Non-Surgical Facial Rejuvenation

Definition
These options represent a range of procedures that ameliorate some of the stigmata of facial aging, and are a useful adjunct to delay more extensive surgical options. They also afford patients minimum **"downtime"** (downtime is sitting at home recovering instead of shopping at Sandton City!).

The Aging Process
It is important to realise that the aging process is a **normal and physiological process** that begins at the moment of birth and continues during life. Two important concepts are those of biological age and chronological age. Your **biological age** is the age at which a similar population mean will have physical, mental and emotional abilities comparable with your own. It is usually compared to **chronological age** which is the number of years which you have been alive for (what your birth certificate says). Biological age is influenced by a number of important factors:

- Genetics
- Toxic load (smoking, alcohol, drugs, dietary intake)
- Lifestyle choices (body fat, physical exercise and general health, especially digestive and immune system "fitness")
- Emotional, mental and relationship health.

There is a wide **"normal" range** within which biological age may differ from the chronological age. As an example, consider attractive actresses Monica Bellucci (born 30 September 1964) and Lindsay Lohan (born July 2, 1986) – Google them !!

Recent evidence suggests that a biological age which appears clinically younger than the chronological age is correlated with less sub-cellular and DNA changes and may have an **impact on longevity**. The **causes of aging** are varied, controversial and still largely not well understood. **DNA changes** such as substitutions, dimers and stand breaks may contribute, but **telomeric shortening** is an exciting new(ish) discovery that may hold an important key to understanding DNA aging. **Cellular senescence** is due to increasing inefficiency of the cellular machinery as well as macromolecule damage. **Mitochondrial DNA damage** may also be a contributing factor. Soft tissue stretching and displacement due to **gravity** is an additional factor (damn gravity).

When considering rejuvenation, another critical point to bear in mind is that the aging process does not only affect the integument, but **anatomical changes** occur within bone, muscle and subcutaneous fat (as well as other vital structures). The aging face is thus the manifestation of a **3-dimentional change** – any aesthetic intervention a practitioner suggests must bear this consideration.

Changes in the Skin : Intrinsic Ageing Vs. Photoageing
Intrinsic ageing is an **inevitable process** that occurs as cumulative damage to DNA and other essential molecules (due to repeated cycles of mitosis) becomes evident at a tissue and functional (organ) level. The very interesting phenomenon is known as **The Hayflick**

Limit and is the number of times a normal human cell population will divide until cell division stops. The concept was described by anatomist Leonard Hayflick in 1961, who demonstrated that a population of normal human fetal cells in a cell culture will divide between **40 and 60 times**, before entering a senescence phase. Basically, our cells are not immortal (unless you are Wolverine!).

Photoageing is a process that occurs as a result of cumulative **exposure to UV light** (UVA mainly, but also UVB) that causes specific cellular and sub-cellular changes, that lead to both aging and cancer (so wear sunscreen). Often intrinsic and photoageing are superimposed in the same area.

	Intrinsic Ageing	**Photageing**
Gross	Thin, fragile skin Dry skin (Xerosis) Fine Wrinkling Paler, mottled Skin (Dyschromia) Prominent Capillaries	Thick, rough skin Inelastic Coarse Wrinkling Sallow, irregular pigmentation Prominent Capillaries
Microscopic	Thinning of Epidermis Thinning of Dermis Decreased, disorganised collagen Frayed Elastic Fibres Dermo-epidermal Flattening Decreased melanocytes and melanosomes Decreased Dermal Appendages (Sebaceous and Eccrine – Xerosis) Vascular lesion such as venous lakes and telangiectasia due to loss of stromal support	Thickening of Epidermis Thinning of Dermis Thicker, Disorganised Collagen Clumped Elastic Fibres (Elastosis) Dermo-Epidermal Flattening Increased irregular pigmentation Dysplastic and Neoplastic Changes in epidermis (BCC, SCC, AK) Vascular lesion such as venous lakes and telangiectasia due to loss of stromal support

What to do about aging

Getting old is not for sissies! The baby boomer generation are in their 50s and older and represent an important driving market, although both gen-x and gen-y contribute to the aesthetic market. There are 5 categories of treatments available to these patients:

1. **Resurfacing procedures** causing controlled epidermal and dermal injury which results in epidermal regeneration and dermal collagen deposition. These improve the appearance of photo-aged and intrinsically aged skin. There are no "miracle cures" despite continued media hype about the next big thing.

2. Skin Tightening devices use a variety of methods to deliver "energy" to the dermis with resulting controlled dermal injury and the induction of wound healing and the ultimate generation of new collagen to account for the tightening effect. Some of the modalities used include photon-based energy, radiofrequency energy, mechanical energy or ultrasound energy. There are more than 50 such devices on the market, many of which use combinations of the above to improve the effect.

3. Soft tissue augmentation. This offers little change (perhaps moisturisation) to the epidermis, but may change the anatomical distribution of "hills" and "valleys" to re-contour the volume depleted aged face. Ground-breaking new work on facial fat and its compartments and layers indicate that some areas undergo volume depletion with time, while others accumulate fat with time. This is one of the major reasons for the contour change of the face.

4. Paralysis of overactive facial musculature. This results in volume loss (muscle atrophy), positional change (a dynamic change in tension vectors) and a decrease in the accompanying skin creases.

5. Topical Pharmacological agents – termed "cosmeceuticals". This diverse group consists of a huge variety of lotions, potions, creams, serums and snake oils!

1. **<u>Resurfacing Procedures.</u>**

These procedures result in a variable amount of epidermal and dermal damage. They are divided into ablative, non-ablative and fractionally ablative.
Ablative procedures remove the entire epidermal thickness and a small amount of dermis – analogous to a superficial partial thickness burn.
Non-ablative procedures remove a partial epidermal thickness only – analogous to a superficial burn.
Fractionally ablative procedures result in "islands" of ablative damage, surrounded by a "sea" of untouched area. The percentage of the islands varies from 20% to 80%.

a. **ABLATIVE**
    i. Chemical Peels
        1. Phenol
        2. Trichloracetic Acid (TCA)
        3. Jessner's Solution
        4. High concentration Fruit acid Peel

Chemical peeling (*chemexfoliation*) involves the application of a chemical solution to the surface of the skin to carefully remove its outer layers. The amount of skin removed will depend on the **type of chemical** used, the **strength** of this product and the **application time**. Chemical peels are classified according to the depth of penetration**:**

- **Superficial peels** remove the outer layer of the skin (epidermis).
- **Medium depth** peels remove both the epidermis and the upper part of the dermis.
- **Deep peels** extend into the deep dermis.

The deeper the peel, the **more effective** it will be in improving the appearance of lines and wrinkles, but the **longer it will take to heal** (downtime) and the **greater the risk of scarring** and other complications. Glycolic acid is an alpha hydroxy-acid and depending on the time and concentration, can effect superficial and medium depth peels. TCA can effect medium and deeper peels.

I personally recommend 15-20% TCA for those patients who can afford the week or so of down time required. It offers the best risk:benefit ratio and is quite cost effective as well. Often only 2 peels a year are required for excellent results. I do not use phenol anymore as it can caused significant melanocyte depletion and permanent skin colour changes.

ii. Dermabrasion
iii. LASER (Pulsed and Q-Switched)
    1. CO_2
    2. Erbium:YAG
    3. Nd:YAG
    4. Mixed Erbium:CO_2

b. NON-ABLATIVE

i. Frequency doubled, cooled 1320nm Nd:YAG Laser
ii. 585nm Pulsed Dye Laser (Good for surface vessels)
iii. Intense Pulsed Light (IPL)
iv. Radiofrequency (Thermage and Pellevé)
v. Microdermabrasion
vi. Low concentration fruit acid peel

I personally use and recommend the Pellevé procedure. It is a truly zero-downtime procedure and significantly improves the appearance of fine lines as well as exerting a tissue tightening effect. The best results are seen with multiple treatments and 2-4 are usually required.

c. FACTIONALLY ABLATIVE

i. Fractionated CO_2 Laser
ii. Fractionated Er:YAG
iii. Fractionated Thulium
iv. Needling
v. Biojetting

2. <u>Soft tissue Augmentation</u>

a. Structural Fat Grafting (Fat Injections and dermo-fat grafts)
b. Hyaluronic Acid
c. Semi-permanent filler with hydroxyl-apatite

Hyaluronic acid is a natural substance and a principle component of the **extracellular ground substance** of human soft tissue and as such is highly biocompatible and degradable. It is used as an injectable dermal filler and is useful for the treatment of **facial lines and wrinkles**, for **lip enhancement** and for **facial volume augmentation** and contouring. There are many variants of hyaluronic acid, from different medical corporations, differing in viscosity and used for various applications depending on the depth of injection.

I personally use products from Juvéderm (Allergan) only. I am a consultant to Allergan

Aesthetics and my preference for Juvederm should be considered in this light (Note: Disclaimer!). Clinical effect varies depending on depth, tissue metabolism, technique and individual variation, but usually lasts 6 to 18 months.

Several fillers have been launched which are considered permanent or semi-permanent. While this may seem advantageous, it should be remembered that any potential problem with these products will also be permanent.

The use of hydroxyl-apatite crystals in HA (known as Radiesse) has been championed by some as offering the best of permanent and non-permanent fillers. I do not personally use this product.

Another so-called permanent product is injectable poly-L-lactic acid (known as Sculptra). This has been dubbed the seeds of new collagen as the PLLA causes an increase in fibroblast proliferation and collagen production. I do not personally use this product.

d. Other Fillers
    i. Bovine Collagen (Zyderm, Zyplast – not used widely anymore due to allergic side effects)
    ii. Allogenic Dermis
    iii. Allogenic Fascia
    iv. Alloplastic permanent fillers (an ever expanding range and each new product promises to be complication free. EVERY one has been associated with devastating complications – use at your own risk!)

3. <u>Topical Pharmacological Skin Rejuvenation</u>

This groups of products consists of a huge range of formulations – some with scientifically documented benefit and others with none whatsoever. Advertising and marketing of a product (with high profile celebrity endorsements) dictates popularity, rather than actual patient benefit. Ingredients vary from natural extracts (ginger, aloe vera), to beneficial macromolecules (vitamin C, retinoids, anti-oxidants) to marketer-invented words (boswelox, ha ha). Confusion among practitioners and patients alike is all too common. Only 5 ingredients have shown benefit in clinical trials – if your product does not have one of these, you are wasting your money !

a. Sunscreen (This is the MOST important. SPF-30 or greater is the minimal requirement)
b. Retinoids
    i. Tretinoin (All trans-retinoic acid) – Retin-A, Renova
    ii. Synthetic Retinoids (Adapalene, Tazarotene)
    iii. Vitamin A – Retinol
c. Hydroxy Acids
    i. Alpha-HA
    ii. Beta-HA
    iii. Poly-HA

d. Antioxidants
    i. Vitamins (C and E)
    ii. Furfuryladenine (Kinerase)
    iii. Copper
    iv. Co-Q10 (aka urbiquinone) [as in Nivea Visage Q10]
    v. Idebanone (Prevage)
    vi. CE-Fuerrulic
e. NEW : Neuropeptides (More Research Needed)

4. <u>Muscle Overactivity (Botulinum Exo-Toxin)</u>

a. Type A (BOTOX, Dysport)
b. Type B (Myobloc, Neurobloc)
c. NEW : Permanent radiofrequency ablation of the neuromuscular junction – the REX device (More research needed, especially in the light of the permanent nature of the treatment)

<u>A (shortish) note on Botox</u>

Introduction

Botulinum neurotoxin is an exotoxin produced by the **gram-negative**, **anaerobic** bacterium *Clostridium botulinum.* [From the **Latin *botulus***, meaning **sausage** after an outbreak of botulism in Stuttgart where Kerner described the signs and symptoms.] Of the 8 serologocial types, only A and B are used clinically.

Mechanism of action

Botox **blocks acetylcholine release at the neuromuscular junction** causing a chemical denervation. Neurotransmission involves exocytosis of *ACh* vesicles into the synaptic cleft which requires docking and binding of the neurotransmitter vesicles to the presynaptic membrane. These vesicles bind to cytoplasmic attachment proteins called **SNAPs** (Soluble *N*-ethylmaleimide-sensitive fusion–attachment proteins). SNAP receptors called **SNAREs** (such as **synaptobrevin and syntaxin**) are found on both the vesicles and the plasma membranes. Boox is actually an **endopeptidase**. Blocking involves by **cleaving the SNAP-25** required for the docking of ACh vesicles on the inner side of the nerve terminal plasma membrane. This is very different to the actions of other neuromuscular blocking agents used in anesthesia. After several months, the inactivated terminals slowly recover function resulting in the loss of clinical effect. Botox injections are thus not permanent.

Dose, mixing and administration

The dose of botulinum toxin is expressed in units **(mouse units actually)**. One unit is equal to the amount that will kill 50% of a group of **18- to 22-g Swiss Webster mice** when injected intraperitoneally. The human lethal dose (LD50) for Botox is estimated at approximately **3000-5000 units**. Botox injections of fewer than 100 units usually are used for cosmetic purposes, thereby allowing a wide safety margin (1/30 of a toxic dose). By way of comparison, paracetamol (the GPs choice and popularly consider very safe –

you can buy it in a supermarket) has an LD50 of 20g, and a standard dose is 4g per day (1/5 of a toxic dose!). Botox is thus 6-8 times "safer" than Panado.

When mixing Botox, please disregard the package insert instructions. Rather reconstitute 100U with **2 ml** of sterile saline (not water, which burns like crazy). The use of "bacteriostatic saline" is off label, but makes the injections even less painful.

The above dilution **provides 5 U/0.1 ml**. In a 0.3ml tuberculin syringe there are 30 graduations (10 per 0.1 ml) and **thus each marked "insulin unit" is 0.5 Botox units.** Thinking is then no longer required – 5 units of Botox = 10 marked insulin units. Volume has not been related to either efficacy or significant diffusion. Once reconstituted **clinical** experience has shown efficacy up to **6 weeks after reconstitution if stored at 4 ^{o}C [although I only keep for 2-3 weeks personally]**. Vigorous reconstitution with bubbles has not shown an adverse effect on efficacy. The dry powder can be stored in a cool place for 24 months, and no special precautions on its handling are required.

Contraindications

Absolute contraindications include:

- Prior documented allergic reaction
- Injection into areas of infection or inflammation
- Pregnancy and breastfeeding (Category C – unknown effects).

Relative contraindications include:

- Neuromuscular junction condition (Myasthenia Gravis, Eaton Lambert)
- Some medications which decrease neuromuscular transmission
    - Aminoglycosides
    - Penicillamine
    - Quinine
    - Calcium channel blockers.

Complications

1. **Heamatogenous spread** of toxin has been documented but is not of known clinical significance. Intravascular injection should be avoided (to prevent haematomas and more importantly, loss of clinical effect).
2. Generalized **idiosyncratic reactions** are uncommon, mild and transient including:
    a. Nausea, fatigue, malaise, flulike symptoms, and rash.
    b. Sequelae **caused by injection** include pain, oedema, erythema, ecchymosis, headache, and hypesthesia.
3. The most meaningful adverse effect is **unwanted weakness**. Fortunately, this resolves in several weeks to months:
    a. **Brow ptosis** (with obstructed vision) or eyelid ptosis are the most common.
    b. **Eyelid ptosis** can be treated with clonidine 0.5% or Neo-Synephrine 2.5% eyedrops (an alpha2-adrenergic agonist, which causes Müller muscles to contract).
    c. Weakness of the lower eyelid with **paralytic ectropion and exposure keratitis** may result. Treatment is symptomatic.

   d. Injection of the lateral rectus can cause **diplopia**.
   e. Injection of platysma muscles can result in **dysphagia or dysponia** or even neck weakness
4. **Therapeutic Failure**:
   a. **Primary non-responders** may have neutralizing antibodies, variations in docking proteins or failure of technique (usually the last one!)
   b. **Secondary non-responders** almost always have neutralizing antibodies, as a result of high doses (200 units per session and repeat or booster injections given within 1 month of treatment). The new BCB 2024 Botox has a lower potential for neutralizing antibody production.

Botox is an amazing medication with phenomenal results and it easy and safe to administer. More than 30 million patients are treated every year. This make novices think that achieving reproducible aesthetic results is easy. It is not! However, with a modest amount of training, this can be a valuable practice tool. Since the dose is easily tailored, with the possibility of adding more at a later time, completely natural results should be expected. Weird or “frozen” faces are not acceptable.