic capillaries not only in the sheaths around the nerves but also between the nerve bundles, the stagnant lymph exerts pressure, producing a feeling of pain on the tissues and nerve extremities. In addition, the stagnation of the fluid will produce a feeling of fatigue and heaviness in the limbs.

The effect of an impaired lymphatic system on skin cells of the dermis is very detrimental to cell renewal and repair. As cells dry out and vital functions like wound healing diminish, the tissues are poisoned by their own waste products.

As well as regular body movement, the lymphatic system relies on a regular fluid intake, as the internal hydration of the body must be maintained at an optimum level for the formation of these vital fluids. So, it is good to advise clients to increase water intake before and after treatment.

In conditions of poor body hydration, the supply of the vital interstitial fluids to the dermis is greatly reduced. This reduction of dermal fluid will have a knock-on effect on the epidermis, resulting in poor dermal/epidermal cell function and enzyme activity.

When addressing any skin condition that is related to hydration, treatment must begin with the systems that are responsible for the movement and maintenance of body fluids. Most importantly, the lymphatic system and the circulatory system they work together and are equally important.

### **Impaired Lymphatic System**

Swelling of the ankles, feet and fingers as an early physical indication of an impaired lymphatic system. Ankles are the first place to look and to test these areas for fluid retention; use the simple toxaemia test of pressing into the swelling, which will be apparent just above the ankle bone.

Do a very firm press into the swelling for about 30 seconds, then a quick release. Count how long it takes for shape and colour to return to the depressed area. If you have counted over 3 seconds, the probability you have an impaired lymphatic system is high.

**If a client has an impaired lymphatic system, advise them there will be fluid retention around the eyes for longer. This is normal**

### **Skin Analysis**

Skin analysis must be carried out before treatment. Ask the client to attend their appointment wearing no make-up.

#### **Skin Type**

- *Skin type* is how our skin behaves or looks due to the different genetic and hormonal make-up of our bodies.
- It cannot be changed by external treatments but can change over time internally. For example, oily skin may become lipid dry due to the reduction in oil production caused by the menopause
- It can only have its appearance improved and made more manageable – the skin type will still remain
- Products will only have an effect on skin type for as long as your client maintains a good routine

Skin Types are categorised as:

**Oily Skin** - experiences an excessive production of sebum due to an excess of the androgen hormone dihydrotestosterone (DHT)



- Sebum prevents water-loss
- The skin will have widespread sebaceous filaments, which are little pockets mainly composed of solidified sebum, inside the tiny hair follicles of the face.
- A greasy sheen can be seen on the skin.
- There are visible enlarged or thickened pores and an uneven texture.
- The skin will have some slip to it, especially on the t-zone.
- Puberty results in an increase in androgens, and this, in turn, increases sebaceous activity. It may result in enlarged pores as sebum fills up the follicles. The results are most pronounced on the t-zone, which is in the shape of a capital T starting at the chin, proceeding up the nose with the top across the forehead.
- The increase in sebum usually results in comedones.
- During the menstrual cycle, progesterone rises, and so do DHT levels; which is why the skin becomes oily and spot-prone at certain times, stopping progesterone rise.

**Lipid Dry** - has an underproduction of sebum and therefore a lack of lipids.

- Dry skin can easily become dehydrated as the Natural Moisturising Factor in the skin can evaporate easily without a protective barrier of lipids.
- Low levels of sebum combined with dehydration leads to cells not functioning properly.
- Results in premature ageing if not treated.
- Clients complain of flakiness and the fact that nothing seems to keep their skin supple.
- Their skin may feel tight.
- Skins look scaly and flaky.
- Look thickened, and milia may be present.
- A client may suffer from eczema or psoriasis elsewhere on the body.
- Fine lines and deep wrinkles are more prominent on these skin types.
- May be some evidence of sun-damage, with sunspots or broken capillaries visible through the skin.
- It feels very rough to the touch.
- Sebaceous filaments are minimal.

**Sensitive Skin** - skin that is sensitive is categorised and treated as so, regardless of whether it is oily, lipid dry or a combination. This is because products normally used to treat other skin types will cause irritation to a sensitive skin

- Sensitive skin has reduced barrier function, making the skin more vulnerable, easily irritated, and easily dried and dehydrated.
- Sensitivity means that it has an overactive immune response to ingredients – causing the skin to attack healthy cells, breaking down collagen, elastin and hyaluronic acid, making the skin become further dehydrated.
- This results in premature ageing if left untreated.
- Sensitive skin also reacts in an exaggerated manner to friction and pressure, causing the skin to flush easily.
- Widespread broken capillaries (telangiectasia, also called couperose skin) found particularly across the nose, cheeks and forehead in a butterfly pattern. Skin can look purple in places.
- The skin may produce erythema (redness) on seemingly unaffected areas at the lightest touch.
- It feels rough, slightly sandpapery and hot in flushed areas.
- May see lumps that look sore. Severe cases include a swollen and red nose.
- The client's skin feels bumpy and hot to the touch.

**Combination Skin** – has a slightly oily t-zone which contributes to the silkiness of the rest of the skin

- Oils are needed to keep skin supple.
- The term 'combination' is useful when you are explaining to clients; they may need to treat the t-zone differently from the rest of the skin, and those occasional breakouts can still occur on good skin due to a surge in hormones when under stress, during menstruation or if the wrong product is used.
- Combination skin leans slightly over to the oily skin type category, not the lipid dry one.
- Confusion arises when people think skin type can be a combination of oily and lipid dry. But an excess of oil production on one part of the skin on the face does not make it possible to have a dry skin type on another.



- Oily skin type is an overproduction of oils.
- Dry skin type is an underproduction of oils.
- Combination skin can quickly become dehydrated with the use of products. For oily skin, these products strip away the protective barrier of lipids, leading to the Natural Moisturising Factor in the skin (which keeps it supple) evaporating much more easily.
- When treating a combination skin, you should consider its separate parts. A typical combination product usually focuses on only the oily part. It is, therefore, usually sebum-reducing and lacking in hydrating ingredients to balance out its oil reducing properties. The product may make an oily t-zone less oily, but, inadvertently, it will also make the rest of the skin (that was previously in good condition) become lipid dry or dehydrated.
- Treat the different areas of the skin with products that are designed specifically for them.

## Glycation

Sugar attaches to proteins, a process called glycation, and the proteins collagen and elastin become linked. Whereas protein strands normally slide over to one another, become attached to the glucose and cannot move about freely.

### Role of Glycation in ageing

Perhaps the worst consequence of glycation is linking, which is the formation of chemical bridges between proteins and other large molecules.

A material undergoes linking usually becomes harder, less elastic and has the tendency to become brittle and fragile. In ageing skin, glycation causes the loss of resiliency (bounce back) and feeling of adhesion (hardening) under the skin and stiffening joints.

### Advanced glycation end products (AGE's)

AGE's exert their harmful effects on two levels; most obviously, they physically impair protein, DNA and lipids, altering their chemical properties. They also act as cellular signals, triggering a cascade of the destructive event when they attach to their cellular binding sites.

Sagging and inflexible skin is a result of this process, aggravating the appearance of ageing; in addition, it can have a detrimental effect on the microcirculatory system of the skin.

### Anti-glycation Agents

Anti-glycation agents are immune system cells called macrophages, which combat glycation.

The only apparent drawback to this defence system is that it is not complete, and levels of AGE's increase steadily with age. One reason is that kidney function tends to decline with advance age; another is that macrophages become less active, thus having a knock-on effect on the skin immune system.

Once AGEs form, they can directly induce the linking of collagen, even in the absence of glucose and oxidation (free radical) reactions.

### Carnosine: anti-glycation

The natural dipeptide carnosine may be another answer to the ageing process, especially glycation. Carnosine is a multiple function dipeptide made up of a chemical combination of amino acids beta-alanine and L-histidine. Carnosine has the remarkable ability to rejuvenate cells approaching senescence, restoring normal appearance and extending cellular life span; it also inhibits the formation of AGE's, it can also protect the normal proteins from toxin effects of AGE's that have already formed. Carnosine is by far the safest and most effective natural anti-glycation agent. Studies have shown that carnosine inhibits damaged protein from damaging healthy proteins and helps the proteolytic system dispose of damaged and unneeded proteins. The main dietary source of

carnosine is red meat, poultry and fish so take note during the consultation process of your clients eating habits to ensure they are balanced.

### **The Diagnosis of glycation**

Diagnosing glycation is very easy; just like the loss of resiliency and adhesion of elastin fibres and collagens loss of structural integrity and skin density, you start with the eyes.

Look to the eye fold first; you are looking for little pillow or squares; this is glycation. In younger skin, it is less obvious; you will, however, find it around the eye area first.

A client suffering from glycation will have heavy eyelids, and this cannot be treated.

The skin in very early glycation will appear as small bumps, a little like goosebumps, but more flattened. In more advance glycation, the squaring of proteins will be seen in the neck area, and when it becomes more advance, it will be found around the mouth and skin area.

Glucose is an example of a carbohydrate which is commonly encountered. It is also known as blood sugar and dextrose.

### **Glycation**

Visual analysis and consultation of skin:

1. Small pillows about the eye fold area, around the mouth, neck, cheeks and chin.
2. Fine vertical crepe lines eyelids, neck, upper lip and décolleté. Always seen with the loss of collagens structural integrity is a client is over 45 years of age, so will have thin skin density and slow wound healing may scar easily.
3. Dark maroon around the eyes and under black light.
4. Loss of resiliency and adhesion, seen as horizontal lines around the eyes, mandible under the chin, neck, décolleté and loosening at the nasal labial folds. Could have excess keratinisation/comedones across the cheeks or mandible

### **Post-inflammatory hyperpigmentation**

History can include infestation, allergic reactions, mechanical injuries (picking acne lesions) or reactions to medications, phototoxic eruptions, burns, bruising and inflammatory skin diseases from eczema/dermatitis family.

This type of pigmentation can darken with exposure to UV light and with the use of various chemicals and medications, such as tetracycline, bleomycin, doxorubicin, 5-fluorouracil, busulfan, arsenicals, silver, gold, anti-malarial drugs, hormones and clofazimine.

### **Dermal pigmentation caused by trauma**

A combination of the inflammatory response and ultraviolet causes the inflammation to disrupt the basal cell layer, a combination of melanin pigment being released and subsequently trapped by macrophages in the papillary layer. Once the wound healing has completed and the junction repaired, the melanin pigment granules caught within the dermal layer have no way of escape and thus a more difficult type of pigment granule to eliminate.

Post-Inflammatory hyperpigmentation is a darkening of the skin that's the result of acne scarring or skin injury due to inflammatory response in the skin. The cells associated with melanin production are closely linked with the skin immune system cells, meaning you can't stimulate one without stimulating the other.

Post-inflammatory hyperpigmentation can be seen after endogenous or exogenous inflammatory conditions. Essentially any disease with cutaneous inflammation can potentially result in post-inflammatory hyperpigmentation in individuals capable of producing melanin.

Several skin disorders such as acne, atopic dermatitis, allergic contact dermatitis, incontinenti pigmenti, lichen planus, lupus erythematosus, and morphea have post-inflammatory hyperpigmentation as a predominant feature. Exogenous stimuli, both physical and chemical, can cause injury to the skin, followed by PIH. These include mechanical trauma, ionizing and non-ionizing radiation, heat, contact dermatitis, and phototoxic reaction.

Optimal treatment for PIH includes prevention of further pigment deposition and clearing of the deposited pigment. Chemical peels work best when used in combination with topical bleaching regimens. Laser therapy should be used with extreme caution and care. Given the propensity of darker-skin types to develop post-inflammatory hyperpigmentation, superficial peels work best while minimizing complications.

Tyrosinase inhibitors, such as Vitamin C, arbutin, kojic acid and mulberry, have been favoured for their ability to inhibit melanin by targeting the tyrosinase enzyme, which covers the amino acid phenylalanine into the melanin precursors.

Effective topical vitamins include niacinamide and several forms of vitamin C, including L-ascorbic acid, magnesium ascorbyl phosphate (MAP) and tetrahexyldecyl ascorbate, an oil-soluble version.

In addition to having a direct skin-lightening effect, Vitamin C can help protect against sun damage by neutralizing free radicals that contribute to hyperpigmentation. Studies have shown that Vitamin C and E, in combination, can improve the efficacy of sunscreen. A great all-around skin vitamin, Vitamin A, helps pigmentation problems by treating slight discolouration and evening skin tone. Vitamin A can be taken orally as well as applied topically in the form of a retinol cream or other retinol.

## Muscles

Muscles are classified into three different types, which are skeletal, smooth and cardiac.

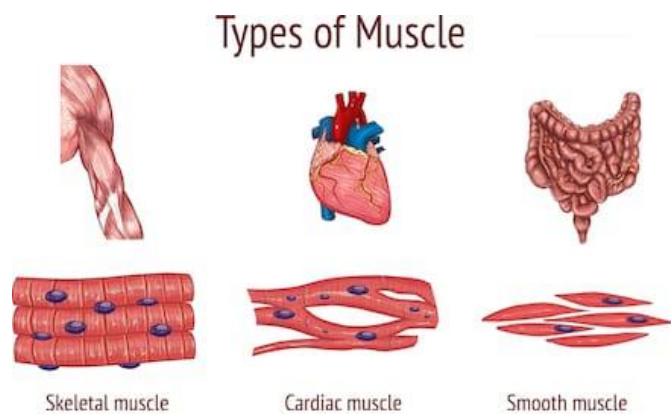
Skeletal muscles, also known as striated due to its appearance or voluntary due to its action, are attached to bones and deal with movement. These muscles are made up of fine, thread-like fibres of muscles containing light and dark bands. Skeletal muscles can be made to contract and relax by voluntary will. They have striations due to the actin and myosin fibres and create movement when contracted.

This system gives individuals the ability to move using muscles and the skeleton. It consists of the body's bones, muscles, tendons, ligaments, joints, cartilage, and other connective tissue.

Smooth muscles, also called unstriated or involuntary, tend to be found within hollow organs such as blood vessels, the intestines and the respiratory tract. This muscle works automatically with no participant control. This type of muscle does not tire easily, and the contractions are slow, rhythmic and automatic.

Cardiac muscle is what the heart is made up of and only exists in your heart. It is similar in appearance to skeletal muscle in that it is striated. This type of muscle never tires and contracts and relaxes with no participant control. It is made up of short, cylindrical fibres and is purely controlled by the nervous system.

There are over 650 different types of muscles in the human body, making up nearly half of the body weight. The main function is to move joints, to which they are joined, by shortening and pulling one end of the muscle closer

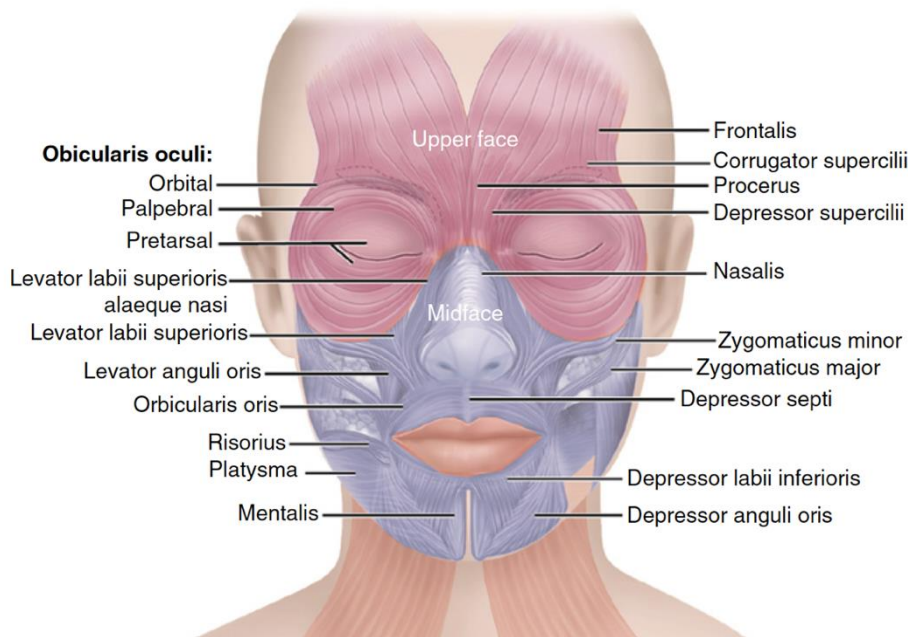


to the other end. Each muscle is made up of muscle fibres that are controlled by the brain, sending an impulse to the fibres via the nerves.

When a muscle is damaged, fibres become torn, and the connective tissue around the muscle is also damaged. The fibres are damaged, and fluid seeps out of torn fibres, which causes localised swelling. This fluid tends to stick the fibres together, which causes pain as the muscle is irritated by the slightest contraction. Stretching exercises will increase the length, flexibility and tone of muscles which allows the joint to move further than before.

### Muscles of the Face

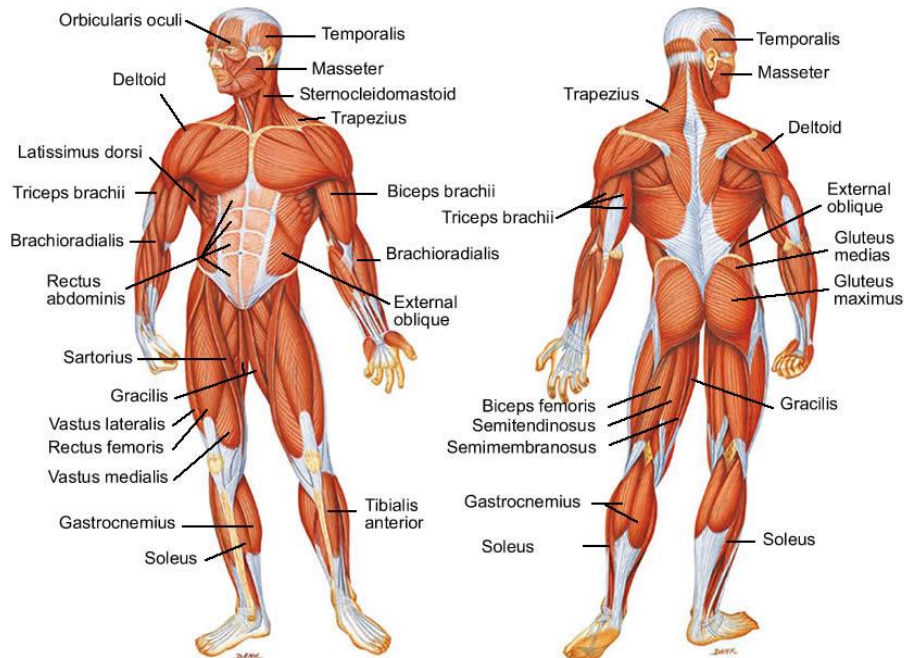
The face has several relevant muscles.



Name	Position	Action
<b>Frontalis</b>	Upper part of the cranium	Elevates eyebrows; draws the scalp forwards
<b>Corrugator</b>	Inner corner of eyebrows	Draws eyebrows together (frowning)
<b>Procerus</b>	Top of nose between eyebrows	Depresses the eyebrows (forms wrinkles over the nose)
<b>Orbicularis Oculi</b>	Surrounds the eye	Closes the eye (blinking)
<b>Nasalis</b>	Over the front of nose	Compresses nose (causing wrinkles)
<b>Temporalis</b>	Runs down the side of face towards jaw	Aids chewing; closes mouth
<b>Masseter</b>	Runs down and back to the angle of the jaw	Lifts the jaw; gives strength for biting (clenches the teeth)
<b>Buccinator</b>	Forms most of the cheek and gives it shape	Puffs out cheeks when blowing; keeps food in mouth when chewing
<b>Risorius</b>	Lower cheek	Pulls back angles of the mouth (smiling)
<b>Zygomaticus</b>	Runs down the cheek towards the corner of the mouth	Pulls corner of the month upwards and sideways
<b>Quadratus labii superioris</b>	Runs upward from the upper lip	Lifts the upper lip; helps open the mouth
<b>Orbicularis Oris</b>	Surrounds the lip and forms the mouth	Closes the mouth; pushes lips forwards
<b>Mentalis</b>	Forms the chin	Lifts the chin; moves the lower lip outwards

<b>Triangularis</b>	Corner of the lower lip, extends over the chin	Pulls the corner of the chin down
<b>Platysma</b>	Front of throat	Pulls down the lower jaw; angles the mouth
<b>Sterno – mastoid</b>	Either side of the neck	Pulls head down to shoulders; rotates head to side; pulls chin onto chest

### Muscles of the body



### Muscles of the Chest and Upper Arm

Name	Position	Action
<b>Pectoralis major</b>	Across upper chest	Used in throwing and climbing; adducts arms
<b>Pectoralis minor</b>	Underneath pectoralis major	Draws shoulders downwards and forwards
<b>Deltoids</b>	Surrounds shoulders	Lifts arms sideways, forwards and backwards
<b>Biceps</b>	Front of upper arm	Flexes elbow; supinates the forearm and hand
<b>Triceps</b>	Back of upper arm	Extends the elbow
<b>Brachialis</b>	Under the biceps	Flexes the elbow

### Muscles of the Hand and Forearm

Name	Position	Action
<b>Brachio radialis</b>	On the thumb-side of the forearm	Flexes the elbow
<b>Flexors</b>	Middle of the forearm	Flexes and bends the wrist drawing it towards the forearm
<b>Extensors</b>	Little finger side of the forearm	Extends and straightens the wrist and hand
<b>Thenar muscle</b>	Palm of the hand below the thumb	Flexes the thumb and moves it outwards and inwards

<b>Hypothenar muscle</b>	Palm of hand below little finger	Flexes little finger and moves it outwards and inwards
--------------------------	----------------------------------	--

### Muscles of the Abdomen

Name	Position	Action
Rectus abdominis	Front of abdomen from the pelvis to the sternum	Flexes the spine; compresses the abdomen; tilts the pelvis
Oblique's	Internal – either side of the rectus abdominis External – lies on top of the internal oblique's	Both compress the abdomen and twist the trunk

### Muscles of the Back

Name	Position	Action
<b>Trapezius</b>	The back of the neck and collar-bones	Moves scapula up, down and back; raises the clavicle
<b>Latissimus dorsi</b>	Across the back	Used in rowing and climbing; adducts the shoulder downwards and pulls it backwards
<b>Erector spinae</b>	Three groups of muscles which lie either side of the spine from the neck to the pelvis	Extends the spine; keeps body in an upright position
<b>Rhomboids</b>	Between the shoulders	Braces the shoulders; rotates the scapula

### Muscles of the Buttocks and Legs

Name	Position	Action
<b>Gluteals</b>	In the buttocks	Abducts and rotates the femur; used in walking and running
<b>Hamstrings</b>	Back of the thigh	Flexes the knee; extends the knee
<b>Gastrocnemius</b>	Calf of the leg	Flexes the knee; plantar-flexes the foot
<b>Soleus</b>	Calf of leg, below the Gastrocnemius	Plantar-flexes the foot
<b>Quadriceps extensor</b>	Front of the thigh: group of four muscles	Extends the knee; used in kicking
<b>Sartorius</b>	Crosses the front of the thigh	Flexes the knee and hip; abducts and rotates the femur
<b>Adductors</b>	Inner thigh	Adducts the hip; flexes and rotates the femur
<b>Tibialis anterior</b>	Front of the lower leg	Inverts the foot; dorsi-flexes the foot; rotates the foot outwards

## Bones of the body

The Skeletal System serves many important functions; it provides the shape and form for our bodies in addition to supporting, protecting, allowing bodily movement, producing blood for the body, and storing minerals.

### Functions :

- Its 206 bones form a rigid framework to which the softer tissues and organs of the body are attached.
- Vital organs are protected by the skeletal system. The brain is protected by the surrounding skull, and the heart and lungs are encased by the sternum and rib cage.
- Bodily movement is carried out by the interaction of the muscular and skeletal systems. For this reason, they are often grouped together as the muscular-skeletal system. Muscles are connected to bones by tendons. Bones are connected to each other by ligaments. A joint is where bones meet one another. Muscles that cause movement of a joint are connected to two different bones and contract to pull them together. An example would be the contraction of the biceps and the relaxation of the triceps. This produces a bend at the elbow. The contraction of the triceps and relaxation of the biceps produces the effect of straightening the arm.
- Blood cells are produced by the marrow located in some bones. An average of 2.6 million red blood cells is produced each second by the bone marrow to replace those worn out and destroyed by the liver.
- Bones serve as a storage area for minerals such as calcium and phosphorus. When an excess is present in the blood, the build-up will occur within the bones. When the supply of these minerals within the blood is low, it will be withdrawn from the bones to replenish the supply.

### Divisions of the Skeleton:

#### The human skeleton is divided into two distinct parts:

The axial skeleton consists of bones that form the axis of the body and support and protect the organs of the head, neck, and trunk:

- Skull
- Sternum
- Ribs
- Vertebral Column.

The appendicular skeleton is composed of bones that anchor the appendages to the axial skeleton:

- Upper Extremities
- Lower Extremities
- Shoulder Girdle
- Pelvic Girdle.

(The sacrum and coccyx are considered part of the vertebral column)

### Types of Bone

The bones of the body fall into four general categories: long bones, short bones, flat bones, and irregular bones. Long bones are longer than they are wide and work like levers. The bones of the upper and lower extremities (e.g. humerus, tibia, femur, ulna, metacarpals, etc.) are of this type.

Short bones are short, cube-shaped, and found in the wrists and ankles. Flat bones have broad surfaces for the protection of organs and attachment of muscles (e.g. ribs, cranial bones, bones of shoulder girdle).

Irregular bones are all others that do not fall into the previous categories. They have varied shapes, sizes, and surface features and include the bones of the vertebrae and a few in the skull.

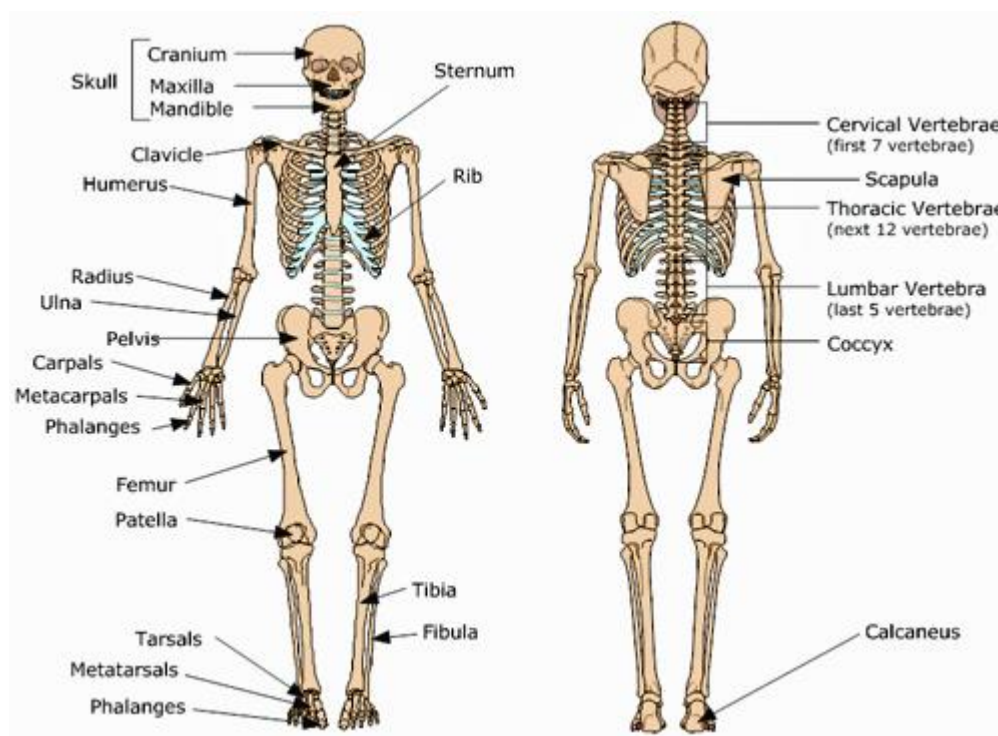
### Bone Composition:



Bones are composed of tissue that may take one of two forms—compact or dense bone, spongy or cancellous bone. Most bones contain both types.

Compact bone is dense, hard and forms the protective exterior portion of all bones.

Spongy bone is inside the compact bone and is very porous (full of tiny holes). Spongy bone occurs in most bones. The charts on the following pages show the main bones that you will need to have good knowledge of.



## The Cardiovascular System

All body systems are linked by the cardiovascular system, a transport network that affects every part of the body. To maintain homeostasis, the cardiovascular system must provide for the rapid transport of water, nutrients, electrolytes, hormones, enzymes, antibodies, cells, and gases to all cells. In addition, it contributes to body defences and the coagulation process and controls body temperature. The term cardiovascular refers to the cardiac (heart) muscle, the vascular system (a network of blood vessels that includes veins, arteries, and capillaries), and the circulating blood. Thus, the three primary components of the cardiovascular system are:

- Heart
- Circulating blood
- Blood vessels (the circulatory system)

### Organ/Structure

Heart

### Primary Functions

- Muscular organ about the size of an adult's closed fist
- Contractions push blood throughout the body
- The average heart beats 60 to 80 times per minute
- Transport blood from the right and left chambers of the heart to the entire body
- Large arteries branch into arterioles the farther they are from the heart
- Carry oxygenated blood that is bright red in colour
- Have thicker elastic walls than veins do
- Have a pulse

Arteries



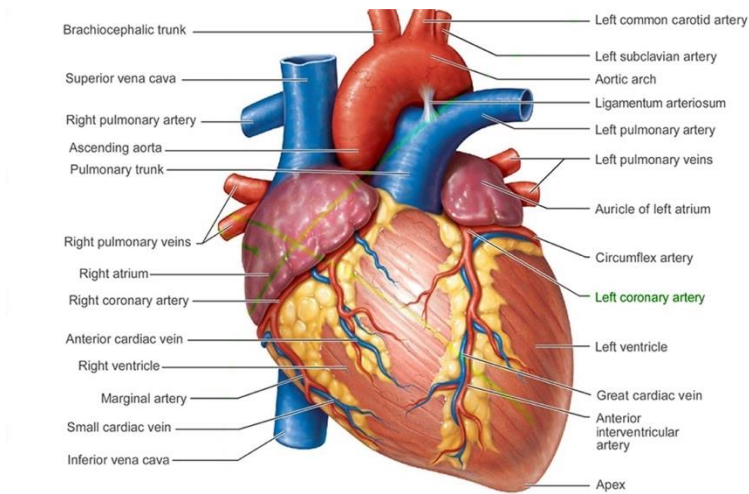
Veins	<ul style="list-style-type: none"> <li>• Are located deep in muscles/tissues</li> <li>• Blood is transported from peripheral tissues back to the heart and lungs</li> <li>• Large veins branch into venules in the peripheral tissues</li> <li>• Deoxygenated blood is carried back to the lungs to release carbon dioxide</li> <li>• Carry blood that is normally dark red in colour</li> <li>• Have thinner walls than arteries; walls appear bluish</li> <li>• Valves prevent the backflow of blood</li> <li>• Are located both deep and superficially (close to the surface of the skin)</li> </ul>
Capillaries	<ul style="list-style-type: none"> <li>• Connect arterioles with venules via microscopic vessels</li> <li>• Oxygen and carbon dioxide, nutrients, and fluids in tissue capillaries are exchanged</li> <li>• Waste products from tissue cells are passed into capillary blood, then onto removal from the body</li> </ul>
Circulating Blood	<ul style="list-style-type: none"> <li>• Carry blood that is a mixture of arterial blood and venous blood</li> <li>• Oxygen and carbon dioxide, nutrients, and fluids are transported by circulating blood</li> <li>• Waste products are removed</li> <li>• Nutrients are disbursed</li> <li>• Regulates body temperature and electrolytes</li> <li>• Regulates the blood-clotting system</li> </ul>

## The Heart

The human heart is a muscular organ about the size of a man's closed fist. The heart contains four chambers and is located slightly left of the midline in the thoracic cavity. The two atria are separated by the interatrial septum (wall), and the interventricular septum divides the two ventricles. Heart valves are positioned between each atrium and ventricle so that blood can flow in one direction only, thereby preventing backflow. The right atrium of the heart receives o<sub>2</sub>-poor blood from two large veins: the superior vena cava and the inferior vena cava. The superior vena cava brings blood from the head, neck, arms, and chest; the inferior vena cava carries blood from the rest of the trunk and the legs. Once the blood enters the right atrium, it passes through the heart valve (right atrioventricular, or tricuspid, valve) into the right ventricle. When blood exits the right ventricle, it begins the pulmonary circuit—it enters the right and left pulmonary arteries. Arteries of the pulmonary circuit differ from those of the systemic circuit because they carry deoxygenated blood.

Like veins, they are usually shown in blue on colour-coded charts. These vessels branch into smaller arterioles and capillaries within the lungs, where gaseous exchange occurs (o<sub>2</sub> is picked up, and Co<sub>2</sub> is released). From the respiratory capillaries, blood flows into the left and right pulmonary veins and then into the left atrium. The left atrium also has a valve (left atrioventricular, bicuspid, or mitral valve). Blood flows through the mitral valve into the left ventricle. When blood exits the left ventricle, it passes through the aortic semilunar valve and into the systemic circuit by means of the ascending aorta. The systemic circuit carries blood to the tissues of the body. If a valve malfunctions, blood flows backwards and a heart murmur results. The right side of the heart pumps o<sub>2</sub> poor blood to the lungs to pick up more o<sub>2</sub>; the left side pumps o<sub>2</sub>-rich blood toward the legs, head, and organs. The heart's function is to pump sufficient amounts of blood to all cells of the body by contraction (systole) and relaxation (diastole). Because the lungs are close to the heart, and the pulmonary arteries and veins are short and wide, the right ventricle does not need to pump very hard to propel blood through the pulmonary circuit. Thus, the heart wall of the right ventricle is relatively thin. On the other hand, the left ventricle must push blood around the systemic circuit, which covers the entire body. As a result, the left ventricle has a thick, muscular wall and a powerful contraction.

Blood pressure increases during ventricular systole and decreases during ventricular diastole. Blood pressure not only forces blood through vessels but also pushes it against the walls of the vessels like air in a balloon. Therefore, it can be measured by how forcefully it presses against vascular walls.



The average heart beats 60 to 80 times per minute. Children have faster heart rates than adults, and athletes have slower rates because more blood can be pumped with each beat. During exercise, the heart beats faster to supply muscles with more blood. During and after meals, it also beats faster to pump blood to the digestive system. During a fever, the heart pumps more blood to the skin surface to release heat. Remember that all responses are designed to maintain homeostasis. The heart rate (pulse rate) is measured by feeling for a pulse

and counting the pulses per minute.

## The Vessels and Circulation

Three kinds of blood vessels exist in the human body:

- Arteries
- Veins
- Capillaries

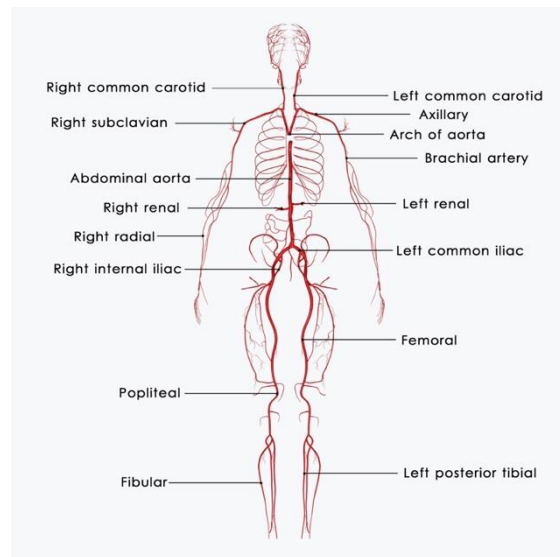
This intricate system travels to every inch of the human body through repeatedly branching vessels that get smaller and smaller as they move away from the heart (arteries) and then get larger again as they return toward the heart (veins). The largest artery (aorta) and veins (venae cavae) are approximately 1 inch wide.

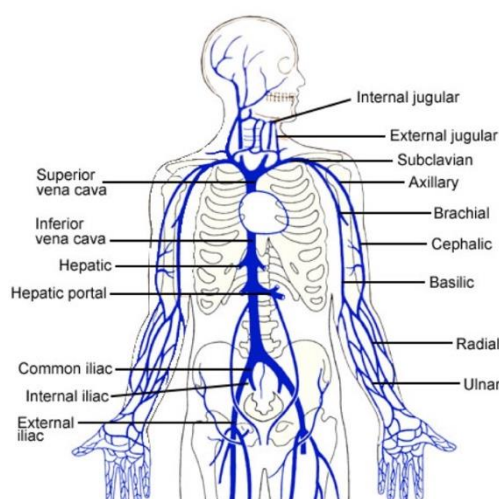
### Arteries

Arteries are highly oxygenated vessels that carry blood away from the heart (efferent vessels). They branch into smaller vessels, called arterioles, and into capillaries. Arteries appear brighter red in colour, have thicker elastic walls than veins do, and have a pulse.

### Veins

Blood is carried toward the heart by the veins (afferent vessels). It is remarkable that the blood in veins flows against gravity in many areas of the body; these vessels have one-way valves and rely on weak muscular action to move blood cells. The one-way valves prevent the backflow of blood. All veins (except the pulmonary veins) contain deoxygenated blood. Veins appear bluish in colour under the skin and have thinner walls than arteries. You should become familiar with the principal veins of the arms and legs. The antecubital area of the forearm is most commonly and generally the largest and best-anchored vein. Others in the antecubital area that are acceptable are the basilic vein and the cephalic vein.





## Capillaries

Capillaries are tiny microscopic vessels that connect or link arteries (arterioles) and veins (venules) and may be so small in diameter as to allow only one blood cell to pass through at any given time. They are the only vessels that permit the exchange of gases (o<sub>2</sub> and Co<sub>2</sub>) and other molecules between blood and surrounding tissues.

Capillaries do not work independently but are a part of an interconnected network. Each arteriole ends in dozens of capillaries (capillary bed) that eventually feed-back into a venule (when gas/ the nutrient exchange has been completed). Blood in the capillary bed is a mixture of arterial and venous blood.

## Comparing External Bleeding from Arteries, Veins, and Capillaries

The nature of taking blood requires you to regularly deal with clients who are bleeding. External bleeding can be described according to the type of blood vessel that is injured and losing blood.

### Types of External Bleeding

Arterial blood is bright red in colour (due to high o<sub>2</sub> content), and since the pressure is higher in arteries, bleeding is usually quicker, more abundant, and in spurts (with each heartbeat). Arterial bleeding is the hardest to control and usually requires special attention from a nurse and/or doctor. During a venipuncture procedure, if you accidentally puncture an artery instead of a vein, you should follow immediate steps to terminate the procedure and apply pressure to the site. Accidental incidents such as this should be reported in an accident form immediately.

Venous blood is dark red in colour (because it lacks o<sub>2</sub>), and bleeding occurs in a steady flow. In normal, healthy adults, venous bleeding is easy to stop by simply applying pressure because venous pressure is lower than arterial pressure.

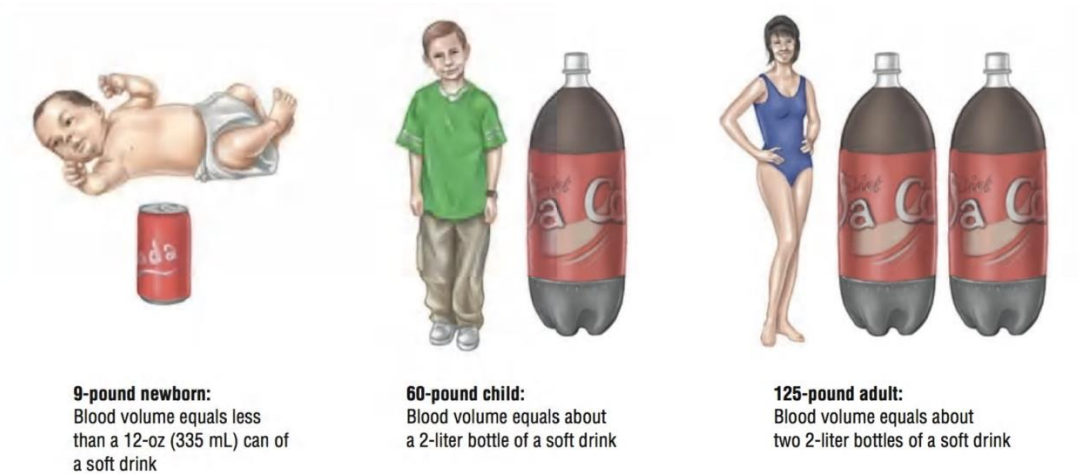
### The Blood

Circulating blood provides nutrients, oxygen, chemical substances, and waste removal for each of the billions of individual cells in the body and is essential to homeostasis and to sustaining life. Any region of the body that is deprived of blood and O<sub>2</sub> soon becomes oxygen-deficient, and the tissues may die within minutes. This condition is called hypoxia.

Human bodies contain approximately 4.73 litres of whole blood, which is composed of water, solutes (dissolved substances), and cells. The volume of blood in an individual varies according to body weight; for instance, adult men usually have 5 to 6 litres of whole blood, whereas adult women usually have 4 to 5 litres.

Abnormally low or high blood volumes can seriously affect other parts of the cardiovascular system. Whole blood is normally composed of approximately 2.84 litres, or about 55 to 60 percent, of plasma and 1.89 litres, or about

40 to 45 percent, of cells. Thus, if a blood specimen is withdrawn into a test tube from a vein and centrifuged, about 55 percent will be plasma, and 45 percent will be formed elements (cells). The plasma portion contains approximately 92 percent water and 8 percent solutes. Solute include proteins, such as albumin (maintains water balance in the blood); fibrinogen (for blood clotting); metabolites, such as lipids; glucose; nitrogen wastes; amino acids; and ions, such as sodium (Na), potassium (K), calcium (Ca), magnesium (Mg), and chloride (Cl).



## Haemostasis and Coagulation

Haemostasis (not to be confused with homeostasis) is a complex series of processes in which platelets, plasma, and coagulation factors interact to control bleeding while at the same time maintaining circulating blood in the liquid state. It enables the human body to retain blood in the vascular system by preventing blood loss. When a small blood vessel is injured, the haemostatic process (clotting response) repairs the break and stops the haemorrhage by forming a plug or blood clot.

This intricate process involves the following phases:

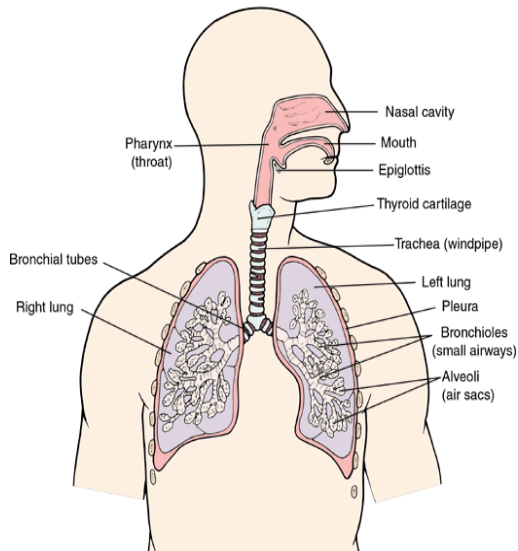
- Vascular phase—Once a blood vessel is injured, a rapid constriction of the vessel (vasoconstriction) decreases the blood flow to the surrounding vascular bed.
- Platelet phase—Platelets degranulate, clump together and adhere to the injured vessel in order to form a plug and inhibit bleeding.
- Coagulation phase—Many specific coagulation factors (including fibrinogen, clotting factors, and calcium) are released and interact to form a fibrin meshwork or blood clot. This clot seals off the damaged portion of the vessel.
- Clot retraction—This occurs when the bleeding has stopped. The entire clot retracts to heal tom edges by bringing them closer together.
- Fibrinolysis—When the final repair and regeneration of the injured vessel occurs, the clot slowly begins to break up (lysis) and dissolve as other cells carry out further repair. The entire process is fast, intricate, self-sustaining, and remarkable.

It is important to focus briefly on the coagulation process (the third phase), which is a result of numerous coagulation factors. For simplicity, it is divided into two systems: intrinsic and extrinsic. All coagulation factors required for the intrinsic system are contained in the blood, whereas the extrinsic factors are stimulated when tissue damage occurs. For example, blood vessels are lined with a single layer of flat endothelial cells and are supported by collagen fibres. Normally, endothelial cells do not react with or attract platelets; however, they do produce and store some clotting factors. When the clotting sequence begins due to a vessel injury, endothelial cells react with degranulated platelets in forming the fibrin plug.<sup>1</sup> Bleeding from small arteries and veins can be controlled by the haemostatic process; however, large- or medium-sized veins and arteries require rapid surgical intervention to prevent excessive bleeding.

## The Respiratory System

The respiratory system is the system that deals with breathing and supplying the blood with oxygen, but also has many other functions, including:

- filtering and cleaning the air we breathe
- adding resonance to our voice.



The respiratory system consists of many organs that work together to allow gas exchange to take place. This system works in conjunction with the circulatory system.

The respiratory system consists of the:

- Nose
- Larynx
- Pharynx (throat)
- Trachea
- Lungs
- Bronchi
- Bronchioles
- Alveoli
- Diaphragm.

Air is sucked into the body via the nose or mouth, where it is cleaned of unwanted dust. It is then passed to the back of the pharynx and into the trachea, where it travels into the divided bronchi, which lead to the alveoli via the bronchioles. Here, in the alveoli, gas exchange takes place.

## The Lymphatic System

The lymphatic system consists of organs, ducts, and nodes. It transports a clear watery fluid called lymph. This fluid distributes immune cells and other factors throughout the body. It also interacts with the blood circulatory system to drain fluid from cells and tissues. The lymphatic system contains immune cells called lymphocytes, which protect the body against antigens (viruses, bacteria, etc.) that invade the body.

The main functions are:

- to collect and return interstitial fluid, including plasma protein, to the blood and thus help maintain fluid balance.
- to defend the body against disease by producing lymphocytes.
- to absorb lipids from the intestine and transport them to the blood.

Lymph organs include the bone marrow, lymph nodes, spleen, and thymus. Precursor cells in the bone marrow produce lymphocytes. B-lymphocytes (B-cells) mature in the bone marrow. T-lymphocytes (T-cells) mature in the thymus gland.

Besides providing a home for lymphocytes (B-cells and T-cells), the ducts of the lymphatic system provide transportation for proteins, fats, and other substances in a medium called lymph.

Lymph nodes are bean-shaped and range in size from a few millimetres to about 1-2 cm in their normal state. They may become enlarged due to a tumour or infection. White blood cells are located within the honeycomb structures of the lymph nodes. Lymph nodes are enlarged when the body is infected.

Lymph means clear water, and it is basically the fluid and protein that has been squeezed out of the blood (i.e. blood plasma). The lymph is drained from the tissue in microscopic blind-ended vessels called lymph capillaries.

## Nervous System

### Structure and Function

The nervous system provides communication in the body, sensations, thoughts, emotions, and memories. Nerve impulses and chemical substances regulate, control, integrate, and organise body functions. The nervous system consists of:

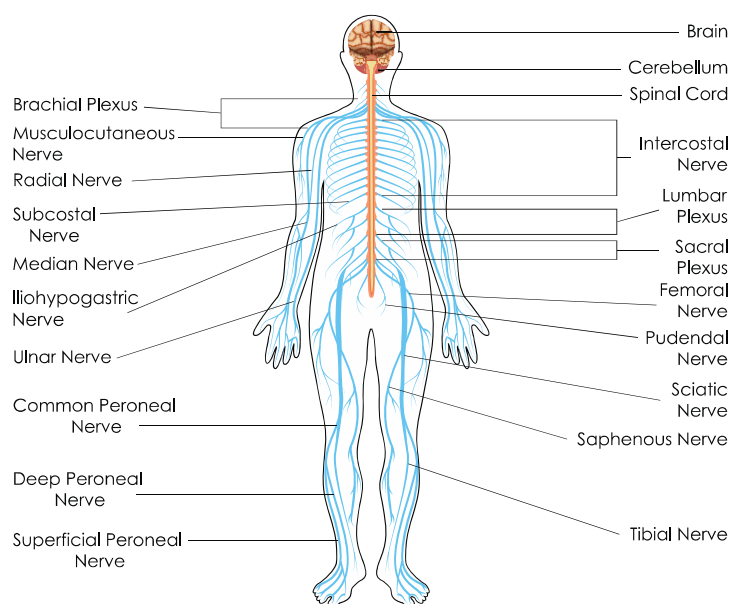
- Neurons (specialised nerve cells)
- Brain
- Spinal cord
- Brain and spinal cord coverings (meninges)
- Cerebrospinal fluid (CSF)

An estimated 10 billion neurons or more reside in the human body, most of which are in the brain. The nervous system can be thought of as two systems: The central nervous system (CNS) is made up of the brain and spinal cord, and the peripheral nervous system (PNS) is everything outside of the brain and spinal cord. Sensory neurons transmit nerve impulses to the spinal cord or the brain from muscle tissues. Motor neurons transmit impulses to muscles from the spinal cord or the brain. Both the brain and the spinal cord are covered by protective membranes (meninges). Between these protective membrane layers are spaces filled with cerebrospinal fluid (CSF) that provides a cushion for the brain and the spinal cord. Furthermore, the brain and spinal cord are protected by the skull and vertebral column, respectively. The bony segments of the vertebral canal are divided into regions (cervical, thoracic, and lumbar vertebrae). There are seven cervical vertebrae (C1-C7) that extend from the head to the thorax, 12 thoracic vertebrae (T1-T12) that extend from the chest to the back, and five lumbar vertebrae (L1-L5) that extend to the lower back. At the lower end of the vertebral column, the sacrum (S1-S5) and coccyx are fused elements of the sacral and coccygeal vertebrae.

The brain, along with the cranial nerves, functions in all mental processes and many essential motor, sensory, and visceral responses. The spinal cord and the spinal nerves control sensory (touch), motor (voluntary movement), and reflex (knee-jerk) functions. Reflexes are responses to stimuli that do not require communication with the brain. A simple reflex, such as moving a finger from something hot, occurs even before the brain realises the pain. Specific cranial and spinal nerves control all complex or simple action processes in the body. There are 31 pairs of

spinal nerves (nerves that branch off the spinal cord), each of which is identified by its location to the nearest vertebrae. Nerves that branch from the spinal cord (C5 through T1) and extend into the arm region (the brachial plexus) are the axillary, radial, musculocutaneous, median, and ulnar nerves.

These nerves control all muscle movement of the shoulder, arm, and hand and also control sensations of the skin of the entire shoulder, arm, and hand. In summary, the nervous system is the primary communication and regulatory system in the body. The autonomic nervous system entails the functions that work without voluntary control of an individual, such as heartbeat, rate of breathing, tear and saliva production, and bladder constrictions.



## NERVOUS SYSTEM



## Disorders of the Nervous System

- Infectious conditions (viral or bacterial) such as encephalitis (inflammation of the brain), meningitis (inflammation of the linings of the brain and spinal cord), tetanus, herpes, and poliomyelitis.
- Conditions such as ALS, MS, Parkinson's disease (a degenerative disorder characterised by hand tremors, loss of facial expression, shuffling walk), cerebral palsy (CP; brain damage at birth that typically causes lack of muscle control) (FIGURE 6-21)
- Epilepsy (episodes of abnormal electrical discharges in the brain that may cause convulsions or loss of consciousness), hydrocephaly (excessive amounts of CSF in the brain that can lead to intracranial pressure and other complications), neuralgia (pain along a nerve), strokes, and headaches
- Injuries that can also result in paralysis or partial paralysis

As a special note to those performing blood collection, nerve damage, including partial paralysis, can also occur as a result of accidental injury during phlebotomy procedures. Injury may be the result of excessive probing with the needle, sticking the needle in a poor site for venipuncture, deep needle penetration all the way into the nerve, and/or if the patient suddenly jerks his or her arm during the venipuncture procedure, causing the needle to puncture a nerve. Choose venipuncture sites that are stabilised as much as possible. Under no circumstances should you use the anterior or palmar side of the wrist to collect a blood specimen because the risk of hitting a nerve is high due to nerve locations close to the skin's surface.

## Skin and Subcutaneous Tissue

The face and neck are divided into two major regions according to the texture, thickness and quality of the skin and its underlying subcutaneous fat tissue.

### The periorificial craniofacial region

This composes of the support for the dynamics of the face. The thinnest skin on the face can be found around the eyes, nose and mouth and has an extremely poor subcutaneous fat layer overlying the muscles in these areas.

The tight adhesions between the superficial muscles and the dermis appear as fine periorificial wrinkles called 'expression lines'. The skin of the eyelids is covered by thin skin, almost devoid of any subcutaneous fat. When present, this fatty tissue should not be confused with the retro-orbital or periorbital fat pockets.

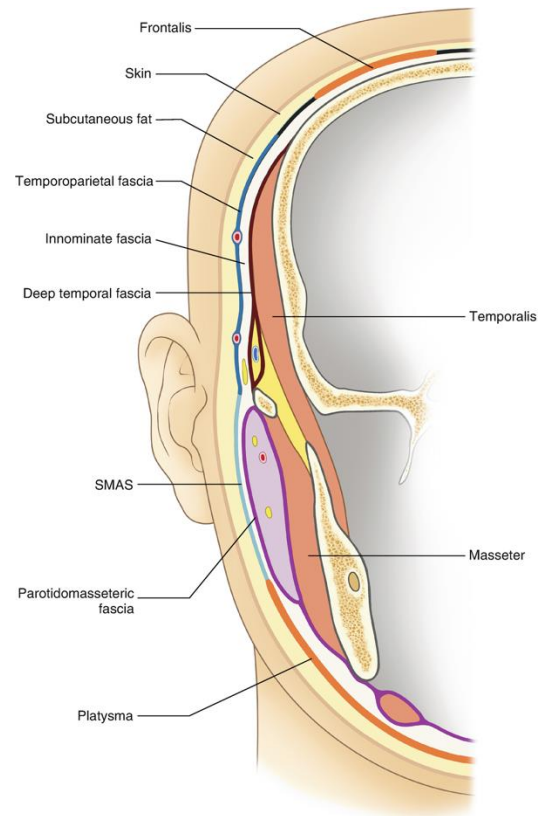
### The cervicofacial region

This is indicated by an abundance of subcutaneous fat tissue and thicker skin. The underlying layer is musculoaponeurotic, that comprises of the superficial musculoaponeurotic system (SMAS)—platysma sheath. It is less vulnerable to wrinkle formation as it is a rather static segment.

This homogeneous thick sheath of subcutaneous fat spreads all over the cheek area and neck, except in the malar area, where it benefits from a further volume that forms the malar fat pads.

Subcutaneous fat has an important role in facial aesthetics. It helps soften bony edges, fills facial contours and improves the quality of the skin.

Platysma muscles and musculoaponeurotic structures



### Periorificial and centro-facial region

The muscular region of the face comprises of the perioral, peri-nasal, and peri-orbital muscles that provide two essential functions:

- a primary protective function covering the eye globes and the oral cavity
- a secondary dynamic function of facial mimics that reflect facial expression.

### The periorbital region

The eyebrow is a mobile structure subject to two antagonist groups of muscles: an eyebrow elevator group, mainly made up of the frontalis muscle, and a depressor group made up of the orbicularis oculi muscle, the procerus muscle, and the corrugator supercilii muscle.

The musculoaponeurotic elevator group of muscles comprises the frontalis muscle, the galea aponeurotica and the occipitalis muscle. The frontalis is a 6-7 cm quadrilateral-shaped muscle. Its medial fibres connect at the glabella level, where they intersect with fibres of the procerus muscle. Its central and lateral fibres sit on top of the corrugator supercilii muscle and intersect with the outer fibres of the pars orbitalis component of the orbicularis oculi muscle. Its located between the galea and the skin, closely adherent to the latter. From the lower insertions on the supraorbital margin, the frontalis fibres cover the forehead and connect with the galea

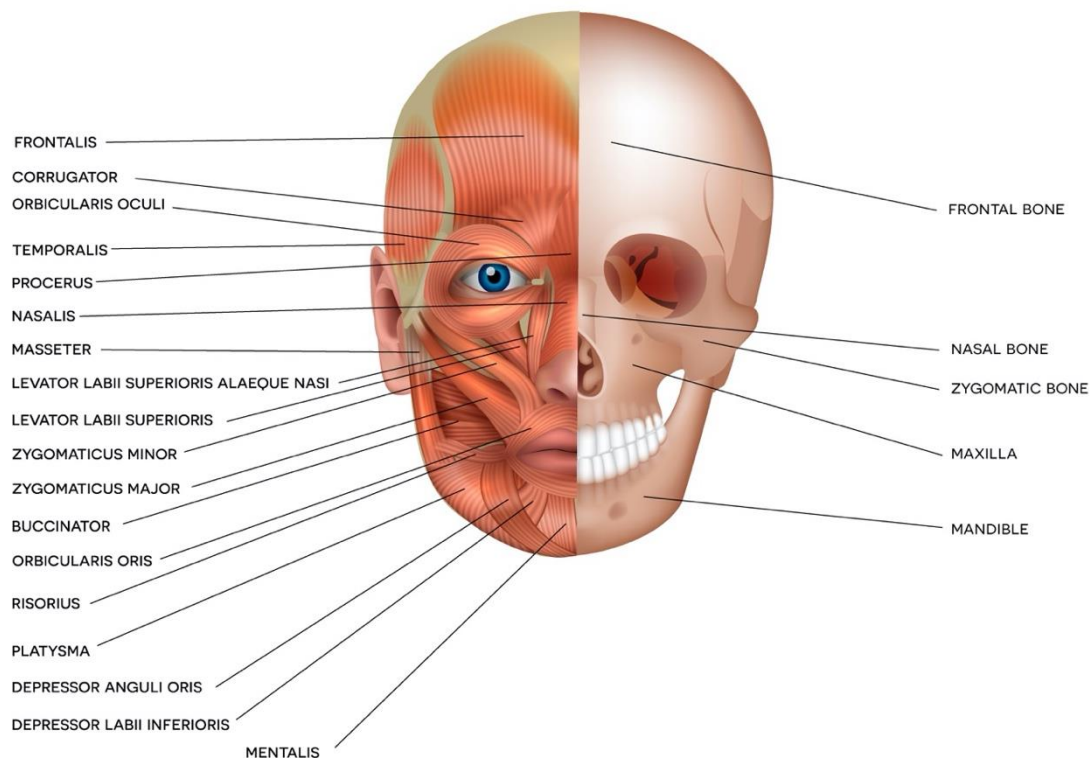


aponeurotica to join posteriorly, in the occipital region, the occipitalis muscle. Repeated contractions of this muscle are what leads to the formation of horizontal forehead wrinkles.

The galea aponeurotica or epi-cranial aponeurosis is a broad musculoaponeurotic layer that covers the calvaria. Posteriorly, it is firmly attached to the occipital protuberance and the superior nuchal line. It is separated from the outer table of the cranium by the loose connective tissue layer. This area is called Merkel's space and allows for the smooth sliding of the scalp over the cranium.

Laterally, over the temporal crest, the epi-cranial aponeurosis is continuous with the superficial temporal fascia. The superficial temporal vessels and the facial nerve's temporal and frontal branches are also found at this level.

The eyebrow depressor muscles are formed by the co-operation of three different muscles: the corrugator supercilii muscle, the pyramidal or procerus muscle, and the orbicularis oculi muscle. The corrugator supercilii muscle is a deep facial muscle. It is narrow and strong and has deep medial insertions on the glabellar periosteum and another more superficial lateral trans-orbicular insertion on the eyebrow's medial portion. It depresses and brings the inner parts of the eyebrows together. This repeated contraction results in the development of vertical glabellar wrinkles.



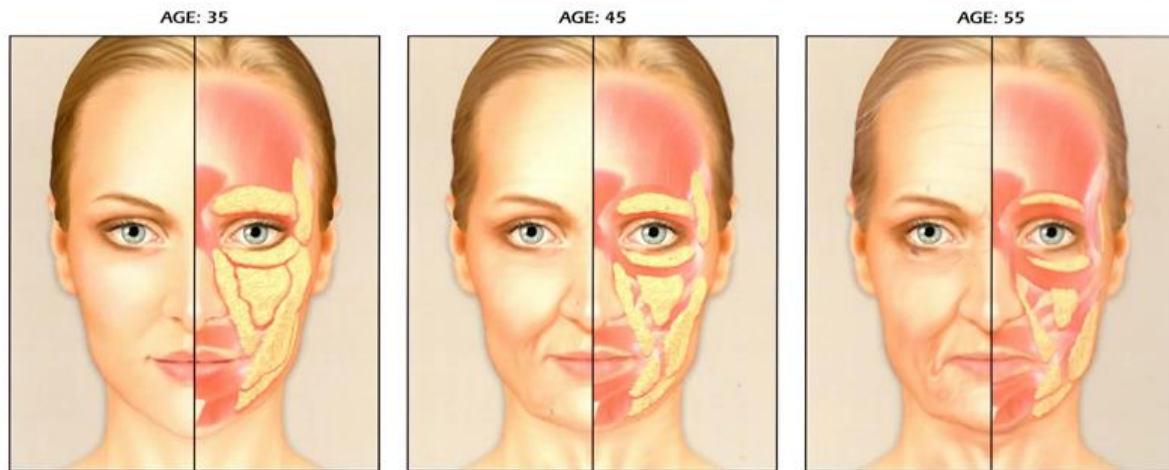
The pyramidal or procerus muscle appears as a medial extension of the frontalis muscle. It overlaps the nasal bones in which it inserts distally along with the upper lateral cartilages. It depresses the medial portion of the eyebrows. The repetitive contractions lead to the formation of horizontal glabellar wrinkles.

The orbicularis oculi muscle is one of the largest muscles responsible for facial expression. It is wide, circular, and diaphragmatic. It appears as a flat and narrow muscle sheath that is closely adherent to the skin. Its fibres sweep in concentric circles around the orbital margins and in the eyelids and consists of three parts:

1. The orbital part or pars orbicularis is external and devoid of deep attachments. It forms a ring and inserts medially on the medial palpebral ligament. The repeated contractions result in the onset of 'crow's feet' and oblique glabellar lines. The lines are caused due to the contraction of the internal superior fibres of the pars orbicularis.

2. The palpebral part, or pars palpebralis, is internal, adherent to the tarsal plates and inserted deeply within the palpebral ligament. A strip of muscle known as the 'Horner's muscle' detaches from the palpebral muscle and runs towards the posterior lacrimal crest. This muscle encourages the emptying of the lacrimal sac and helps with lymphatic drainage in the orbital region.
3. The orbitomalar crease corresponds to the inferior border of the orbicularis oculi muscle. It stands out as the limit between the orbital region and the cheek. It also delineates the superior border of the malar fat pad.

Beneath the orbicularis oculi muscle, there is a thin layer of fat continuous with the jugal fat called the sub-orbicularis oculi fat (SOOF). This layer provides a natural division.



The levator palpebrae superioris muscle in its retro-septal position causes the upper eyelid to be raised. It starts from its superior periosteal insertions in the orbital roof to its tight skin and tarsal insertions in the upper eyelid. The posterior head, also known as the Muller's muscle, inserts inside superior border of the upper tarsal plate.

The fibroelastic layer is a continuous structure formed by the tarsus, the medial and lateral palpebral ligaments, and the orbital septum.

### The nasal and perioral region

The nasal muscles of expression are:

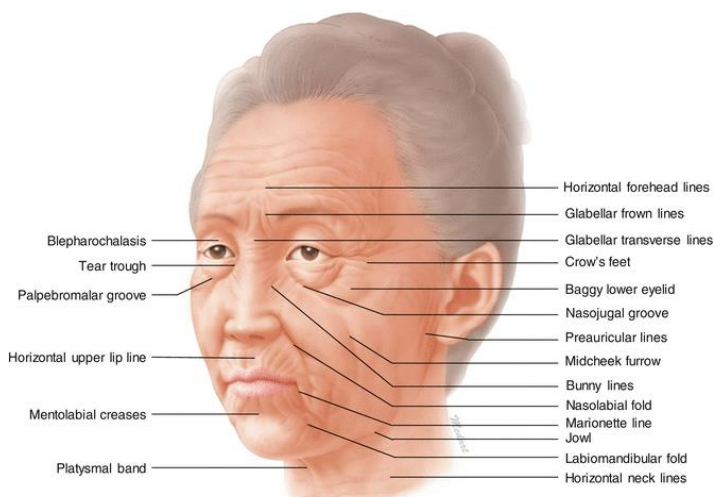
- the nasalis muscle consists of a transverse bundle (pars transversa) that depresses the nostrils and an alar bundle (pars alaris) that causes the nostrils to dilate.
- The procerus muscle, a naso-glabellar muscle, the depressor septi or myrtiliform muscle, which depresses the nasal septum
- The levator labii superioris alaeque nasi muscle elevates the lip and the nose.

### The oromental region

Muscles appear in layers or strata as described by Freilinger:

- A superficial layer made of the zygomaticus minor muscle, the depressor anguli oris muscle, and the orbicularis oculi muscle
- A second layer comprises of the zygomaticus major muscle, the risorius muscle, the platysma muscle, and the depressor anguli oris muscle
- A third layer is devised of the orbicularis labii muscle and the levator labii superioris muscle
- A deep layer comprising of the mentalis muscle, the levator anguli oris muscle, and the buccinator muscle.

The platysma is an extensive sheet of wide and shallow vertical muscle fibres that cover part of the inferior third of the face and most of the anterolateral region of the neck. It extends from the lower cheeks and the perioral region down towards the clavicular region. The right and left platysma muscles draw as they diverge, an inverted 'V' with the apex pointing towards the mandibular symphysis. The platysma is part of the SMAS–platysma sheath. The cervical component of this sheath is purely muscular (platysma muscle per se), whereas its parotid region component is mainly aponeurotic (fibrous platysma). This musculoaponeurotic sheath adheres to the underlying structures through the so-called 'facia'.



## Vessels of the face

### Arteries of the face

The face is supplied mainly by two distinct networks:

- a major superficial network derived from the external carotid artery
- a deep network derived from the internal carotid artery.

These two systems connect freely, which explains the vitality of the facial skin.

The facial artery derives from the external carotid artery and lies superficially as it hooks around the inferior border of the mandible. In its course over the face, it runs alongside the nasolabial fold and follows a sinuous course between the muscle layers and runs deep into the platysma and the zygomatic muscles. Near the edges of the mouth, it sends the labial and alar branches that branch on the midline with the contralateral arteries. Near the upper section of the nasolabial fold, it then runs along with the nose to the inner angle of the eye as the angular artery and branches off inconstantly, with the ophthalmic artery.

The superficial temporal artery starts in the parotid region, where the external carotid artery splits into two branches, the superficial temporal artery and the internal maxillary artery. It ascends through the superficial temporal fascia, lateral to the temporal branch of the facial nerve. Along its ascending course, it gives off three collateral branches, the transverse facial artery, the zygomaticomalar artery, and the deep medial temporal artery. It ends in the scalp by splitting into two branches, an anterior frontal branch that contributes to the periorbital network of vessels and a posterior parietal branch that connects with the contralateral arteries.

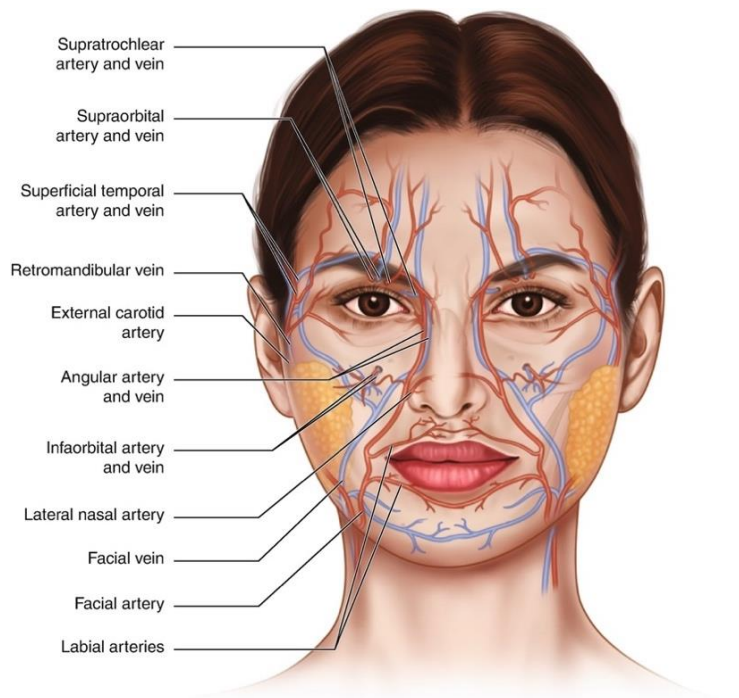
The internal maxillary artery contributes to the deep supply of blood to the face. Among its collateral branches, we mention the buccal artery supplying the soft tissues of the cheek and the infraorbital artery emerging from the infraorbital foramen and supplying the lower eyelid and the cheek.

The ophthalmic artery branches from the internal carotid artery and contributes to the vascular supply of the face through its terminal branching from the nasal artery, the angular artery. It has two facial branches:

the supraorbital or external frontal artery, and the supratrochlear or internal frontal artery that runs upward and connects with the frontal branch of the superficial temporal artery.

### Veins of the face

The venous system of the face can be superposed to the arterial one. A superficial network that is made up mainly of the facial vein that arises from the union of the supratrochlear and the supraorbital veins. The facial vein lies inferiorly through the face and finishes by draining into the internal jugular vein.



The superficial temporal vein drains the forehead and scalp and unites with the maxillary vein, posterior to the neck of the mandible, to form the retromandibular vein. The retromandibular vein splits into an anterior branch that unites with the facial vein and a posterior branch that joins the posterior auricular vein to form the external jugular vein. The external jugular vein drains into the subclavian vein.

There is a deep venous network linked to the superficial one through the angular vein that connects the cavernous sinus to the facial vein.

### Nerves of the face

Motor nerves of the face include the Cranial nerve (CN) VII, the facial nerve, supplies the muscles of facial expression. Posteriorly, over the cheek, the extracranial section of the facial nerve is protected by the parotid gland and then by the parotid masseteric fascia. The facial nerve emerges from the skull through the stylomastoid opening and runs within the parotid gland giving rise to a cervicofacial branch and a temporofacial branch. These subdivide into five major branches. All branches of the nerves run superficially within the substance of the parotid gland before they supply the muscles of expression and mimetic muscles.

The cervical nerve branch of the face is the most posterior and inferior of the five nerve branches. It runs behind and below the mandibular angle and supplies the platysma muscle.

The mandibular nerve branch of the face can be unique or divided into two sections. The inferior branch is always more significant. This runs superficially over the facial artery before supplying several motor branches to the inner surface of the mentalis muscle, the depressor labii inferioris, and the depressor anguli oris.

The buccal branch of the facial nerve divides early into two branches running over the masseter muscle just beneath the parotid masseteric fascia:

- A superior ramus which follows an anterior and inferior oblique path and crosses above the Stensen's duct before supplying the outer surface of the buccinator muscle.
- An inferior ramus supplies the inner surface of the orbicularis oris.

The zygomatic branch of the facial nerve passes transversely over the zygomatic bone before dividing into



three major branches:

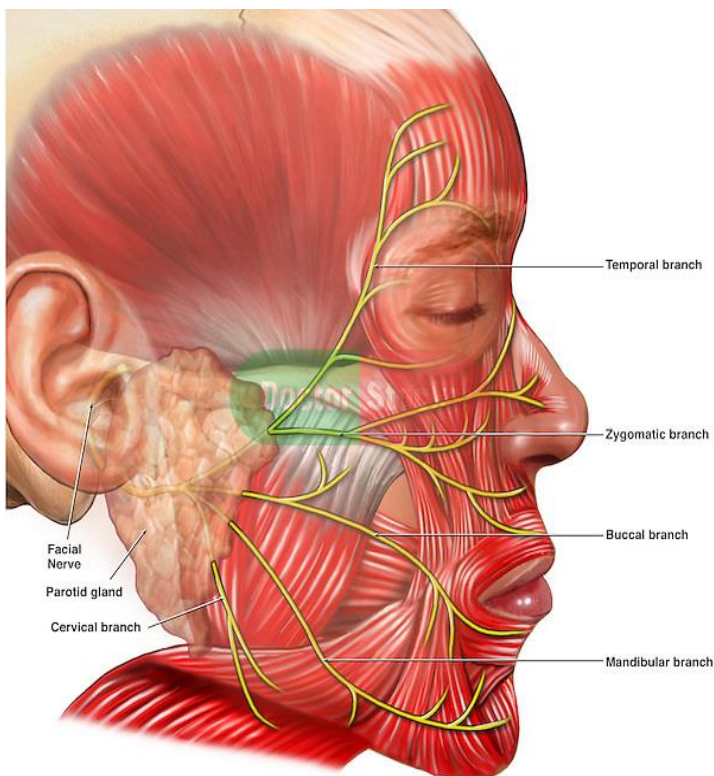
- The superior palpebral branch which supplies the orbicularis oculi muscle and the corrugator muscle
- The inferior palpebral branch which again supplies the orbicularis oculi muscle
- The infraorbital branch supplies the zygomatic muscles and muscles of the upper lip and nose.

There are many connections between the buccal and zygomatic branches of the facial nerve.

The temporal branch of the facial nerve is the most vulnerable to injury during facial treatments. This path can be outlined by drawing a line passing through a point of 0.5 cm beneath the tragus and another 1.5 cm above the lateral border of the eyebrow. The different nerve branches connect each other, crossing the zygomatic arch approximately 2 cm anterior to the tragus, and reaches the superficial temporal fascia where it runs beneath the superficial temporal artery. The nerve ends by supplying the inner surface of the frontal muscle.

### Sensory nerves of the face: the trigeminal and the great auricular nerves

Knowledge of these is essential for the practice of local anaesthesia of the face.



The trigeminal nerve provides sensory innervation of the face through these three branches:

1. The ophthalmic nerve is the superior division of the trigeminal nerve. It splits into three branches: The lacrimal, the frontal, and the nasociliary branches. The lacrimal nerve supplies the lacrimal gland, the upper eyelid, the conjunctiva, and the lateral angle of the eye. The frontal nerve splits into two separate branches: supratrochlear and supraorbital. The supratrochlear nerve supplies the medial angle of the eye, the upper eyelid, the nasion, and part of the glabella. The supraorbital nerve emerges from the superior orbital margin through an opening or a small canal before it supplies the lateral canthus, the upper eyelid, and the temporal and frontoparietal regions of the head. The nasociliary nerve splits into two further branches, one internal and one external, that supply the nasal dorsum and the nasal tip.
2. The maxillary nerve is the intermediate division of the trigeminal nerve. In the infratemporal region, it gives off an orbital branch before it divides into a lacrimopalpebral branch supplying the lateral part of the upper eyelid and a temporomaxillary branch supplying the anterior temporal region. It emerges then below the inferior orbital margin, through the infraorbital opening as a large terminal branch, the infraorbital nerve that supplies the lower eyelid, the lateral aspect of the nose, the cheek, and the upper lip.

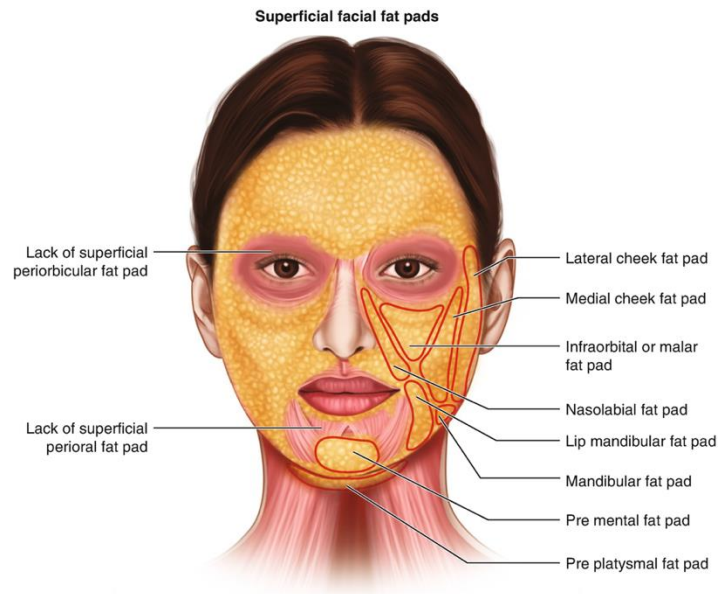
The mandibular nerve is the inferior section of the trigeminal nerve. It has cutaneous sensory branches, called the inferior alveolar nerve. After it passes through the inferior alveolar canal, the nerve emerges from the mental opening supplying the mental nerve that provides sensation to the chin and lower lip. Medial to the neck of the mandible, the mandibular nerve splits off into the auriculotemporal nerve that supplies the tragus, the ear lobe, and the skin within the temporal region. These nerves arise from the

posterior division of the mandibular nerve. The anterior division provides the buccal nerve that supplies the skin over the cheek area.

3. The great auricular nerve belongs to the superficial cervical plexus. It runs in the superficial cervical aponeurosis above the external surface of the sternocleidomastoid muscle, lateral to the external jugular vein. Beneath the ear, it becomes strictly subcutaneous before it supplies the lobe of the ear, the retro auricular region, and part of the cheek close to the tragus.

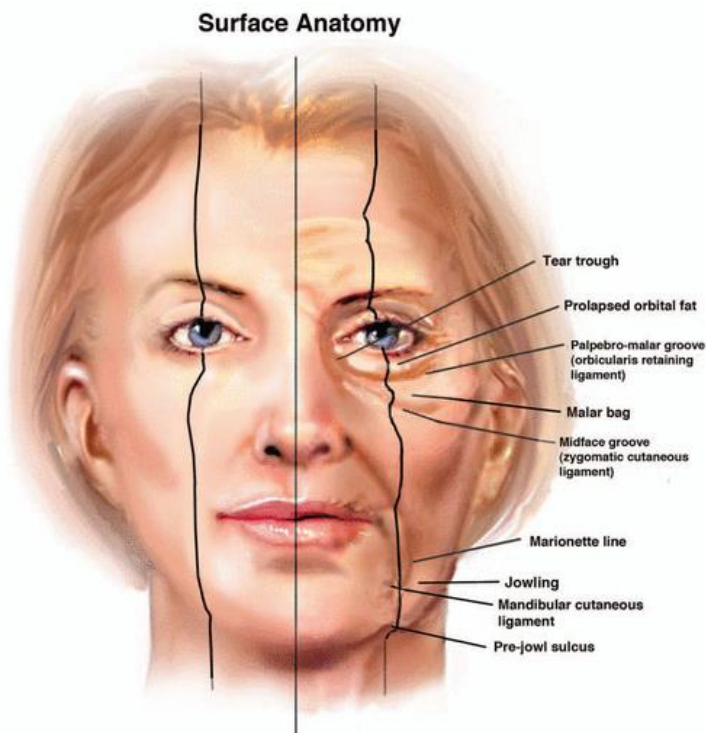
### Ageing of the face and neck

In the course of ageing, the face and neck change their morphology and appearance dramatically. Ageing concerns all tissue layers composing the face and neck: the skin primarily but also the fatty tissue, the musculoaponeurotic system, and the bony scaffolding beneath. All levels of the face are affected by the ageing process. According to the skin type, morphotype, and exposure to certain predisposing factors, the different constituents and elements of the face will not age uniformly. Treatment of the consequences of ageing has become an important part of aesthetic treatments within the beauty industry.



### Mechanisms of facial ageing

There are two main types of mechanisms that play a role in facial ageing: tissue modification, involving all components of the face, and a global drop of the facial tissues.



Impairment of the skin begins with the onset of fine lines, wrinkles, and grooves and cutaneous slackening. The two main reasons for this impairment are a reduction in skin's elasticity and repeated contraction of the fine muscles. The effects of solar elastosis, which concerns the dermis and the epidermis, become visible from the mid-20s, especially in cases of genetic predisposition (fairer skin types). The face and neck are the area's most severely affected first, owing to sun exposure.

Wrinkles begin to appear on a woman's face around the mid-30s, at the same time that oestrogen levels begin to diminish. Changes start in the epidermis and occur due to the accumulation of dead keratinocytes in the stratum corneum. The amount of collagen and elastin in the dermis begin to decrease, particularly in women with excessive exposure to the sun and from smoking.

From the age of 40, the rate of renewal of keratinocytes starts to diminish (the life of a keratinocyte changes from 100 to 48 days).

The epidermis becomes thinner with a reduction of cell turnover, and in the number of melanocytes (10–20% per decade) and fine, superficial wrinkles, deep wrinkles, and expression wrinkles appear. With the rapid decline of oestrogen levels during the menopause, the epidermis becomes irregular; thinning of the dermis becomes more marked, and the hypodermal fat layer atrophies. When the skin loses elasticity and becomes thinner, its capacity to renew itself diminishes, as does the vascularisation of the dermo-hypodermis.

The dermo-epidermal junction atrophies and becomes progressively flatter. The superficial dermis atrophies introducing a disorder of the collagen support, comprising degeneration with progressive reduction of elastin fibres and increased mucoid ground substance. A further degenerative process appears that is characterised by the accumulation in the dermis of colloid masses, giving a yellowish colour to the skin: senile elastosis. Damage caused by sun exposure can be separated into four stages.

**Stage 1** (20–30 years), or the start of photo-ageing, is defined by the presence of mimic wrinkles and the beginning of impairment of pigmentation.

**Stage 2** (35–50 years), expression wrinkles start to appear at the corners of the mouth and the eyes, and there is some keratosis.

**Stage 3** (from 50 years) is characterised by persistent wrinkles at rest, obvious discolourations, and marked keratosis.

**Stage 4** is defined by deep and widespread wrinkles, a yellow tone to the skin, and an increased frequency of skin malignancies. Hirsuteness is augmented by an increase in androgen production. The loss of elasticity is further aggravated by skin dryness and as a secondary reduction of sweat and sebaceous secretions. Under the effects of tissue impairment and gravity, prolapse of the skin becomes progressively established. It affects the surface skin, fatty structures, and platysma muscles of the face, causing creases (skin folds) and loss of the oval shape. To these cutaneous impairments is added the ageing of deep structures. The basal metabolism diminishes by about 5% per decade on average from age 40, which can favour fat accumulation at the level of the abdomen, the waist, the hips, and the thighs, but also to a lesser extent the face, especially under the chin, at the level of the cheeks, and around the eyes. Facial fat is supported by septa or fasciae, which become lax. Fat settles in the deep zones under the fasciae while it becomes thinner subcutaneously, which causes thinning and skin fragility. Slackening and atrophy of glandular tissue of the face, which accelerates after the menopause, also contribute to the loss of suppleness and firmness of the skin.

### **Cutaneous ageing:**

#### **wrinkles**

The superficial skin starts to become thinner, more dehydrated, and progressively loses its elasticity. Subcutaneous adipose tissue becomes reduced. Muscular hypotony joins fatty hypotrophy in contributing to skin impairment.

According to the depth of wrinkles, they can be differentiated into fine lines (wrinkles) and grooves (furrows).

Fine wrinkles are initially isolated and discrete, then converge and become multidirectional. They are sometimes associated with repeated contraction of the muscles of the face and neck; they then become deeper and are called expression wrinkles (mimic lines), such as ‘crow’s feet’ in the orbit temporal region. When expression wrinkles extend to the dermis, they are called grooves (skin furrows) or glabellar wrinkles (frown lines). When the skin starts to slacken, it can be redundant in the form of excessive creases appearing on the upper eyelid. Main reasons for this is due to loss of elasticity of the dermis (dermal elastosis), which depends on genetic makeup and sun exposure, and repeated contraction of the muscles of the face and neck. You will need to learn to distinguish between fine wrinkles, expression wrinkles, and grooves, as well as creases, in terms of treatment. Fine wrinkles can be treated by laser resurfacing and expression wrinkles and grooves by filler products or botulinum toxin, but creases usually require surgical intervention.

#### **Musculoaponeurotic ageing**

The superficial fascia, a fine muscular insertion in all mammals and limited to the deep layer of the hypodermis, has evolved in man to the point of being only a fibrous small strip, often difficult to identify, at the level of the members of the trunk. Its phylogenetic related persistence in the human face allows for facial expression and is

described by Mitz and Peyronie as the superficial musculoaponeurotic system (SMAS), composed of elements of muscular origin found in the same vicinity and forms a continuous structure. This group of discontinuous structures, including the fine muscles of the face, parotid aponeurosis, and fine muscles of the neck or platysma, are not in the same plane. Recent research distinguishes two types of SMAS: type 1, a network of fibrous septa enveloping lobules of fatty tissue, found in the posterior part of the face behind the nasolabial groove, at the level of the forehead, covering the parotid, zygoma, and infraorbital region; and type 2, a network of collagen and elastin fibres intermixed with muscular fibres, found at the front of the nasolabial groove around the levels of the upper and lower lips.

Muscular ageing is characterised by a reduction in muscle mass, modification to metabolism, and excess fat. A particularly visible slackening occurs at the level of the orbicularis muscle and also around the lips.

### **Ageing of the fatty masses**

The evolution of the fatty masses on the face can be either a decline or an increase. A reduction in fatty tissue affects the orbital, temporal, and submalar regions. However, the fat pad of the premaral region shows a progressive decline, with the sliding of the malar region into the canine fossa, this overhangs the nasolabial groove.

### **Ageing of the bony base**

Recent research has contradicted the idea that craniofacial skeletal growth is completed at the end of adolescence. This growth continues and is associated with an enlargement of the sinus and an anticlockwise rotation of the bony structure, and a clockwise rotation of the mandible. Anthropometric measurements of the skulls of ageing subjects, and especially video study of the ageing of numerous subjects over several decades, showed notable modifications. A reduction of mandibular and maxillary height, principally in relation to edentation and alveolar lysis, and a related retrusion of the jaw, appear with age. In women, this is accompanied by an increase in depth of the upper two-thirds of the cranial arch. Each transverse dimension of the face is augmented, while the depth of the inferior third section of the face diminishes. The facial skeleton is not static but a dynamic structure that evolves with age. The upper part of the face widens and deepens, and its projection increases by 6%, the frontal sinus from 9 to 14%, and the mandible by 7%.

There is the further development of the prominence of the supraorbital arch, and the bony protuberances start to become more pronounced with prominent frontal bumps and, an increase of the nasofrontal angle can be seen in men. Finally, the projection and form of the chin change via mandibular rotation leading to an appearance of general concavity of the facial contour. There is no reduction of the facial bony volume but, on the contrary, expansion.

### **Demineralisation**

In addition, demineralisation occurs. Bony structures, due to progressive demineralisation (accelerated by the menopause), undergo a reduction which can, especially in very old persons, change the appearance. This reduction affects the jaw in particular. Thinning of the alveolar bone leads to a loss of teeth and a thinning of the anterior part of the upper jaw aggravates cutaneous slackening and upper lip wrinkles.

### **Topographic ageing**

The face can be separated into three regions: upper, mid-, and lower. The upper face comprises the forehead, the glabella, the eyebrows, temporal regions, and the upper eyelids. The mid-face comprises the lower eyelids, the cheeks, which are divided into the anterior, mid-, and posterior zones, as well as the upper lip. The lower face is consists of the lower lip, the chin, and the vertical and horizontal sections of the anterior part of the neck.

### **Upper face**

The first signs of ageing appear in the upper third of the face. Wrinkles appear at the level of the forehead and glabella, with fine wrinkles around the temporo-orbital region (crow's feet). Slackening and thinning of the frontalis muscle leads to the onset of horizontal forehead wrinkles, which, from simple expression wrinkles, can



be transformed into deep grooves or even folds. Hypertrophy of the corrugator and procerus muscles is the origin of the frown lines, often wrinkles of very deep expression. The procerus is responsible for horizontal wrinkles, the corrugator for slanting wrinkles. As for the forehead, impairment can lead to simple expression wrinkles or deep grooves or folds implicating the reticular dermis. The tail of the eyebrow is subjected to prolapse due to the subsidence of the orbicularis.

The glabella starts to become more prominent owing to the fall of the frontal tissues and expansion of the sinus. The temporal pit begins to hollow, and the external orbital arch, owing to the resorption of superciliary fatty tissue and the prominent expansion of the bone.

The upper eyelid presents with excess skin, which can be so severe that it can interrupt the visual field. Fatty excess is often present, particularly at the level of the internal pocket, particularly in a case where weakening of the orbital septum occurs, which can cause a pseudo-hernia of the fatty pocket. There can also be a deficiency of fat.

### **Mid-face**

The lower eyelid presents in variable manners, such as a fatty enlargement in the form of the nasal, middle, and the temporal pockets, as well as excess skin. The convexity of these 'pockets' is due to an excess of fatty tissue but also because of a slackening of the septum supporting them. The orbicularis muscle loosens, which favours the appearance of fatty pockets and herniated subocularis oculi fat pads (SOOF) known as 'malar bags', while the ligaments of the external canthus relaxes, sometimes leading to its fall. The slackening of fine muscles of the mid-third of the face accentuates the fall of fat under the skin, which seems to be accumulated in the lower, anterior region and diminished in the lateral, upper region. The nasolabial fold then becomes a deep groove.

The malar bone becomes flattened and diminished. The zygoma and malar and submalar regions lose fat, giving a skeletonised appearance of the cheekbones with submalar hollows, while 'jowls' appear from around age 30 and increase progressively. Diminishing fat is particularly notable at the level of the ball of 'Bichat', which aggravates the skeletonisation of the face. The cutaneous and muscular flaccidity appears on the cheeks and increases the nasolabial groove, which leads to the appearance of the labiomental groove. The orbicularis oris muscle atrophies and slackens, leading to thin and impaired skin of the upper lip and chronic muscular shrinkage, causing the progressive appearance of the characteristic vertical wrinkles of the ageing upper lip. Initially, the fine multidirectional lines appear, then wrinkles, which begin to converge, then the true grooves and vertical or slanting creases appear. The profile of the upper lip and vermilion starts to become flat. The loss of teeth and osteoporosis of the anterior part of the upper maxilla increases the cutaneous laxity of the upper lip. With the descent of the labial corners, the interlabial line becomes lower than the incisal line.

The nose is also subject to the effects of ageing but in an isolated manner. The quality of the skin is disrupted by solar elastosis and loss of elasticity, sometimes with skin excess, and in men and increase in density of the sebaceous glands, which thickens the skin and can lead to rhinophyma. The tip starts to lose its definition and falls (under a horizontal line that crosses the nasal ridge) via diminution of the alar cartilage secondary to the thinning and the division of the fibrocartilage between the different structures, and via the weakening of the suspensory ligament, the thinning of cartilage, cutaneous thickening, and the subsequent decrease of the columella secondary to maxillary detachment caused by alveolar bony lysis and reduction of the nasal ridge.

### **Lower face and neck**

Ageing of the cervicomental angle is particularly marked by the fall of subcutaneous fat and accumulation in the lower part of the cheeks. The youthful oval shape of the face loses its definition with the appearance of cutaneous and muscular prolapse that creates 'jowls' from around age 30, which are further increased by fatty subsidence and can 'overflow' under the mandibular border. The apex of the chin drops and becomes lower than the mandibular line.

Hypotony and slackening of the orbicularis oris and the depressor anguli oris cause vertical wrinkles at the corners of the lower lip and on the chin and further increases the depth of the nasolabial groove. Atrophy of the skin favours the appearance of these wrinkles. With the extension of the nasolabial groove, a labiomental wrinkle

starts to develop. Muscular hypotony is further increased by gingival retraction and resorption of the alveolar bone.

The neck presents with cutaneous and muscular subsidence that can be particularly important and associated with diastasis of the internal edges of the platysma muscle, which also begin to show hypotrophy, slackening, and weakness, giving rise to the 'turkey neck' appearance and visible platysma bands. Weight gain that is often linked to ageing causes adipose infiltration under and in front of the platysma to varying degrees.

Fat underneath the platysma can become visible due to the separation of the platysma muscle and gives a thickened appearance of the neck. Fine, cervical wrinkles due to atrophy of the skin, solar elastosis, and a reduction of subcutaneous fat all contribute to semi-circular skin creases and loss of the cervicomental angle. Lastly, the cervical contour becomes convex with compaction and hyperlordosis of the cervical vertebrae that leads to a shortening of the neck, disappearance of the curve of the nape, lowering of the hyoid bone, and hypertrophy and protrusion of the trachea and thyroid cartilage and cricoids.

### **Ageing, according to Fitzpatrick grading.**

#### **Ethnicity and ageing**

The thickness of the skin varies according to the ethnicity of the client. Dark skin has more melanin in the deeper layers of the epidermis and better resistance to sun exposure. Hence, solar elastosis appears earlier and is more severe in clients with pale skin, e.g. those with red or blonde hair. These clients must be very vigilant regarding the duration of sun exposure in relation to risk augmented by sunburn, especially for skin carcinomas: basocellular, spinocellular, and melanoma principally.

Certain ethnic groups have more prominent cheekbones (especially those of Asian origin) that delay the onset of cutaneous subsidence. When a prominent facial skeleton is associated with fine skin having a tendency to retraction more than prolapse. In Africans, Afro-Caribbean's, and 'mestizas', with the greatest thickness of the skin, an aged and wrinkled aspect of the skin is less visible, and the indication for a cervicofacial facelift is reduced. In fact, the visible signs of ageing are delayed on average for at least a decade in most non-Caucasian populations: Asian, African, and Afro-American.

Fine lines and expression wrinkles appear much later and are less pronounced than in clients with a Fitzpatrick of 1-3. In contrast, fat prolapse, and muscular slackening are equally or more important than in Caucasians.

#### **Morphotype and ageing**

Ageing presents with important individual variations according to the predominance of skin prolapse, wrinkles, skin thickness, and exposure to environmental factors such as solar radiation or smoking.

The bony relief of the facial skeleton is particularly important, especially in the malar and mandibular regions.

Prominent cheekbones will delay the effect of prolapse, and a hypomandibular or 'long face' syndrome will favour the early appearance of subsidence of the inferior third of the face and neck. A rounder face associated with excess weight is an advantage, but significant weight loss accentuates flaccidity and, therefore, cutaneous fall. Facial signs of ageing can have a global nature or can be isolated, with the appearance and emphasis of different signs seen in a discrete manner.

#### **Factors favouring cutaneous ageing**

Sun exposure, besides the obvious risks of the appearance of cutaneous cancerous lesions or transformation of precancerous lesions favours cutaneous ageing via its negative effect on elastin fibres. 'Age spots' appear, and solar elastosis develops in the skin of the face and neck, highly exposed zones which are therefore affected most severely. These effects appear earlier for the same duration of exposure in people with a fair complexion. Smoking is associated with well-known risks of lung cancer or chronic lung disease, and cardiovascular disease, and it also contributes to cutaneous ageing. Repeated contraction of the orbicularis muscle while smoking a cigarette reveals

early vertical wrinkles of the upper lip. It also causes a poor buccodental state, which, as a source of infection and lysis of the alveolar bone, can change the aspect of the mouth. It also accelerates the yellowing of teeth.

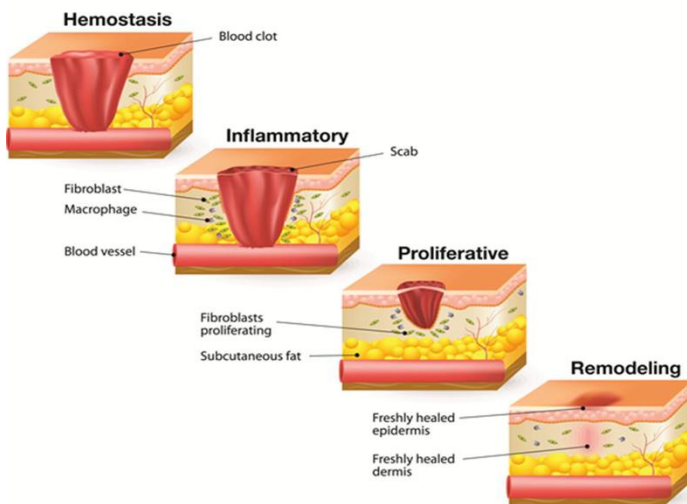
Lack of sleep and psychological stress also have a harmful effect on the appearance of the skin. A low-humidity atmosphere can dehydrate the skin, and climatic changes can act on its physiology.

Excessive blinking of the eyes can cause the appearance of periorbital wrinkling.

Large weight loss leads to a slackening of the skin, giving a prematurely aged appearance not only to the face but also to the rest of the body.

## Wound Healing

Wound healing is a natural restorative response to tissue injury. Healing is the interaction of a complete cascade of cellular events that generates resurfacing, reconstitution, and restoration of the tensile strength of injured skin. Healing is a systematic process, traditionally explained in terms of 4 overlapping classic phases: haemostasis, inflammation, proliferation, and maturation.



While platelets play a crucial role in clot formation during haemostasis, inflammatory cells debride (remove) injured tissue during the inflammatory phase. Epithelialisation (forms a barrier), fibroplasia (forming fibrous tissue), and angiogenesis (formation of new blood cells) occur during the proliferative phase. Meanwhile, granulation tissue forms, and the wound begins to contract.

Finally, during the maturation phase, collagen forms tight cross-links to other collagen and with protein molecules, increasing the tensile strength of the wound. For the sake of discussion and understanding, the process of wound healing

may be presented as a series of separate events. In fact, the entire process is much more complicated, as cellular events that lead to scar formation overlap.

### Haemostasis (phase 1 day)

Haemostasis is the process of the wound being closed by clotting. Haemostasis starts when blood leaks out of the body. The first step of haemostasis is when blood vessels constrict to restrict the blood flow. Next, platelets stick together in order to seal the break in the wall of the blood vessel.

### Inflammatory response (phase 1-5 day)

The second the skin tissue is damaged, Mast cells in the tissue release Histamine to trigger the inflammatory response. At the same time, the capillaries and arterioles begin dilating and release blood plasma into the area as part of the inflammatory response to injury.

The plasma contains nutrients, oxygen, antibodies and white blood cells to help flushes away any foreign matter from the area.

After the initial rush of the inflammatory response, leucocytes and the later arriving macrophages remove the dead tissue and foreign material, and the fibrin net lay down in the tissue is dissolved.

### **Fibroblastic phase (5-28 days) Also, the Regenerative phase.**

Once the wound is ready to move into the regenerative phase, a sequence of events occurs, and it is all part of the regenerative phase of wound healing, "collagen synthesis". Collagen, however, cannot be synthesised in the abundance of oxygen and nutrients, and if the blood supply has been damaged, it will need to be replaced.

### **New Collagen Production**

To produce new collagen, tissue, the fibroblasts that are found in low numbers in the dermis proliferate and migrate to the base of the wound with the help of growth factors and a very important glycoprotein called fibronectin.

Fibronectin acts as a conduit for fibroblasts, and it binds both the wound and the fibroblast together to allow the fibroblast to stay in place (the fibronectin) and take up residence in the wound.

Once in the wound, fibroblasts begin to synthesise collagen fibres and produce fibronectin and GAGs like hyaluronic acid.

This dermal remodelling will continue for up to two years from the original injury, with this time-varying individuals and with age. Unfortunately, the scar is rarely as strong as the tissue it replaced.

## **Acne**

### **Barrier Function**

The epidermal cells produce lipids during the process of cell turnover. These lipids or fats are comprised of a mixture of sphingolipids (also known as ceramides), triglycerides, cholesterol, fatty acids, waxes, and phospholipids. This lipid mixture is extruded from the cells and begins filling the spaces between the epidermal cells, especially in the corneum. This is not the same lipid group that is secreted by the sebaceous glands. The appearance of the cells surrounded by the lipids can be described as the brick and mortar concept.

In this concept, the cells of the bricks and the lipid complex is the mortar. The lipid complex can also be referred to as an intercellular cement or intercellular matrix. When it fills the spaces between epidermal cells, it is known as the skin's barrier function.

The barrier function is one of the most important functions of the skin and has two major purposes.

The first is to prevent trans epidermal water loss (TEWL) as the barrier lipids block the evaporation of water or moisture and prevent cell dehydration. The lipids help to hold water between the cells making the skin appear smoother, firmer and more useful.

The second function is to protect the skin against the penetration of any unwanted or possibly irritating substances.

Environmental exposure such as sun exposure or sunburn, cold exposure or frostbite may damage the barrier's lipids. The barrier could also be damaged by incorrect or overly aggressive skincare. The intercellular lipids can also be stripped using a cleanser or wash that is too strong for the skin type or washing the skin too often. The most common cause of barrier function damage is the overuse of chemical or mechanical exfoliators or Microdermabrasion.

When this lipid barrier is damaged, moisture can easily escape from the epidermis into the atmosphere, making the skin appear dehydrated, more wrinkled, and sometimes rough or chapped. When there are holes in the mortar, this allows moisture evaporation. The skin may feel tight or itchy. When the barrier function is not working properly, it is said to be impaired.

This lipid barrier is somewhat protected in oily and acne-prone skin due to the abundance of sebum on the surface of the skin. However, this layer can be damaged in the skin of acne-prone individuals due to the overuse of strong surfactant to control the sebum or from the overuse of drying or peeling agents to remove excess sebum build-up. Whilst surfactant cleaners do a good job of removing excess sebum, if overused, they strip the sebum off the surface and begin emulsifying the lipid layer.

Skin redness can be a sign of an impaired barrier function. The fatty complex between cells help to prevent irritant from entering the skin. When lipids have been stripped away from the skin, irritating substances can easily penetrate the skin, which causes redness from the blood bringing immune cells to the skin area to respond to the irritation.

The lipid barrier can be repaired using serums or moisturises containing components of the natural lipid complex such as ceramides. Ceramides can help patch in the mortar by filling in a lipid complex deficiency within the barrier. Discontinuing the use of any product that strips too much fat from the skin can also help the barrier to re-establish on its own. When the lipids are allowed to form in the normal keratinisation process, barrier function and proper moisture levels will return, the skin will look smoother, and redness will dissipate.

### **Skin and the Immune System**

The skin helps to serve to protect the inner organs. As well as being a barrier and shield from the outside world, it also contains elements that are part of the immune system and are part of the bodies defence system against disease.

The immune system comprises of specialised cells in the blood as well as the skin. Langerhans cells are one of the most important immune cells that run through the mid-epidermis and dermis. The function of the Langerhans cells is to detect and identify foreign bodies in the skin and the signal biochemical reactions that cause the skin and the body systems to react to these foreign bodies.

Keratinocytes secrete biochemicals that influence the immune system's behaviour, helping the immune cells communicate, replicate, and control immune functions.

Leucocytes and lymphocytes, also known as white blood cells or a major part of the immune system. They react to and defend the body against foreign invaders and pathogenic organisms. White blood cells are very important factors in acne. They can help fight acne bacteria and react to help rescue the follicles involved in the acne process.

### **Acne bacteria, fatty acids and inflammation**

Acne is a multifactorial condition, meaning that many factors play a role in the development of acne. Several of those factors have to exist in order for a person to have acne. Acne is not a contagious disease and is not infectious. However, the presence of a certain bacteria is one of the main causes of acne.

Propionibacterium acnes (P.acnes) is the bacteria associated with acne. This bacteria lives in the sebaceous follicles of every human being and is part of the normal microflora. People who have acne have a higher number of these bacteria present on their skin.

P.acnes bacteria are anaerobic, which means that they cannot survive in the presence of oxygen. Within normal skin, follicles are not obstructed with cell build-up, and they do not have an abnormal amount of sebum filling them; even though P acnes bacteria can be present in the normal follicle, the numbers are kept in check by the presence of oxygen within the follicle which constantly kills off some of the bacteria. Free in the follicle of follicular debris can enable oxygen to penetrate the follicle and kill the acne bacteria.

When a comedone is present, oxygen cannot reach the bottom of the follicle as the filament itself obstructs it.

Another factor is the abundance of sebum that is found in the closed comedones. P.acnes bacteria obtain the nourishment from sebum, breaking the sebum down into glycerol and fatty acid. This is accomplished by the P.acnes produces an enzyme called lipase,

which breaks triglycerides in sebum down to free fatty acids and glycerol, which is consumed by the P.acnes bacteria. Several other enzymes produced by the P.acnes bacteria contribute towards inflammation. When there is an abundance of sebum in a sebaceous follicle, there will be an abundance of the P.acnes bacteria.

Other types of microorganisms are also associated with acne: staphylococcus epidermidis are cocci and have been detected on the surface of the skin in comedones. Pityrosporum ovale is a type of yeast often associated with seborrheic dermatitis, which is also present in comedones. Malassezia is another yeast present in the majority of acne papules and can also play a role in the inflammation of the follicle.

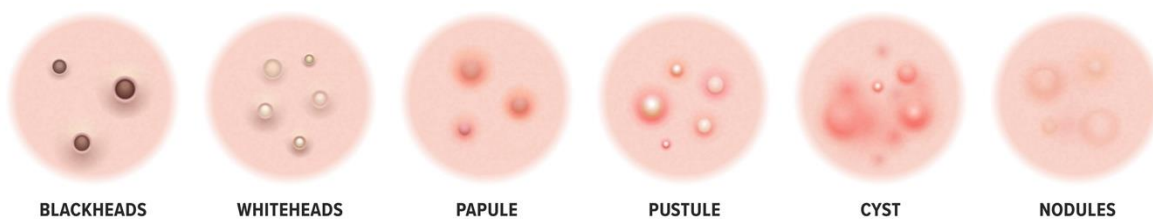
### Inflammation

Another important factor in the development of acne is inflammation. Inflammation causes swelling, redness, pressure and leads to the deterioration of the follicle walls. Free fatty acids and other enzymes produced during the P.acnes metabolic process can chemically inflame the follicle walls inside the sebaceous follicles, causing the walls to break down and eventually rupture. This is further compounded by the pressure of debris in the follicle, including dead corneocyte build-up, hardened sebum, and other biochemical inflammatory factors. As these walls rupture, debris, including bacteria, can spill out into the dermis.

White blood cells target the rupture site and release enzymes to dissolve the debris in the lesion. These enzymes can also affect the follicle lining, which causes even more inflammation and creates more swelling and discomfort. These enzymes then begin destroying collagen, which can lead to the formation of scar tissue. Although external factors can also cause inflammation, these could include mechanical pressure on the skin, chemical irritants, and some cosmetic ingredients. Hormonal factors can also contribute to inflammation.

### How Acne Develops

In acne, prone skin cells do not shed in the normal way, especially inside the sebaceous follicles. Corneocytes accumulate in the sebaceous follicle, which forms a clump lower in the follicle known as a microcomedo. A microcomedo is the beginning of an acne lesion; although these can be invisible to the naked eye, controlling microcomedones allows us to control acne. A clump of dead corneocytes mixed with sebaceous secretions solidifies, forming a small plug light structure. The walls of the sebaceous follicle thicken with the build-up of corneocytes.



### Inflammatory or non-inflammatory lesions

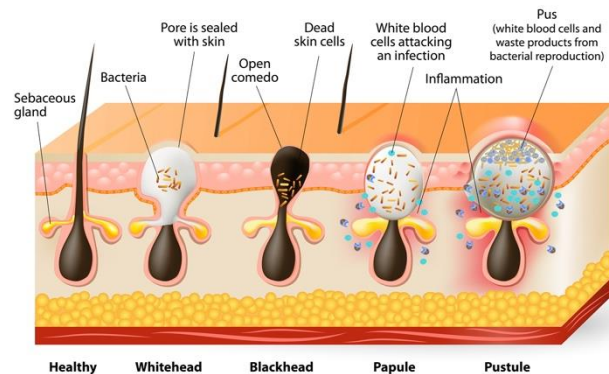
A comedone is a mixture of dead cells and solidified sebum that forms a plug inside a sebaceous follicle that evolves and develop from a microcomedone. Unlike microcomedones, these lesions are visible to the naked eye. There are two types of comedones, open comedones and closed comedones. These type of acne lesions are known as non-inflammatory because the follicle walls remain intact. Inflammatory acne lesions are red and inflamed due to blood penetrating the follicle after the follicle has ruptured.

The two types of inflammatory acne lesions are known as papules and pustules.

Open comedones are often referred to as blackheads. These are sebaceous follicle with a dilated follicle opening where the follicle is filled with a solidified plug of dead cells imbedded in a semi-hardened mass of sebum. The head of the blackhead is dark in colour hence its name. The black colour of the tip is indicative of melanin presence and oxidation of the sebaceous plug. The infundibulum is often distended due to the pressure of the impacted debris. Open comedones rarely progress into inflammatory lesions due to the presence of oxygen that can penetrate the follicle.

Closed comedones are often flesh coloured and harder to see as they appear as small bumps under the skin. They can be diagnosed due to an obvious bumpy skin texture and can be found anywhere on the face, but most frequently seen on the cheek and chin. This type of lesion is more likely to develop into an inflammatory lesion due to the tiny tight opening of the follicle, which does not permit aeration limiting oxygen exposure and therefore setting the stage for P.acnes proliferation and activity.

## TYPES OF ACNE PIMPLES



Closed comedones can become larger and more packed due to debris and inflammation from the metabolic activity of the P.acnes, which produce enzymes that weaken the follicle wall. Eventually, the follicle wall ruptures. The immune system will respond to this rupture by sending white blood cells to the follicle to fight off the infection and contain the rupture. The white cells travel through the bloodstream, which also transports red blood cells, and the blood engulfs the ruptured follicle to bring the white cells to the sight of the rupture. This is when the lesion turns red due to blood engulfing the ruptured follicle. At this point, the closed comedo becomes a papule; this is defined as a red raised acne lesion that does not have a pustular head. Papules are notorious for being red and sore due to the inflammation-causing pressure within the skin, pressing on pain nerve endings.

As the white blood cells enter the ruptured follicle to attack the bacteria, many are killed in the process. This causes many biochemical and enzymatic processes to take place the breakdown of the inflamed tissue, decreasing inflammation and removing the debris and bacteria, beginning the regeneration of the follicle. This results in the liquefying effect of the follicle contents. A pustule is formed from pus, a fluid that comprises millions of white blood cells mixed with liquefied debris from this action.

And nodule is a very deep lesion similar to a papule; only this is much deeper in the dermis and could even reach the subcutaneous layer of the skin.

Nodules often occur when the rupture in the follicle wall is very deep within the structure. In acne, nodules can often involve more than one follicle, which breaks down to form a larger pocket of infection.

A cyst is a pocket like a nodule with an epithelial lining with a tremendous amount of inflammation. A massive amount of white blood cells form a boil-like lesion. This lesion can eventually rupture. Cysts are responsible for many scars that can occur from acne. Cysts and nodules are often too deep in the skin to be treated by beauty therapists. Dermatologists can surgically remove cysts, but this can leave a scar, and they can also be injected with Cortisone to reduce inflammation and cause the cyst to reduce in size over a few days.

### Comedonal versus inflammatory acne.

Inflammatory acne is caused by inflammation inside the follicle. Sudden surges of Sebum production cause this inflammation which can be commonly attributed to sudden hormonal flares. Another cause of inflammatory acne is the application of a topically applied cosmetic product, skincare, or drug. When someone starts using a new



product or starts a new skincare regime, they may experience a sudden outbreak of acne papules or pustules. This is due to ingredients within the product, causing inflammation within the follicle.

Inflammation occurs due to swelling of the follicle walls, which minimise the oxygenation of the lower portion of the follicular canal, creating an ideal environment for anaerobic P.acnes bacteria. This is also an inflammatory reaction after a facial treatment. Inflammation occurs during the treatment that irritates the follicle walls, which result in the sudden flare of acne. Stopping the use of an offending product can often resolve the issue.

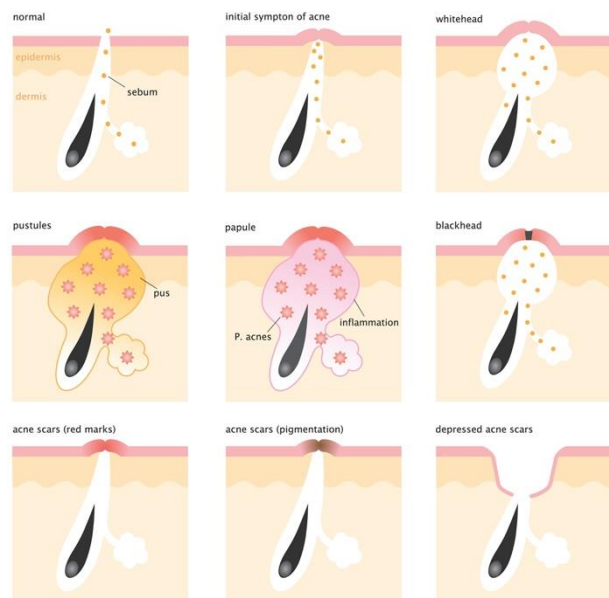
### Scarring

Scars often form from inflammation and from the skin trying to deal with infection and inflammation. The enzyme is triggered by white blood cells to destroy the collagen while rescuing the affected ruptured follicle. These enzymes, along with other immune reactions, continue to dissolve the tissue, which causes depressed or hypertrophic scarring.

The activation of fibroblasts to attempt to repair the damage from inflammation is produced in abundance and in a manic way to try and repair, replace and isolate the damaged areas resulting in pileups of collagen causing hypertrophic scarring. Hypertrophic scarring can become less prominent over time, asking enzymes dissolve some of the excess collagen.

The skin of colour is more prone to keloid scarring, which responds to an injury of the skin in people who are genetically predisposed to develop them. In scanned forms, keloids, the fibre blast respond to skin injury by overproducing collagen to the point that the heavy, fibrous tumours form. Tumours are thick masses of tissue. Keloids are non-cancerous and are simply think lumps of tissue.

Scar tissue can be very upsetting to clients, and they can often have unrealistic expectation about resolving the scars. It will often be a slow process, with many different treatments being performed to see a result. Whilst good results can be achieved, it is almost impossible to achieve the perfect resolution of any scar.



Scarring can be resolved by targeting the reticular dermis using either micro-needling or deep peels that resurface the skin, breakdown old collagen formation and form a whole new collagen matrix.

Scarring is often caused by self-picking at lesions know as excoriating. It is important to educate the client about the significant skin damage that can be caused and to avoid picking, especially deep lesions that can lead to cysts and eventual scarring.

### Overview

Acne is a multifactorial skin condition that involves specific changes in the normal anatomy and physiology of the skin that include abnormal keratinisation and overproduction of sebum. Propionibacterium acne is the primary bacteria associated with acne that can be found in large numbers within impacted follicles. Inflammation caused by this bacteria is activity, and other forms of inflammation all play a significant role in acne development.



## Hair Anatomy

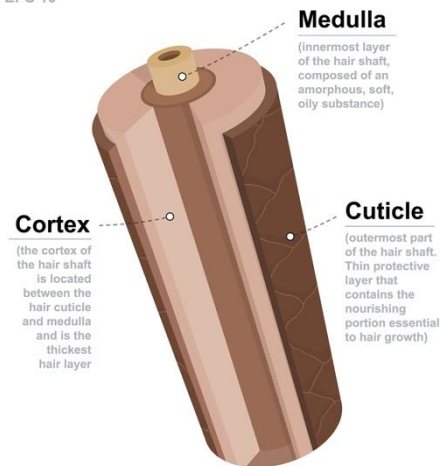
Hair is composed of a strong structural protein called keratin. This is the same kind of protein that makes up the nails and the outer layers of the skin.

Each strand of hair consist of three layers:

- Medulla** An innermost layer only present in large thick hairs
- Cortex** The middle layer that provides the hair with its strength, colour and texture.
- Cuticle** The outermost layer of the hair, the cuticle is thin and colourless and serves as the protector of the cortex.

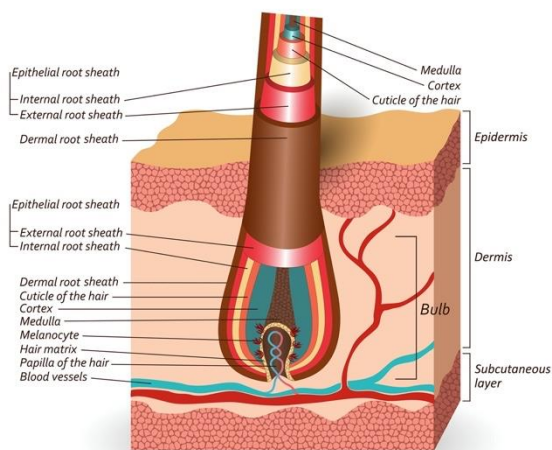
### SCIENCE OF HAIR HAIR STRUCTURE

VECTOR OBJECTS  
EPS 10



## Structure of the Hair Root

### Anatomy of the hair bulb



Below the surface of the skin is the hair root, which is enclosed within a hair follicle.

At the base of the hair follicle is the dermal papilla. The dermal papilla is supplied with nourishment from the bloodstream to produce new hair. The dermal papilla structure is vital to hair growth because it contains receptors for male hormones and androgens.

Androgens regulate hair growth. In scalp hair, the androgens may cause the hair follicle to become progressively smaller, causing the hair to become finer in individuals who are genetically predisposed to this type of hair loss.

## Hair Growth Cycle

Hair follicles grow in repeated cycles. One cycle consists of three phases:

<b>Anagen</b>	Growth Phase
<b>Catagen</b>	Transitional Phase
<b>Telogen</b>	Resting Phase

Each hair passes through the phases independent of neighbouring hairs.

### Anagen Phase

Approximately 85% of all hairs are in the growing phase at any time. This growth phase can vary from 2 years to six years. Hair will grow approximately 10cm per year, and any individual hair is unlikely to grow more than one meter long.

In the anagen stage, the hair receives nourishment from the blood supply from the dermal papilla. This enables the cells to reproduce. Cells move upwards to form the different structures of the hair shaft. Melanin is also produced to form the hair colour.

### Catagen Phase

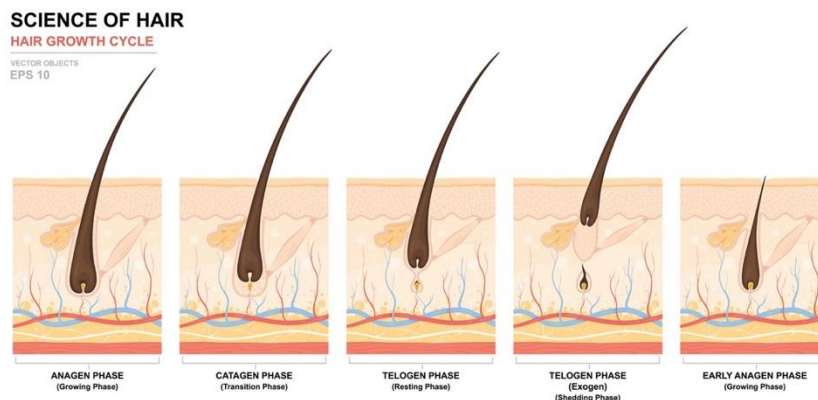
This is the transitional phase that follows the growth phase. The catagen phase lasts around one to two weeks. During the catagen phase, the hair follicle shrinks to about 1/6 of the normal length. The lower part is destroyed, and the dermal papilla breaks away to rest below.

This is the inactive or resting stage of hair growth. In this stage, the dermal papilla breaks away to make the lower end of the hair become loose from the base of the follicle. The hair is still being fed from the follicle wall and is sometimes known as club-ended hair. The hair starts to become drier and continues to move up to just below the sebaceous gland. At this stage, it can be easily brushed out.

### Telogen Phase

This resting phase follows the catagen phase and lasts around five to six weeks. During this time, the hair does not grow but stays attached to the follicle whilst the dermal papilla stays in a resting phase below. Around 10-15% of hairs are in this phase at any time.

The hair follicle re-enters the anagen phase. The dermal papilla and the base of the follicle join together again, and a new hair begins to form. If the old hair has not yet been shed, the new hair pushes the old one out, and the growth cycle starts over again.



## Hair Types

**Vellus hair** is the fine, non-pigmented hair that covers the body of children and adults. It does not usually grow longer than 2cms in length. Vellus hair is usually straight, regardless of ethnic origin, due to the fact that the follicles are not deep. The growth of vellus hair is not affected by hormones.

**Terminal hair** is the thick pigmented hair found on the scalp, beard, underarms, and pubic area. The growth of terminal hair is influenced by hormones.

Terminal hair is generally more abundant on males than females. However, variations exist within populations with some women appearing hairier than some males.

These hair types can be straight, curly or wavy depending on ethnic origin, hereditary factors and chemical hair treatment such as perms.

European hair would appear to be oval in shape and would tend to be wavy. Asian hair would appear to be round in shape and tend to be straight. Afro-Caribbean hair would appear to be flattened and tend to be very curly.

In some cases, excess hair growth, called hirsutism (pronounced: hur-suh-tih- zum), maybe the result of certain medical conditions. In girls, polycystic ovary syndrome and other hormonal disorders can cause dark, coarse hair to grow on the face, especially the upper lip, and on the arms, chest, and legs. Some medications, like anabolic steroids, can also cause hirsutism.

**Superfluous hair** is coarse unwanted hair, also termed hypertrichosis. Superfluous hair is considered not only a physical burden but can become a psychological one, too if not treated. The modern woman is keenly aware of the importance of being well-groomed; her happiness, poise, even her success or failure in life very much depend upon the face she presents to the world.

The reluctance and timidity of women to discuss this condition would vanish if they realised superfluous hair is not something to be ashamed of, but a simple problem requiring remedial treatment.

It is estimated that 80% of the women in Britain have some superfluous hair growth. Generally considered a "cosmetic" issue, hair growth can cause real or perceived problems with social acceptance for many people, both male and female. Many cultures have a perceived ideal amount of hair growth. Changes in hair growth patterns are sometimes a symptom of hormonal imbalances. Managing or removing unwanted hair can go beyond being a simple "cosmetic" problem.

## Changes in Growth Patterns

The hair growth pattern can change due to several factors:

**Illness** - Illness has a strong effect on hair growth, usually making it lank and lifeless. It can also cause hair loss, or growth of unwanted hair.

**Medication** - Drugs can affect the growth pattern; hair may become coarse and thick. Follicles can often be weakened, causing hair to fall out. In some cases, this can be temporary.

**Hormones** - Different changes of life can affect hair growth, e.g. women going through the menopause may find they develop whiskers of coarse hair on their face. Endometriosis or Polycystic Ovaries can cause male pattern hair growth in women.

**Emotion** - Sudden shock, an accident, or stress can all lead to hair loss. This is called alopecia (patches of hair loss).

## Causes of Hair Growth

Excess hair growth can be either normal or abnormal and may be the result of a number of causes.

- Topical – Hair growth caused by irritation of the skin caused by friction which results in an increased blood supply. The hair follicles receive more nutrients and thus grow longer and thicker hair. The removal of vellus hair by plucking can also cause the hair follicle to become deeper, causing more blood supply and the change in structure from vellus to terminal. For example, sunburn can cause excess hair growth, as can moles, scars and birthmarks.
- Congenital – this type of hair growth is inherited. The person can be born with it or develop it later in life.
- Systemic – this includes normal hair growth caused by hormones from puberty, pregnancy and menopause, as well as abnormal hair growth caused by hormonal imbalances from diseases, surgery, tumours, medicine or stress.

## Malfunctions of the endocrine system and the effects on hair growth

Abnormal hair growth is often caused by an abnormal change in the endocrine system, which causes a hormonal imbalance. This can be due to illness, tumours, medication or dietary disorders.

### Virilization

This is when the female body becomes more masculine, and results develop heavy facial hair and excess body hair growth in the male pattern of growth. A hormone imbalance that can be due to a tumour on the adrenal cortex or a tumour on the ovaries can influence the hypersecretion of androgens and the reduction in the release of oestrogen. This causes abnormal systematic hair growth.

Virilization is also accompanied by loss of menstruation, deepening of the voice, loss of scalp hair, development of acne, and the breast tissue reduce and the body thickens.

### Polycystic Ovary Syndrome

A variety of symptoms can be seen with this condition, including heavy or irregular periods, excessive facial and body hair growth and infertility. It is caused by cysts or growths on the ovaries that develop due to non-completion of the ovulation process.

### Cushing Syndrome

This is caused by tumours on the adrenal cortex where it causes the gland to produce too much cortisol. There is an associated overproduction of androgens, and as a result, a heavy male pattern of hair growth can be seen. Other symptoms may include a thickening of the trunk, round face, dowagers hump and thin legs and arms.

### Anorexia Nervosa

Clients suffering from this eating disorder become very thin and undernourished. It is, therefore, quite common to see excessive hair growth all over the face and body. This is caused by a shutdown in the ovaries that reduces the amount of oestrogen produced and stimulating the androgens. Females who exercise or undertake athletic training may also be affected by the same symptoms.

### Medication

Some prescribed drugs such as androgens or anabolic steroids have a secondary effect causing excess hair growth.

## Hair Loss

The hair itself has few physical functions. These include defence against the effects of UV radiation, suppression of heat loss, and tactile sensation. The various hair types consist of terminal, intermediate, and vellus hairs. Terminal hairs fit the classic perception of hair and are the hairs of the scalp, axillae, pubic region, beard, eyebrows, and eyelashes. These are long, pigmented, and thick. Vellus hairs, on the other hand, are short and generally lack pigmentation. These cover the body. Intermediate hairs have characteristics that fall in the middle of the spectrum between a terminal and vellus hairs. Loss of hair can be irreversible, causing the skin to atrophy and follicular openings to vanish. Such cases are categorized as cicatricial (or scarring, permanent) alopecia. Reversible hair loss is non cicatricial.



Humans are usually born with approximately 5 million follicles, and no new follicles are thought to be added after birth. The hair follicle cycle, which begins in utero, is composed of three stages: anagen, telogen, and catagen. The anagen phase is the longest, lasting an average of 3 yr and ranging from 1 to 6 yr depending on body location. It is also the most prevalent phase, with 90%–95% of all hairs existing in the anagen phase at any one point in time. Anagen represents the growth period, comprising extensive mitotic activity, such that a longer anagen phase means longer hair (e.g., scalp as opposed to eyebrows, eyelashes, or pubic hair). The hair then changes during the catagen phase through apoptosis of the follicular keratinocytes, leaving a club hair. Telogen is the resting period with inactivity of the follicle, persisting 2 to 3 months on the scalp or longer elsewhere. The club hair is shed, and a new anagen hair grows in its place to resume the cycle. Given its properties of regeneration, the hair follicle is a fascinating organ.

## Noncicatricial alopecias

### Androgenetic alopecia

- The most common type of hair loss in both men and women.
- Onset may be as early as puberty: 50% of men affected by age 50, 40% of women by age 70.
- Male pattern: Thinning of the frontal hairline, bitemporal recession, hair loss at the crown.
- Female pattern: Hair loss at the crown with preservation of the frontal hairline.
- It is caused by the effect of dihydrotestosterone on hair follicles leading to miniaturisation.

### Alopecia areata

- Equally affects both sexes, with usual onset before age 30.
- The most common areas of hair loss are scalp and beard regions.
- Round areas of complete hair loss with retained follicular ostia.
- Exclamation point hairs found at the edges of expanding areas of hair loss are a hallmark sign.
- It is caused by the autoimmune destruction of hair follicles involving cell-based and humoral immunity.

### Telogen effluvium

- Acute telogen effluvium is characterised by diffuse scalp hair loss lasting less than six months, whereas the duration is over six months for chronic telogen effluvium.
- Women between ages 30 to 60 are most commonly affected.
- A stressor event may or may not be present, usually occurring 2–4 months before the onset of hair shedding.
- 20%–50% of scalp hairs transition prematurely to the telogen phase and are shed with normal hair shafts.

### **Anagen effluvium**

- Diffuse hair loss characterised by hair breakage during the anagen phase.
- Classic causative agents are radiation therapy and cancer chemotherapy.
- Affects 80%–90% of scalp hairs with onset within 1–4 weeks of exposure.
- Narrowing, fractured hair shafts constitute a characteristic sign.

### **Loose anagen syndrome**

- The typical patient is a blonde female aged 20–50 who presents with diffuse hair loss and short, dull hair.
- 6:1 Female to male ratio among the patient population, which includes adults and dark-haired individuals as well.
- Greater susceptibility to hair breakage caused by premature keratinisation of the inner root sheath, causing impaired adhesion with the hair shaft cuticle.
- A shorter anagen phase leads to reduced hair length.

### **Trichotillomania**

- Patients experience an irresistible urge to pull out their own hair despite negative impacts on their occupational and social function.
- Childhood trichotillomania affects more boys than girls and resolves spontaneously.
- Adult trichotillomania affects women much more frequently than men.
- Often comorbid with mood or anxiety disorders.
- Short, fractured hairs distributed sparsely and irregularly in affected areas.

### **Traction alopecia**

- Results from tension applied to hair for a prolonged period of time, from hairstyles such as tight ponytails and braids, as well as hair-styling devices.
- Areas under the greatest pressure are most affected, usually scalp margins.
- Especially common among African-American females because of their association with certain hairstyles.
- Typically hair loss is transient; scarring or inflammation may be observed.

### **Cicatricial alopecias**

#### **Chronic cutaneous lupus erythematosus**

- Scaly, erythematous plaques with well-demarcated borders that eventually atrophy, found on sun-exposed areas, including the scalp.
- The most common form is discoid lupus erythematosus, accounting for 50%–85% of all cases.
- It affects more women than men, usually between ages 20–45.
- It is associated with a carpet tack sign describing follicular spikes on the under-surface.
- Cases among African-Americans are often more severe.

#### **Lichen planopilaris**

- Considered to be a variant form of lichen planus.
- Classic lesions are smooth white areas with absent follicle ostia and central scarring; edges are characterised by erythema and scaling around hair follicles.
- It mostly affects adult women at the crown and parietal areas of the scalp.
- Due to autoimmune attack on hair follicles mediated by T lymphocytes.

### Central centrifugal cicatricial alopecia

- Scarring hair loss that usually begins at the crown and expands outward to affect the entire scalp.
- Middle-aged African-American females are most commonly affected; individuals of other races rarely present with this condition.
- It may be associated with chemicals and pressure applied to hair.
- Lymphocyte-rich infiltrates observed at edges of balding lesions with signs of inflammation.



### Unusual Hair Growth

#### Ingrowing Hairs

These are hairs that have not grown above the surface of the skin and are still trapped in the hair follicle. If left, the hairs can become infected, so they need to be freed.

#### Embedded Hairs

These are also hairs that have become trapped beneath the skin. They should be treated as ingrowing hairs. When the skin is pierced, the hair will uncoil from beneath.

#### Pili Multigemini Hairs

Two or more hairs grow out of a single hair follicle. Beneath the opening, there are separate papillae for each hair, and the hairs have their own outer and inner root sheath.

#### Corkscrew Hairs

This hair is curved due to the follicle being distorted in shape. Overtreatment using temporary or permanent hair removal methods can cause this condition.

#### Tombstone Hairs

If you treat telogen hair in the follicle and there is an early anagen also growing in the follicle. The anagen hair will work its way to the surface and appear dull and thicker than normal. It will eventually fall out.

#### Distorted Hair Follicles

The direction of hair growth and angle as it leaves the hair follicle are important factors to consider when inserting the needle into the follicle. Hairs that grow from a distorted follicle are harder to work on as insertion depth is limited to where the angle of the follicle changes. These follicles are better treated with galvanic or blend to enable the treatment application to target the full follicle.



## Rosacea

Rosacea is a common chronic inflammatory skin condition that occurs in adults and affects the face. Rosacea can also be referred to as “acne rosacea”, “couperose”, and “facial erythrosis”. Symptoms manifest primarily, centropacially, with forehead, nose, chin and cheeks significantly affected.

Regarding the age of onset, 80 % of rosacea patients are 30 years or older. Women tend to develop the condition typically from age 35 onward, with the highest prevalence at the age of 61 to 65 years. In contrast, men are more frequently affected from the age of 50 upward, with a peak prevalence around 76 to 80 years. In rare cases, rosacea appears in children. Studies report a slight female predominance. Other studies have shown that both genders are equally affected, with only a slight male predominance.



Rosacea is more common in patients with Fitzpatrick types I–II than in Fitzpatrick types (IV and V).

### Psychosocial aspects of rosacea

Compared to other disorders, dermatoses like rosacea are visible to others, and they are perceived as disfiguring by the person affected and accompanied by social stigmatisation. The psychosocial impact of rosacea can be severe and affect quality of life—the patients affected by this condition experience the symptoms as a high psychological and social burden.

### Pathogenesis

The pathophysiology of rosacea is still not fully understood; a multifactorial aetiology along with a genetic predisposition is most likely. Factors such as a dysregulation of the innate and adaptive immune system, neuroinflammatory mechanisms, ultraviolet (UV) exposure, local inflammatory responses to cutaneous microorganisms, and changes in the regulation of vascular and lymphoid vessels seem to play a role.

### Genetics of rosacea

Genetics are thought to play a major role in rosacea conditions but has not yet been proven. Studies in twins showed that genetics accounted for approximately half of the contribution to the condition.

Environmental factors such as UV exposure, temperature (including extreme heat, cold), spicy foods, alcoholic beverages and physical activity account for the other 50 %.

### Innate immunity and antimicrobial peptides

The innate immune system releases antimicrobial peptides at the boundary surfaces of the organism for the purpose of unspecific defence against certain pathogens. Cathelicidins are members of this family of antimicrobial

peptides and are expressed within the skin. The human cathelicidin peptide LL-37 plays a central role in the pathogenesis of rosacea and has antimicrobial and immunomodulatory, and angiogenic properties.

Patients with rosacea exhibit a specific pattern and increased cutaneous concentrations of cathelicidin peptides, which can be attributed to increased production of cathelicidin precursor molecules and increased expression and activity of the serine protease kallikrein 5. The increased cathelicidin production and protease activity are induced via the vitamin D signalling pathway by endoplasmic reticulum (ER) stress and the Toll-like receptor 2 (TLR2).

### **Demodex folliculorum**

Demodex mites are another possible trigger of inflammation in rosacea. The skin of rosacea patients displays a significantly increased *Demodex folliculorum* colonisation compared to healthy populations, not only in patients with papulopustular but also with erythematotelangiectatic rosacea. Also, specific IgG antibodies to Demodex components can be found. The success of the treatment that leads to a reduction of Demodex colonisation suggests a pathophysiological link between Demodex density and rosacea. Antiparasitic drugs such as ivermectin also reveal anti-inflammatory effects. It remains to be clarified to what extent Demodex infestations are involved in the pathobiology of rosacea, and secondly, how impactful is the anti-inflammatory effect of antiparasitic drugs. Neuroinflammation and vascular hyperreactivity

Many rosacea patients will experience recurrent flushing and/or develop redness of the skin that persists for days to years (persistent erythema), caused by two different underlying mechanisms. Vascular hyperreactivity (vasodilation) refers to the prolonged vasodilation of the skin due to physiological (e.g. UV exposure, spicy food) or non-physiological (e.g. heat, alcoholic beverages such as red wine) stimuli. Most of these triggers will lead to rosacea patients skin flushing, which can also be associated with the sensation of pain/burning/stinging. Both flushing and persistent erythema can occur as isolated symptoms or in combination with other clinical features of rosacea.

Although both symptoms are induced by vascular reactions, flushing pathophysiologically differs from erythema (colour of the redness rather pink, kinetics, symptoms).

### **Precursor form – rosacea diathesis (transient erythema)**

Rosacea often begins with transient episodes of facial redness known as flushing. These can be triggered by a variety of endogenous and exogenous stimuli. Exogenous stimuli include chemical irritants, e.g. components of cosmetic products such as cosmetics, specific soaps, and exposure to heat or cold or UV irradiation. Endogenous stimuli include spicy food, hot beverages, and psychosocial stress. In general, the skin is very sensitive. This acute and uncontrolled skin flushing is often a source of great insecurity for affected patients.

### **Erythematotelangiectatic rosacea**

Erythematotelangiectatic rosacea is characterised by persistent erythema of varying severity, aggravated by certain triggering factors, as well as telangiectasia. Most patients can also report a sensation of burning, stinging, pain, less frequently itching, and dryness/tension with or without scaling of affected skin areas.

### **Papulopustular rosacea**

Typical clinical manifestations consist of persistent erythema of the midface with isolated or grouped, inflamed, red papules and pustules, mostly arranged symmetrically.

Patient with papulopustular rosacea will have centropapular papules and pustules, partly on an erythematous base (front).

These may persist for weeks. Furthermore, lymphedema can occur, and throughout the condition, it may affect the entire face. Rarely, there is extra facial involvement, affecting the scalp, chest, neck or décolleté.

Papulopustular rosacea may resemble *acne vulgaris*, yet without comedones typical for acne.

## Glandular rosacea

This form of rosacea is characterised by hyperplasia of sebaceous glands and the connective tissue and can be associated with circumscribed nodular changes (phymata) or diffuse thickening of the skin.

Patients with glandular rosacea (rhinophyma) are predominantly seen in men. However, thickening of the skin (phymata) can occur together with other rosacea symptoms. The lesions are often upsetting for the patient and affect the nose (rhinophyma), chin/jaw (gnathophyma), forehead (metophyma), ear (otophyma) or eyelid (blepharophyma). It is uncertain whether patients with phyma also have an increased risk of developing basal cell carcinoma.

## Rosacea conglobate

Only a few rosacea patients will develop *rosacea conglobata*. The disease presents with acute and large inflammatory nodules and plaques similar to that found in *acne conglobata*. The lesions affect only the face. The underlying cause for *rosacea conglobata* in some patients still remains unclear.

## Rosacea fulminans

*Rosacea fulminans* is the worst variant of rosacea. The onset is often acute to highly acute and occurs within a few days or weeks. *Rosacea fulminans* will mainly affect young women. The lesions are almost always found in the face (forehead, cheeks, and chin), as well as during pregnancy.

There are large, partially fluctuating nodules and numerous pustules present. Also, seborrhoea is a constant feature of this particular form of rosacea. Unlike the fulminant type of the condition and the psychosocial impact, the general well-being is not usually affected. However, there have been occasional reports of fever and weight loss. So far, microbiological tests have failed to identify responsible organisms. The condition is not prone to recurrence, and its pathogenesis remains unclear.

## Gram-negative rosacea

This rare condition occurs after long-term treatment of rosacea with topical or systemic antibiotics against Gram-positive bacteria (tetracyclines). The treatment leads to a selection of Gram-negative bacteria, causing an inflammatory disease resembling Gram-negative folliculitis. The clinical manifestation includes pustules on extended erythema. A diagnostic criterion is the detection of Gram-negative bacteria, the most common of which are *Klebsiella*, *Proteus*, *E. coli*, *Acinetobacter* and *Pseudomonas spp.* Due to this resemblance to papulopustular rosacea, the condition is often misdiagnosed. However, distinguishing the two is vital, given the need for different treatment approaches.

## Steroid-induced rosacea

The long-term use of topical or systemic glucocorticosteroids in rosacea or other inflammatory skin diseases may lead to steroid-induced rosacea. Throughout treatment with topical glucocorticosteroids, there is an initial improvement in the condition of the skin in many cases. Subsequently, it is often followed by steroid atrophy, which increases the number of telangiectasias, follicular papulopustular eruptions, and dark red patches of erythema. Patients report a feeling of skin tension. A severe infestation can accompany the disease with Demodex mites. Discontinuation of corticosteroids is almost always followed by exacerbation (steroid withdrawal dermatitis).

## Granulomatous rosacea

Granulomatous rosacea presents with disseminated red-brown papules and nodules, found mostly on the upper and lower eyelids, as well as on the cheeks, and in the perioral region. The skin on the rest of the face is reddened. Many patients report typical rosacea skin symptoms, which include burning, itching, stinging and dryness.

This particular form of rosacea is challenging to treat.

## History of Light & Energy Devices

Medical light sources were discovered by Albert Einstein in 1916. Einstein understood how sunlight was emitted and how humans could theoretically create and harness a form of light energy. It wasn't until 1958 that Einstein's mathematical equations were interpreted by Arthur Schawlow and Charles Townes into the creation of MASER (microwave amplification by stimulated emission of radiation) at Bell Laboratories. This first version of a human-made light was microwave driven but never became popular. In 1960 however, the first visible LASER (light amplification by stimulated emission of radiation) was developed by Theodore Maiman from a ruby crystal. Originally this pure form of light was used in dermatology and ophthalmology and started the technological development still happening today. There are now over 150 different types of laser light and energy devices available on the market.

### The electromagnetic spectrum of radiation

Laser light is an advanced method of converting light into energy. Sunlight is a beam or a ray of light that is made up of several variable electromagnetic energies, commonly called EM energy and are made up of both invisible and visible forms. EM energy is reflected or emitted from objects and travels through space in electrical and magnetic waves.

EM energy is composed of small particles called photons. Photons travel at the speed of light in the form of a wave. Visible and invisible EM energy generates a different kind of wavelength. These wavelengths are measured from the distance at the top of one wave (the amplitude) to the top of the next. These wavelength distances are measured in nanometers (nm) or micrometres (um).

Laser light ranges from both visible to invisible light depending on its purpose and use. This can be illustrated within the particular colours of the rainbow's spectrum of light.

Near-infrared to far-infrared lasers range from 800nm to 10,600nm, and they are invisible to the human eye. They are as safe and therapeutic as visible lasers used in beauty salons and clinics. Their placement on the electromagnetic spectrum determines the amount of energy and the depth of penetration for their use in cosmetic treatments.

### Properties of laser light

Lasers have unique properties that are not seen in any other type of energy form, which allows them to be used for cosmetic treatments. Normal light emitted from a lightbulb is made up of a multitude of both visible and invisible infrared wavelengths that are out of sync and travelling in various directions. When these wavelengths merge, they create white light.

### Coherent Light

Photons from normal white light disperse in different directions as they are out of phase or incoherent. Laser light is the opposite of this and is known as coherent light. Coherent light is light energy that is in phase'. This simply means that all light waves are travelling in the same direction and in unison with each other. These photons travelling together work as a single unit of energy. This combination of a single unit of energy allows laser light to be focused with a focusing lens that produces different spot sizes as well as different tissue effects. This spot size is usually measured in millimetres and is the size or the width of the beam used to affect the treatment. This allows for a great degree of precision and manipulation of the light.

### Monochromatic Light

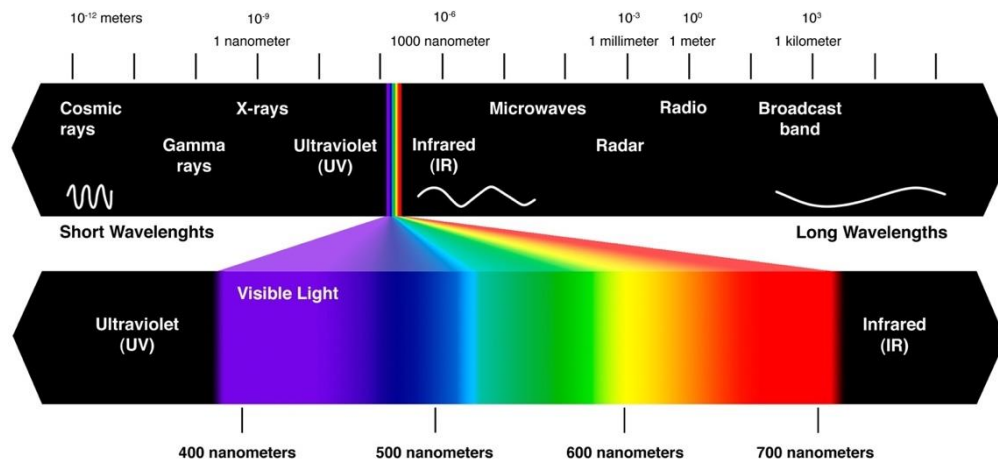
Normal light contains all the visible colours of the spectrum and appear white. When this light is passed through a prism or water, the full light spectrum becomes visible as a rainbow. Laser light is referred to as monochromatic (mono means one). It is created with one wavelength and one colour and can be either visible or invisible light. The colour of the laser is particularly vital as it will determine which chromophore in the body the light will affect. Each different colour of light will act differently when exposed to different tissue.

## Collimated Light

This is laser photons that are coherent and parallel to each other and thus can travel long distances. Because of this, laser light can travel across a room, so safety precautions must be in place.

## Chromophores

A chromophore is a target in the epidermis or dermis that absorbs the lasers thermal energy, causing the desired injury or destruction of cells. The five main chromophores in the body are water, blood, collagen, protein and pigment. All lasers react to different chromophores depending on the laser's wavelength. A sub chromophore will react to one wavelength and not another, and this is what makes laser light to be target-specific.



## Tissue Effects

Laser works in four different ways on the tissue.

### Absorption

When a specific wavelength of light comes into contact with tissue, the photon of light loses its heat energy to the chromophore or specific target, and this is called absorption. If there is no absorption of light by the tissue, there would be no reaction.

Understanding the main chromophores, as well as the tissue reactions, is very important. Hair removal lasers emit a wavelength that is absorbed by dark pigment or melanin. Vascular lasers are absorbed by the blood, and lasers that stimulate collagen and skin rejuvenation are absorbed by water, whilst those that breakdown tattoos, pigments or lesions target melanin in the skin.

### Reflection

Laser beams can reflect off shiny surfaces such as mirrors, jewellery or metal. The flatter or smoother the surface, the higher the potential for risk. Once reflected, the laser beam can cause severe skin burns, fire or eye damage. It is important to keep reflective surfaces in the treatment room covered up or kept to a minimum.

### Transmission

Some laser light can be transmitted through tissue, fluids and even glass. Visible light lasers and some wavelengths in the near-infrared zones can easily pass through the epidermal and dermal layers in search of their target chromophore. Lasers that are absorbed by water do not possess these characteristics, and therefore their effects are superficial.

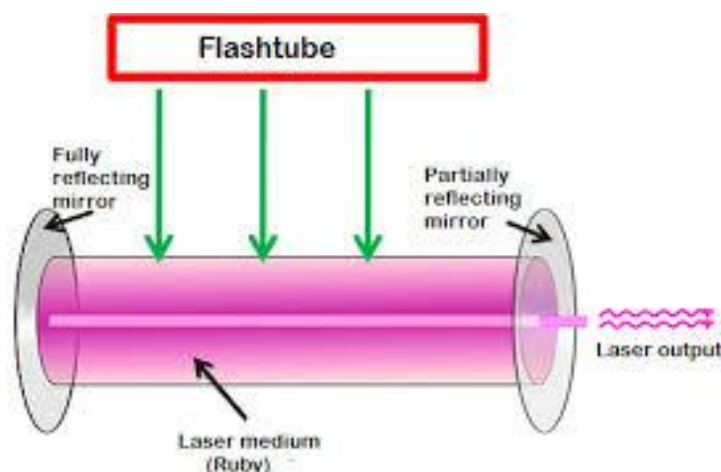
## Scatter

In some wavelengths, such as Nd: Yag lasers (1064nm), there can be a deep forward or backwards scatter or diffusion of light. The deeper the light is able to penetrate through the skin, the more scatter that occurs; this scatter can cause thermal destruction at greater depths as well as backscatter towards the clients and operators' eyes; this makes eye protection mandatory.

## Creation of Laser Light

Inside every laser machine is a tube or optical resonator. This optical resonator contains a medium such as a gas-solid or liquid that is responsible for the creation of light. A gas medium could be made up of argon, carbon dioxide or helium-neon gas particles. A liquid medium could be made from an organic liquid or dye. A solid medium is usually a synthetic crystal made up of yttrium aluminium garnet (YAG) particles and then doped with certain elements such as holmium, neodymium and thulium or erbium electrons. Lasers are usually named in reference to their medium.

When you turn on the laser machine, a high voltage is created that stimulates an intense light source from within the machine. The electrons within the laser medium become stimulated by the electricity passing through the machine, which then collides with mirrors placed on opposite ends of the laser tube and spontaneously produce identical photons. Due to this, all the photons travel at the same frequency, parallel to each other and in phase in a collimated, coherent, monochromatic beam of light.



## Selective Photo thermolysis

The use of lasers in clinics to achieve hair removal or skin rejuvenation treatments is achieved by means of selective photo thermolysis. This refers to the theory that a selected absorption of a specific light by a targeted chromophore. This light transfers thermal energy to a selected chromophore to cause the destruction of the designated target. Selective thermolysis is achieved by selecting the appropriate wavelength at the right exposure time and pulse duration and teamed with sufficient energy or fluence. Fluence refers to the energy of the pulsed laser beam. It is expressed as joules per square centimetre ( $J/cm^2$ ) and refers to energy x time. Fluence can be increased by upping the energy output of the laser and decreasing the pulse duration, or reducing the spot size. The larger the laser beams spot size, the less fluence that is affecting the tissue. When you decrease the spot size by half, it multiplies the energy or fluence by four times. This must be taken into consideration when treating a client to avoid the risk of burns.

You will also need to take into consideration the thermal relaxation time (TRT) of the target. TRT is the amount of time needed for a chromophore, blood vessel, hair follicle or melanin to lose more than 50% of its heat that was produced by the laser. The amount of heat produced will depend on the pulse duration (or pulse width). Pulse duration is measured in nanoseconds (ns) or milliseconds (ms). It is the timing of light energy or how long the laser is applied on the skin, and it determines the clinical effect of light energy. The light energy needs to be applied long enough to destroy the target but not so long that it burns the skin.

Limiting the exposure time on the skin to a time shorter than the TRT keeps the heat or energy in the selected target tissue and does not cause damage to surrounding tissue. TRT varies depending on the size and density of the target. A coarse 200-um hair follicle may have a TRT of 40ms, whereas large 0.4-mm vessels TRT maybe 80ms. The larger the target, the longer the TRT, and subsequently, longer pulse duration or pulse width is needed. Longer pulse width is needed for the larger object to slowly absorb the heat and then slowly cool down through diffusion. Small objects with a short TRT will require shorter pulse durations in order to destroy the object whilst sparing the epidermis. This method is essential in producing the desired effects without causing excessive heating and undesirable side effects such as blistering, hyper or hypopigmentation or scarring.

### **Cooling the Skin**

Skin cooling is necessary during laser treatments. Lowering the skin temperature allows the safe treatment and application of energy to the target without causing excessive trauma to the epidermis.

Different methods of cooling the skin during treatment can be used, such as forced air cooling, pre-skin cooling, ice packs, laser head cooling and contact gel.

### **Laser Classifications**

Laser hazard classification is determined by a variety of parameters; beam diameter, shutter speed, beam divergence energy output and so on. All these combine to create the intensity of the emitted beam and its potential risk to cause injury. Lasers are classified into the following categories:

#### **Class 1 Lasers**

This means any laser product that does not permit access during the operation to levels of laser radiation in excess of the accessible limits.

#### **Class 2a Lasers**

These are any lasers that permit human access during operation to levels of visible laser radiation in excess of the accessible emission limits but does not permit human access during the operation to levels of laser radiation in excess of the emission levels.

#### **Class 2 Lasers**

These are any lasers that permit human access during operation to levels of visible laser radiation in excess of the accessible emission limits but does not permit human access during the operation to levels of laser radiation in excess of the emission levels.

#### **Class 3a Lasers**

Any laser product that allows human access during operation to levels of visible laser radiation in excess of the accessible emission limits but does not permit human access during operation to levels of laser radiation in excess of the accessible limits.

#### **Class 3b Lasers**

Any laser product that permits human access during operation to levels of laser radiation in excess of the accessible emission limits of 3a but does not permit human access during operation to levels of laser radiation in excess of the accessible emission limits.

#### **Class 3 Lasers**

Laser product means any class 3a or 3b laser product.



## **Class 4 Lasers**

This means any laser that permits human access during its operation to levels of laser radiation in excess of accessible emission limits.

### **Laser Health and Safety**

#### **Room**

Should be free from as many reflective surfaces as possible, such as mirrors, metal, windows and shiny surfaces. The room should have adequate lighting and ventilation. Lasers have the ability to heat rooms fast; when the machine becomes too warm, they often switch off to allow them time to cool down. Proper ventilation in the room allows for air circulation.

The door must have the ability to be locked from the inside to prevent people from walking in during treatments. There should also be a laser warning sign on the door.

#### **Machine**

Laser machines are dangerous in the wrong hands. All devices are operated with a key. It is good practice to keep laser keys locked away in a secure cabinet and signed out by the operator before each use and signed back in at the end of the treatment.

A record of shots should be recorded at the start and end of each treatment with the client number and date by the record, as well as the therapist's name. Do not use the client's name as this will break client data protection. This keeps control of how many shots the machine has used and by whom. You should also keep shot numbers used recorded on the client form.

Your machine will have a number of shots on each lamp on the handpiece. Once these shots have been used, the machine often stops working until the lamp is replaced. The machine, if it doesn't have an override mechanism, will lose power after all the shots have been used; this will result in a treatment not being consistent or effective.

On IPL machines, the Glass heads should be checked prior to starting the treatment to ensure there are no cracks or chips. These chips can cause excessive energy to flow through them or cause light to refract from the area intended. Filters should be checked for breaks or burn marks in them as this can cause burns on the skin.

Machines should be maintained, and PAT tested every 12 months, and full-service records should be kept.

#### **Eye Protection**

Both client and therapist should wear protective eyewear during the procedure to prevent damage to the eye from reflected or scattered light.

#### **Fire Protection**

An adequate and regularly tested fire extinguisher should be available directly outside the room, along with a fire evacuation plan.

#### **Patch Testing**

Patch testing is essential 48 hours prior to laser treatment to assess the client's skin and determine tolerance and reaction. It gives the client the opportunity to experience laser and to determine treatment protocol and settings. Testing should be done to the manufacturer's instructions.

## Contra-indications

A contra-indication is the presence of a condition which may make the client unsuitable for the treatment. The treatment may not be able to take place, or the treatment will need to be adapted.

When treating a client, if they show any signs of contra-indications, you should tactfully refer them to their GP for treatment or advice. You should never make a diagnosis even if you are certain of the condition as you may be wrong.

If you are unsure about any contra-indications, then do not treat the client and refer them to their GP.

Be careful if you deal with a contra-indication, and they can often be contagious. Make sure you clean the work area and any implements between clients to prevent cross-infection.

## Common contra-indications

### General Health & Wellness

<i>Condition</i>	<i>Description</i>	<i>Salon Treatment</i>
<b>Diabetes</b>	<p>Diabetes is a lifelong condition that causes a person's blood sugar level to become too high.</p> <p>There are two main types of diabetes:</p> <p><b>type 1 diabetes</b> – where the body's immune system attacks and destroys the cells that produce insulin</p> <p><b>type 2 diabetes</b> – where the body does not produce enough insulin or the body's cells do not react to insulin.</p> <p>Type 2 diabetes is far more common than type 1. In the UK, around 90% of all adults with diabetes have type 2.</p> <p>The amount of sugar in the blood is controlled by a hormone called insulin, which is produced by the pancreas (a gland behind the stomach).</p> <p>When food is digested and enters the bloodstream, insulin moves glucose out of the blood and into cells, where it's broken down to produce energy.</p> <p>However, with diabetes, the body is unable to break down glucose into energy. This is because there's either not enough insulin to move the glucose, or the insulin produced does not work properly.</p>	<p>Can often be treated if the client is managing their diabetes well.</p> <p>Check with your insurer as their criteria may not allow treatment. A GP note may be required.</p> <p>Treatments that cause injury to the skin can increase the risk of infection. Those with diabetes will need to understand wound management and treatments should be done under extreme caution as to not injure the skin if necessary.</p> <p>Diabetics have a slower wound healing response and have a higher risk of infection. All products used must be sterile, and care should be taken not to injure the skin.</p>
<b>Epilepsy</b>	<p>Epilepsy is diagnosed when a person has had more than one epileptic seizure and could have more in the future.</p> <p>Electrical activity is happening in our brain all the time. A seizure happens when there is a sudden burst of intense electrical activity. This is often referred to as epileptic activity. This intense electrical activity causes a temporary disruption to the way the brain normally works, meaning that the brain's messages become mixed up. The result is an epileptic seizure.</p>	<p>If well-managed treatments may be able to be undertaken. It is worth assessing the client and finding out what triggers a fit and when as well as how it is managed and their last episode.</p> <p>You may also need to check your insurer's terms and refer the client to a GP for a letter of approval.</p>

There are many different types of seizure, and each person will experience epilepsy in a way that is unique to them.

Some things make seizures more likely for some people with epilepsy. These are often referred to as 'triggers. Triggers are things like stress, not sleeping well and drinking too much alcohol. Some people say they have more seizures if they miss meals. Not taking epilepsy medicine is another common trigger. A very small number of people with epilepsy have seizures triggered by lights that flash or flicker. Avoiding triggers can stop them from having seizures.

### ***Heart conditions***

Heart disease describes a range of conditions that affect the heart. Heart diseases include:

- Blood vessel disease, such as coronary artery disease
- Heart rhythm problems (arrhythmias)
- Heart defects you're born with (congenital heart defects)
- Heart valve disease
- Disease of the heart muscle
- Heart infection

Risk of fainting, risk of slow healing or chances that the client may be medicated to keep their condition under control are some risks you will need to be aware of when treating the client. Clients may also have a heart catheter or a pacemaker.

Treatments that do not involve electrical currents being passed through the body are usually safe. Heart conditions should be well managed. You will need to check the terms of your insurance policy. A referral to a GP may be required.

### ***Deficient Immune System***

Immunodeficiency disorders prevent the body from fighting infections and diseases. This type of disorder makes it easier to catch viruses and bacterial infections.

Immunodeficiency disorders are either congenital or acquired. A congenital, or primary disorder is one you were born with. Acquired, or secondary, disorders you get later in life. Acquired disorders are more common than congenital disorders.

Your immune system includes the following organs:

- spleen
- tonsils
- bone marrow
- lymph nodes

These organs make and release lymphocytes. These are white blood cells that fight invaders cells called antigens. Cells release antibodies specific to the disease the body detects. White blood cells destroy foreign or abnormal cells.

Examples of antigens that white cells might need to fight off include:

- bacteria
- viruses
- cancer cells
- parasites

A deficient immune system can increase the risk of infection. Treatments that break the skin may increase the risk of infection. Clients may need a GP referral and understand wound management.

An immunodeficiency disorder disrupts your body's ability to defend itself against these antigens.

### ***Pregnancy***

Pregnancy is a period of considerable changes in a woman's body. These changes, affecting virtually every part of the body, are all geared towards growing and delivering a healthy baby, without harming the mother.

Changes begin within days of conception when the fertilised egg implants itself in the wall of the uterus. The first changes are subtle, and most women will not notice them.

Pregnancy lasts an average of 266 days (38 weeks) from the date of conception or 40 weeks from the first day of the last menstrual period. Pregnancy is divided into three periods of three months each. These periods are known as the first, second and third trimesters. Each trimester brings with its own unique set of experiences.

Risks of pregnancy include:

- Miscarriage
- Increased/decreased blood flow
- Risk of fainting
- Oedema
- Pigmentation/Chloasma/mask of pregnancy
- Pelvic trauma

Nearly all treatments are contraindicated in the first trimester. Treatments that cause friction may have a side effect of PIH and should not be performed. Electrical treatments must not be performed at any point.

### ***Breastfeeding***

Anything the mother consumes or applies to her skin could be absorbed into the bloodstream and through into the milk ducts, where this can pass to the baby. Great care should be taken with what is being applied to the skin as well as avoiding treatments that could cause open wounds. An open wound is susceptible to infection, and this can cause infection or septicaemia.

During breastfeeding, hormones are still active within the body, and these can have an overall effect on the skin. This may lead to dehydrated skin (if the mother is not ingesting enough water) and also lead to a high risk of pigmentation. Invasive procedures should be avoided until a few months after the mother has stopped producing milk.

A small battery-operated device called a pacemaker is placed into the chest. It sends regular electrical impulses, which help keep the heart beating regularly.

The pacemaker is a small metal box weighing 20–50g. It is attached to one or more wires, known as pacing leads, that run to the heart.

If the pacemaker senses that the heart has missed a beat or is beating too slowly, it sends signals at a

Treatments that break the skin are strictly contraindicated. The client also has a high amount of hormone imbalance still and may be susceptible to PIH on certain treatments.

### ***Electrical implants or pacemakers***

Electrical implants contraindicate any treatment that involves an electrical current. Other treatments that may affect blood pressure may also contraindicate a procedure. Check your insurer's terms and refer the client to GP for a letter of approval.

***Anticoagulant medicines such as warfarin or aspirin***

steady rate. If it senses that the heart is beating normally by itself, it does not send out any signals.

Most pacemakers have a special sensor that recognises body movement or the breathing rate. This allows them to speed up the discharge rate when active.

An implantable cardioverter-defibrillator (ICD) is a device similar to a pacemaker. An ICD delivers an electrical shock to the heart during a life-threatening heart rhythm. The aim is to 'reboot' the heart to get it back into a normal rhythm again. Some modern devices contain both a pacemaker and an ICD.

Anticoagulants are medicines that help prevent blood clots. They're given to people at a high risk of getting clots, to reduce their chances of developing serious conditions such as strokes and heart attacks.

A blood clot is a seal created by the blood to stop bleeding from wounds. While they're useful in stopping bleeding, they can block blood vessels and stop blood flowing to organs such as the brain, heart or lungs if they form in the wrong place.

Anticoagulants work by interrupting the process involved in the formation of blood clots. They're sometimes called "blood-thinning" medicines, although they don't actually make the blood thinner. Although they're used for similar purposes, anticoagulants are different from antiplatelet medicines, such as low-dose aspirin and clopidogrel.

Anticoagulants prevent the blood from clotting and can affect the healing process of the skin. The client will be at higher risk of bruising also. Treatments that injure the skin or cause trauma will need to be avoided. A GP letter may be required for some services.

***Steroids, antidepressants, antibiotics and other medications***

Many drugs can affect the skin. For example, prescription antidepressants, especially the popular class of medications called selective serotonin reuptake inhibitors (SSRIs), can cause a wide variety of adverse skin reactions, including bruising. Acne medications and certain antibiotics may make the skin more sensitive to sunlight and light or heat-based procedures.

It is vital that we find out the medications both prescription and over the counter drugs that the client is taking. The internet is a great source of information to establish the risks the medication may have on the skin during a procedure.

Medications can have numerous effects on the skin. If you are unsure, you should ascertain how the treatment affects the skin and the effects of the medication that is being taken. A patch test may be required or a letter from the clients GP. Where the side effects may be photosensitivity or thinning of the skin, then treatments should be avoided until the client has come off their medication for three months at their GPs request.

***Recent surgery***

Clients will have surgery for a variety of reasons and on any area of the body. Surgery puts the body under extreme pressure. The client may be on pain medication which could affect their susceptibility to feeling pain during treatment.

Surgery wounds can take many months to fully heal. Post-surgery complications can also arise a few

If the client has had recent surgery, you will need to weigh up the risk of the procedure, the length of time between the surgery and treatment as well as where the surgery was. In most cases, it is advised to wait six months post-surgery before

***Metal plates or pins***

months after the procedure. This can include, infection or necrosis of the wound, infection of the blood, blood clots, internal bleeding, or fever.

If you break a bone, it will need to be held in place while it heals. This can be done using a splint, sling, brace or cast. But sometimes a broken bone will need to be fixed with surgery, using metal plates, rods, wires, screws or pins.

Implanted metal can help broken bones heal in proper alignment. While these implants do not help the bone heal faster, they can help to hold bones in the proper position while healing takes place. Implants may include metal plates and screws, pins, and intramedullary rods inserted into the cavity of a bone.

undertaking any procedures, especially where these may involve invasive techniques, massage or electrical machines.

Electrical treatments are almost always contraindicated for clients with metal implants in their body. However, this can vary depending on the area of the implant vs the area of treatment.

Care may also need to be taken when massaging over the area or any pressure is applied.

***Chemotherapy/ radiotherapy***

Chemotherapy is a form of cancer treatment where a patient is given drugs designed to kill cancer cells. Radiation is a type of cancer treatment where high doses of radiation are delivered to cancerous tumours in the body.

Both procedures can affect the sensitivity of the skin, and the skin texture may change. A waxy appearance to the skin can alter the effects of treatments and treatments may not be suitable. Clients may also be at risk of pigmentation.

Clients undergoing treatment for cancer may benefit from a number of procedures in a salon for the purpose of relaxation and pain management as well as to make them feel good.

Some treatments may be too much for the client to handle and cause unwanted side-effects.

***Broken bones***

When a bone has an outside force exerted upon it, like a blow or a fall, there is potential that it cannot withstand the amount of force and it breaks. That loss of integrity results in a fracture. It is important to remember that a fracture, break, or crack all describe the same situation, an injury to the bone where it has been damaged. One term is not more serious than another. Fracture break and crack all mean the same thing.

It is worth discussing the treatment with the client and working out alternatives where suitable. If unsure, you may wish to ask for a letter from the client's oncologist.

Clients with a suspected or recent fracture should be treated with caution. If working over the area of a recent break, then the time between the break and the treatment should be at least six months. If working on other areas of the body, it is best to wait for 6-8 weeks post-injury as the client may be more susceptible to an embolism.

***Previous or recent treatments in the area***

When providing a service to the client, it is important to establish what previous treatments they have had, not only at clinics but at home. You should look to enquire over the products they use regularly that may affect the skin and the treatment outcome.

Some treatments can affect the skin by either removing out layers of the stratum corneum or stimulating a healing response. You will need to identify if the client has had any recent procedures in the treatment area you will be working on.






## Contra-indications

A contra-indication is the presence of a condition which may make the client unsuitable for the treatment. The treatment may not be able to take place, or the treatment will need to be adapted.

When treating a client, if they show any signs of contra-indications, you should tactfully refer them to their GP for treatment or advice. You should never make a diagnosis even if you are sure of the condition as you may be wrong.

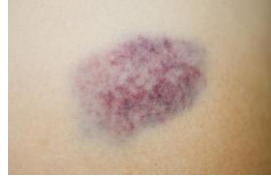
If you are unsure about any contra-indications, then do not treat the client and refer them to their GP.

Be careful if you deal with a contra-indication, and they can often be contagious. Make sure you clean the work area and any implements between clients to prevent cross-infection.

CONDITION	IMAGE	DESCRIPTION & CAUSE	SALON TREATMENT
PSORIASIS		Scaling and inflammation of the skin.  Cause unknown but thought to be related to the nervous system	Treat with caution; avoid the affected area.  Do not treat if the skin is weeping.
ECZEMA		Atopic eczema is a common skin condition that causes patches of skin that are itchy, cracked and sore.	Treat with caution: avoid the affected area.
CONJUNCTIVITIS		A transparent and sticky substance covers the white of the eye and lids.  It is caused by a bacterial infection.	This is highly infectious; do not treat; the client should be referred to their GP for correct diagnosis and treatment.
CUTS & ABRASIONS		Broken skin caused by an injury.	Avoid treatment in the affected area.
BACTERIAL KERATITIS		A severe disorder which can result in partial or total loss of vision.  It is caused by a bacterial infection.	Do not treat; refer clients to their GP for correct diagnosis and treatment.



BRUISING



Black, green. Yellow or red marks appear on the skin.

Avoid the area if possible.

They are generally caused by an injury.

RECENT OPERATIONS (SCARS)



Scar tissue raised or flat undergoing the healing process.

Avoid treatment if the scar is less than six months old.

Scar tissue is very sensitive.

BLEPHARITIS



Inflammation of the eyelids; the inflammation is like eczema of the skin with red, scaly eyelids; you may notice tired or gritty eyes, which may be uncomfortable in sunlight or smoky atmospheres; they may be red and swollen and feel as though there is something in them.

Avoid the area; refer the client to GP for correct diagnosis and treatment.

The exact cause is unknown, but people who have dandruff or dry skin conditions may be more prone to blepharitis.

STYE



Infection in the root of an eyelash.

Avoid the area; no treatment until the infection has gone.

They are caused by a bacterial infection.






SUNBURN



Sunburn is a red, painful skin that feels hot to the touch. It usually appears within a few hours after too much exposure to ultraviolet (UV) light from sunshine or artificial sources, such as sunbeds.

No treatment should be provided until the skin has healed.

48 hours should be left from sun exposure/sunbed use before a treatment.

COLD SORES		Cold sores are painful lumps or blisters on the face. They're caused by a virus and are very contagious.	Treatment should not be provided on the face until the skin has healed.
IMPETIGO		Impetigo is a highly contagious skin infection that often starts with red sores on the face or hands.  It causes red sores or blisters that burst and leave crusty, golden-brown patches.	Precautions should be taken when treating other areas to avoid cross-contamination.  Treatment should not be provided on the face until the skin has healed.  Precautions should be taken when treating other areas to avoid cross-contamination.
MOLES		<i>Moles</i> are small, coloured spots on the <i>skin</i> . Most people have them, and they're usually nothing to worry about unless they change size, shape or colour.	Avoid treating over a mole. Irritation or damage to the area may cause the mole to change.
RINGWORM		Ringworm is a fungal infection on the skin. It causes a rash that is often ring-shaped.	Treatment should not be provided to the client until the condition has been treated.
SENSITIVE SKIN		Sensitive skin is a common issue but not a medical diagnosis in itself. The term generally refers to skin that is more prone to inflammation or adverse reactions. People with sensitive skin may have strong reactions to chemicals, dyes, and fragrances present in products that come into contact with the skin.	Treatments should be applied with caution. Patch tests may be required before undertaking a full procedure.

## Client Consultation

A client consultation is a one to one talk with your client. During this time, you will find out very important and confidential information that will allow you to advise and provide the best treatment for the client.

It is important to always introduce yourself to the client as this removes any barriers and relaxes them. Consultations should always be undertaken in a private room or area where you cannot be overheard by others.

A client should first fill out a client consultation which helps identify any contra-indications that may mean you have to alter the treatment or be unable to treat them at all. If their form shows no reason why they cannot proceed with the treatment, then you can move onto verbal questioning.

Verbal questions would be to establish why the client has visited the salon and what their expectations and outcome of the treatment may be. Asking what they want ensures you can provide customer satisfaction as the client should be pleased with the outcome of their treatment. It is good practice to speak to the client in front of a mirror and explain the treatment to them and see if that meets their requirements.

Once you have established what the client is after, then a physical examination should be undertaken. This allows you to further check for any undeclared contra-indications and get a better overview of any issues that you may face during the procedure.

Allow around 15 minutes for the client's first salon visit. Ideally, you should sit face to face or next to the client to create an open atmosphere. Avoid barriers such as a couch or table between you.

Use open questions to tactfully encourage the client to give you information that you may need rather than using interrogating questioning techniques. Use the consultation form to work from and record anything you may discuss.

## Record Keeping

Records must be maintained and updated for a number of reasons.

- They provide contact details in case you need to alter or cancel an upcoming appointment.
- So that you can track client's progression.
- To record the products used and timings so you can use these at further visits and adjust the treatment plan if required.
- Tracks any aftercare you provide the client.
- Records patch test history.
- As a backup in case, the client has an adverse reaction to treatment.
- For legal reasons if the client brings a claim against you.

Client records can be stored electronically or filed away manually and should be updated at every visit. If consultation forms are not updated and do not contain a history of services and dates, then you may find your insurance invalid.

Forms should be kept for the timeframe suggested by your insurance company. This may be for up to six years. If a client is under 21 at the time of service, then it is recommended to keep the forms for six years past their 21<sup>st</sup> birthday.

Client confidentiality must be protected at all times. Forms need to be locked away in a secure cabinet, and electronic records should be held on a password-protected computer. You may also need to register with the ICO as a data controller.

- All information must be accurate and necessary for the service or treatment being performed.

- Individual client records must be available for the clients to view if requested.
- Data should not be passed on or sold without the client's prior written permission.

The following details should be recorded on the client consultation form:

- Personal details – name, address, contact details
- Results of any patch tests
- Contra-indications
- Contra-actions
- Reasons for the treatment
- Any reactions to treatments/previous treatments
- Home care advice/suggested retail items.
- Any sales
- Treatment timings/products used etc.
- Next appointment or recommendations

Any contra-indications and possible contra-actions should be identified and discussed prior to the treatment. In the case of a medical referral, the therapist should keep a copy of the GP's letter with the client's record card.

Consultation forms must be signed and dated to prove that you have covered everything and given the correct advice and treatment plan.

**Treatment Form – Laser**

Title (Mr, Mrs, Miss, Ms.): .....

First Name: ..... Surname.....

Address:.....  
.....

Post Code: ..... Date of Birth.....

Tel: ..... Mobile: .....

E-Mail: .....

\_\_\_\_ I am voluntarily consenting to a Laser procedure.

\_\_\_\_ I understand that the procedure can result in an appearance enhancement and is typically used for skin rejuvenation and hair removal. The treatment uses a laser device that create a controlled-changes of the skin surface and hair follicle.

\_\_\_\_ I also understand that I may require a series of treatments with at least four-six weeks between procedures to achieve the maximum cosmetic result.

\_\_\_\_ I acknowledge that no written or implied verbal guarantee, warranty or assurance has been made to me regarding the outcome of the procedure.

\_\_\_\_ I agree to follow the full aftercare advice given to me, which includes avoiding sun and UV exposure, avoiding saunas and steam rooms and using an SPF when outdoors.

\_\_\_\_ I understand that there may be discomfort during or post procedure, including oedema, bruising, redness directly after treatment, change in pigmentation (increased, decreased, change in freckles) and wound healing (crusting, flaking and possible infection and scarring if aggravated)

\_\_\_\_ If I am undertaking laser for hair-reduction, I understand that I must not wax or epilate between appointments as this can reverse the treatment outcome.

\_\_\_\_ I give full consent to the use of my before and after images for marketing purposes, providing all identifying features are covered and that there is no way to identify myself from the image. Images will be kept for 6 years and may be used in the event of a claim being brought against us. They will be stored on a password encrypted hard drive.

\_\_\_\_ Under GDPR rule, I understand that I have full access to all data held on me. This data will be held by the clinic for no longer than 6 years for insurance purposes, after which, digital information will be deleted permanently, and paper documents will be destroyed. All information on myself is kept on password encrypted hard drives or locked in filing cabinets to which only selective staff members have access. None of my personal data will be sold or used for anything other than to provide the services of this clinic.

Please ensure you understand the potential complications and personal requirements of the procedure indicated below and please acknowledge or answer the points and questions:

	YES	NO
Are you allergic to local anaesthetics, do you have a history of anaphylactic shock (severe allergic reactions)?		
Do you consent to the use of a local anaesthetic?		
Do you suffer from any known allergies? If yes, please specify on the next page of the is form.		
Have you taken oral retinoids (Roaccutane) in the last 12 months?		
Are you using topical retinoids/Vitamin A products?		
Do you have active acne with papules or pustules?		
Are you taking Aspirin, Warfarin, other anti-coagulant treatments or any other medication or dietary supplements such as Omega-3 that can affect platelet function and bleeding time?		
Do you have or have you had any form of skin cancer?		
Are you taking/receiving steroids, chemotherapy or radiotherapy?		
Are you taking any other medication? If Yes, please specify on the next page of this form.		
Do you suffer from any illness e.g. diabetes, angina, epilepsy, hepatitis, auto immune disease?		
Do you suffer from keloid or hypertrophic scars?		
Do you have a history of herpes simples (cold sores) or other skin infections?		
Have you undergone a laser resurfacing or skin peel in the last 6 weeks?		
Are you pregnant or is there any possibility that you are pregnant?		
Are you breastfeeding?		
Will you refrain from intensive sunlight exposure and/or artificial UV exposure for a period of at least 2 weeks?		
Will you use topical sun protection products with an SPF 30+ or higher and with stated UVA/UVB protection on a daily basis with regular applications for the same period?		

**Additional comments:**

---



---



---

I confirm that to the best of my knowledge that the information that I have supplied is correct and that there is no other medical information I need to disclose.

I understand that treatments and products is not an exact science and therefore that no guarantee can be given as to the results of the treatment referred to in this document. I accept and understand that the goal of this treatment is improvement, not perfection, and that there is no guarantee that the anticipated results will be achieved.

**Patient/Client Signature:** ..... **Date:** .....

**Practitioner Signature:** ..... **Date:** .....

## IPL Treatment Form

Client:

Area to be treated:

Purchased Package

Date						
Treatment Number						
Any change in Medical History?						
Skin Type						
Any Pre-existing Marks in area?						
Treatment Head						
Tip Size						
Area						
Fluence						
Pulses						
Delays						
Skin Reaction						
Aftercare Given						
Time Taken						
Number of Shots						
Operators Name						
Clients Signature <i>'I agree to comply with the aftercare given and that medical details are unchanged'</i>						



## Skin Rejuvenation

Photorejuvenation is a non-ablative treatment using a laser or light device to treat extrinsic or intrinsic signs of ageing. All ageing factors can lead to superficial vascular and pigmented irregularities as well as a loss of elasticity and collagen.

IPL (Intense Pulsed Light) has become popular for skin rejuvenation because of its non-ablative, noncoherent, polychromatic, flash lamp effects. During the procedure, white light is pulsed with wavelengths ranging from 500nm to 1200nm in the energy spectrum. Visible yellow and red light are emitted instantaneously in a single white flash. These multiple wavelengths of light together can treat numerous signs of photodamage.

### Symptoms that can be treated with IPL

- Rosacea, excess erythema, flushing or papules.
- Telangiectasias/spider veins
- Pigmented lesions/pigmentation
- Fine lines and wrinkles
- Enlarged pores

### Contraindications

- Fitzpatrick IV and above to be used only with manufacturers recommendations and with caution
- Epilepsy
- Herpes
- Topical skin creams such as retinol or Accutane's.
- Recent chemical peels
- Photosensitivity to sunlight
- Suspicious skin lesions
- History of skin cancer
- Photosensitising drugs
- Current sun exposure within the last four weeks
- Pregnancy and breastfeeding
- History of Keloid scarring

## Skin Rejuvenation Protocol

1. Prepare the treatment area and client.
2. Set up products and protective devices.
3. Review client consultation form and patch test outcome.
4. Cleanse the client's face and cover the eyes with eye goggles.
5. Turn on the device and record previous shots and start shots.
6. Perform device calibration as per the manufacturer's instructions.
7. Take photographs.
8. Select appropriate treatment mode, filter, parameters and cooling settings on the machine.
9. Put on your own protective glasses.
10. Apply gel coolant to the skin.
11. Ensuring there is plenty of contact gel under the filter, place the filter on the skin and do a test shot.
12. Assess clinical endpoints; these would be erythema, darkening of vessels or pigmentation and client comfort.
13. If the test is responsive, then continue the treatment on the rest of the client's face; you can raise or lower the joules or switch to a different parameter or filter.
14. Start treatment on the forehead, being careful not to place the filter over the hairline or eyebrows.
15. Follow the manufacturer's recommendations for treatment for the number of passes on all treatment areas.
16. Ensure there are no overlaps when firing shots.
17. Remove residual gel.
18. Apply an ice pack to the clients face if needed.
19. Complete all documentation, including the number of shots, skin reaction and client reaction.
20. Turn off the device and clean all filters, remove and store away the key.

## Skin Rejuvenation Post Treatment Advice

- Avoid sun exposure for one week and use SPF 30+ at all times.
- Avoid the use of heat treatments, sauna or steam rooms for 48 hours
- Use appropriate post-treatment skincare to support salon treatment
- No invasive or exfoliation treatments for four weeks

## Laser and IPL Hair Removal

Intense pulsed light is polychromatic and broadband and is achieved through the use of filters that affect the light's wavelength. The wavelengths vary between 400nm and 1000nm. The filters used create wavelengths that target different structures such as hair, pigment and vessels. Intense pulsed light, although not actually a laser as it is not a monochromatic light, can target multiple chromophores. The head of the IPL device usually determines the treatment modality. IPL is vastly popular for hair removal as the devices to purchase are cheaper than Laser machines, and they are faster and easier to use, making the treatment more affordable to the client.

IPL devices have proven efficient in achieving permanent hair reduction.

<b>Lasers and their efficacy in hair removal</b>			
<b>Laser or Light</b>	<b>Skin Type</b>	<b>Hair Colour</b>	<b>Type of Hair</b>
Pulsed Diode	I-IV	Black to light brown	Coarse
Ruby	I-II	Black to light brown	Fine and coarse
Normal mode Nd:YAG	I-VI	Dark	Coarse
Q-Switch Nd:YAG	I-VI (temporary removal only)	Black to light brown	Fine and coarse
Alexandrite	I-IV	Black to light brown	Fine and coarse
Intense pulsed light	I-IV	Black to light brown	Coarse

## Client Selection

There are four main categories for excess hair growth:

- Hypertrichosis
- Hirsutism
- Hair bearing flaps
- Cosmetic concerns

Hypertrichosis is an increased hair growth that is not androgen-dependent. Typically, it is caused as a result of medications or disease.

Hirsutism is androgen-dependent and can be accompanied by other diseases.

Hair bearing flaps are the results of surgeries in which skin flaps have been used, especially in skin reconstruction surgery. While surgeons are careful to turn flaps with unwanted hair, it can still happen, and a client may seek laser hair removal as a method to fix this.

Cosmetic concerns are the most common reason for laser hair removal by clients wanting hair removal on legs, arms, underarms, bikini and face.

Clients should be advised of the types of hair removal available. These consist of:

Temporary hair removal is short term up to 3 months, reduction of hair growth.

Permanent hair reduction will last longer, but there is a high chance that the hair follicle will regenerate, and hair may come back.

Complete hair removal involves the obliteration of the hair follicle, where the hair follicle is permanently destroyed. This can still regenerate in some clients, and some hair regrowth may occur due to follicles being dormant at the time of the treatment. Therefore, it is better to call it Permanent hair reduction instead.

## Fitzpatrick Skin Typing

In its simplest form, the Fitzpatrick scale measures the amount of pigment in the skin and its tolerance to the sun. Fitzpatrick skin typing helps you to predict the skin's response to the treatment. To determine the skin type of your client, you will need to ask them a series of questions to establish a numeric score to determine their skin type.

### Eye colour

- 0. Light colours
- 1. Blue, gray or green
- 2. Dark
- 3. Brown
- 4. Black

### Natural hair colour

- 0. Sandy red
- 1. Blond
- 2. Chestnut or dark blond
- 3. Brown
- 4. Black

### Your skin colour (unexposed areas)

- 0. Reddish
- 1. Pale
- 2. Beige or olive
- 3. Brown
- 4. Dark brown

### Freckles (unexposed areas)

- 0. Many
- 1. Several
- 2. Few
- 3. Rare
- 4. None

### If you stay in the sun too long?

- 0. Painful blisters, peeling
- 1. Mild blisters, peeling
- 2. Burn, mild peeling
- 3. Rare
- 4. No burning

### Do you turn brown?

- 0. Never
- 1. Seldom
- 2. Sometimes
- 3. Often
- 4. Always

### How brown do you get?

- 0. Never
- 1. Light tan
- 2. Medium tan
- 3. Dark tan
- 4. Deep dark

### Is your face sensitive to the sun?

- 0. Very sensitive
- 1. Sensitive
- 2. Sometimes
- 3. Resistant
- 4. Never have a problem

### How often do you tan?

- 0. Never
- 1. Seldom
- 2. Sometimes
- 3. Often
- 4. Always

### When was your last tan?

- 0. +3 months ago
- 1. 2 - 3 months ago
- 2. 1 - 2 months ago
- 3. Weeks ago
- 4. Days

Score		
0 - 6	Skin Type I	
Always burns, never tans (pale white skin)		
7 - 13	Skin Type II	
Always burns easily, tans minimally (white skin)		
14 - 20	Skin Type III	
Burns moderately, tans uniformly (light brown skin)		
21 - 27	Skin Type IV	
Burns minimally, always tans well (moderate brown skin)		
28 - 34	Skin Type V	
Rarely burns, tans profusely (dark brown skin)		
35+	Skin Type VI	
Never burns (deeply pigmented dark brown to black skin)		

\* The information published here is not intended to take the place of medical advice. Please seek advice from a qualified health care professional.

## Contraindications for Laser Hair Removal

- Pregnancy
- Epilepsy
- Recently tanned skin or sun exposure in the last four weeks
- Birthmarks, moles or beauty spots in the treatment area
- Certain oral and topical medication can cause thinning of the skin or photosensitivity
- History of keloid scarring
- Open wounds

## Treatment Protocol for Laser or IPL Hair Removal

1. The client should have shaved the area prior to treatment.
2. Prepare the treatment area and client.
3. Set up products and protective devices.
4. Review client consultation form and patch test outcome.
5. Cleanse the area and cover the eyes with eye goggles.
6. Turn on the device and record previous shots and start shots.
7. Perform device calibration as per the manufacturer's instructions.
8. Select appropriate treatment mode, filter, parameters and cooling settings on the machine.
9. Put on your own protective glasses.
10. Apply gel coolant to the skin.
11. Ensuring there is plenty of contact gel under the filter, place the filter on the skin and do a test shot.
12. Perform the treatment at the highest fluence, the skin can tolerate and in accordance with the manufacturer's recommendations for the most effective hair reduction. The time taken to complete the treatment depends on the spot size of the beam and the pattern on the handpiece.
13. Apply the handpiece firmly on the skin to disperse oxyhaemoglobin away from the treatment area. This allows greater absorption of the laser light and reduces epidermal damage.
14. Assess clinical endpoints; these would be erythema, darkening of vessels or pigmentation and client comfort.
15. If the test is responsive, you should see red spots on the skin around the hair follicle.
16. Follow the manufacturer's recommendations for treatment for the number of passes on all treatment areas.
17. Ensure there are no overlaps when firing shots.
18. Remove residual gel.
19. Apply an ice pack to the clients face if needed.
20. Complete all documentation, including the number of shots, skin reaction and client reaction.
21. Turn off the device and clean all filters, remove and store away the key.

## Aftercare

- A quick warm shower can take a quick warm shower after the treatment. No hot baths for 24-48 hours.
- Healing balm can be applied; perfumed products should be avoided.
- If blisters occur, an ointment can be applied.
- Sun should be avoided for 48 hours.
- SPF 30+ should be applied in treated areas during the course of treatment.
- Avoid make up for 24 hours.
- Avoid tight clothing.
- No waxing, plucking or threading between treatments.
- Hair may appear to grow faster post-treatment as the hair 'falls' out.
- A revisit appointment should be booked in 4-12 week's time.