Episode 113 – Dermal Fillers July 26, 2024

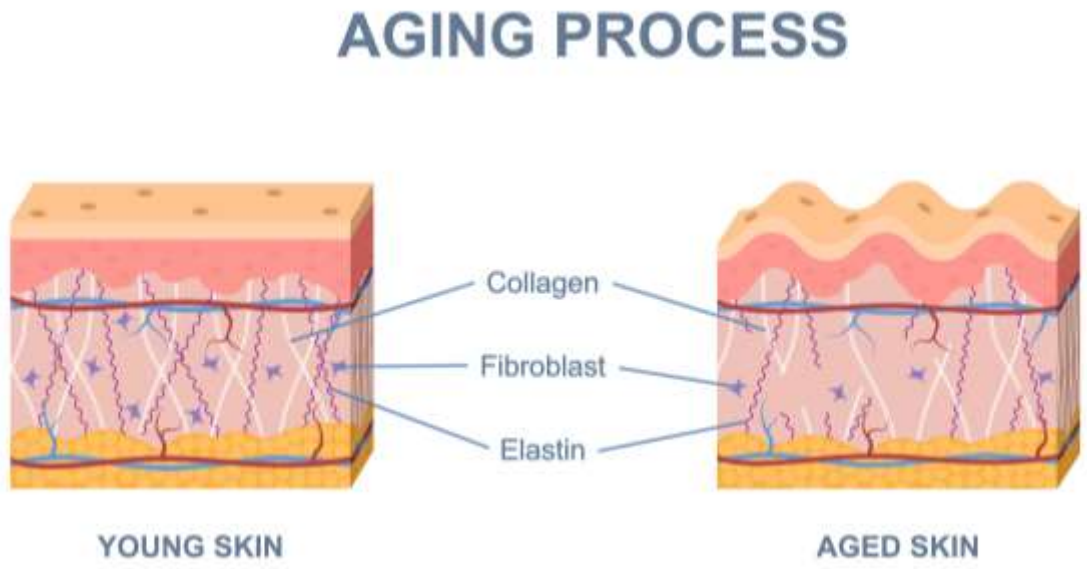
Introduction

Skin ages over time resulting in:

- Wrinkles
- Dryness
- Skin laxity
- Hollowed cheeks and eye sockets
- Irregular or blotchy pigmentation

These facial manifestations are a result of reduced collagen production, slower cell turnover rates, hereditary factors, skin damage from chronic recreational and occupational sun exposure, and smoking. [1] [2]

Collagen is the main component of the dermis and contributes to skin strengthening and support. With aging, the physiological activity of fibroblasts deteriorates, resulting in decreased tissue volume and elasticity. [3]



Sun exposure

Chronic exposure to ultraviolet (UV) irradiation from the sun causes photoaging that is superimposed with chronological aging. As a result, areas of the body frequently exposed to the sun (e.g., face, neck, forearms, back of hands) acquire visible signs of aging more rapidly than other areas of the body. [4]

Aging and repeated exposure to harmful environmental elements, especially UV irradiation from the sun, alter both the epidermis and the underlying dermis. Chronologically aged skin appears thin, dry, and finely wrinkled. Photoaged skin typically appears leathery, lax, with coarse wrinkles, telangiectasia (small, widened blood vessels), and lentigines (uneven pigmentation with brown spots [age spots]). [4]

Protecting the skin from excessive sun exposure helps to reduce photoaging. Health Canada advises Canadians not to use homemade sunscreens and to only use sunscreens approved for sale in Canada to protect against the sun's UV radiation. Approved sunscreens can be identified by their drug identification number (DIN) or natural product number (NPN).

Homemade sunscreen recipes are becoming increasingly common on social media. Health Canada warns the public about the potential risks of making and using them, as they are unlikely to be effective at protecting people from the sun's harmful UV radiation.

There are myths and misinformation circulating on social media about sunscreen safety, claiming their ingredients are harmful to the skin and can cause cancer. All authorized sunscreens on the market are safe when used as directed. Sun exposure without adequate protection is the leading cause of skin cancer. Sunscreens provide significant health benefits and when used with other sun protection measures (e.g., wearing protective clothing, seeking shade, avoiding peak sun hours), they reduce the risk of skin cancer, sunburn, photoaging, and wrinkles. A small study by Randhawa et al. (2016) suggests regular sunscreen use may even reverse wrinkles and lentigines. [5] [6]

Tobacco use

Toxins in tobacco can decrease blood flow to skin cells, reduce moisture in the dermis, and break down collagen and elastin, causing wrinkles. Generally, wrinkles caused by smoking tend to show up earlier in life than those caused by typical aging. The association between smoking and prominent wrinkles seems to be especially apparent when individuals smoke more than 40 packs of cigarettes per year. Additionally, the act of puckering to smoke may cause wrinkles around the lips to be more visible. [7] [8]

Smoking hinders collagen production, but this effect may be temporary. A small study by Iida et al. (2019) found that 19 former smokers had significantly improved collagen levels 4-8 weeks after quitting. After 12 weeks, collagen production had almost reached pre-smoking levels. [9]

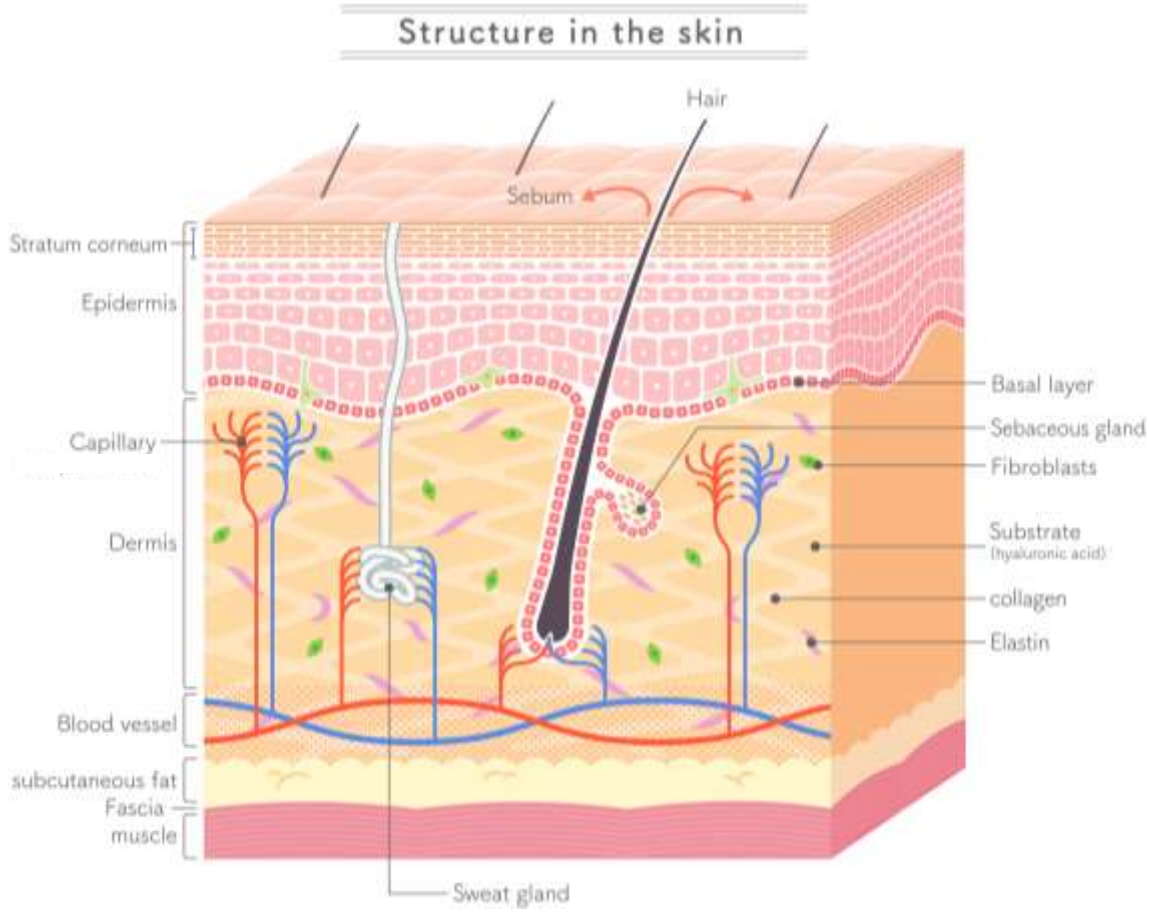
A small study by Yazdanparast et al. (2019) found that hyperpigmentation and age spots reversed within a month of smoking cessation. Thus, smoking cessation[1] can have positive effects on skin health. [10]

[1] Refer to Episode 101 for discussion on tobacco cessation.

Treatment options for aging skin

Treatment options to correct or reduce signs of aging range from surgical procedures (facelift, eye lift, etc.) to dermal filler and botulinum toxin cosmetic injections (e.g., Botox®). Both females and males are choosing injectable cosmetic treatments to reduce facial wrinkles and restore skin to a smoother appearance. Injection of dermal fillers into orofacial tissues is becoming increasingly popular, especially for lip augmentation where fillers are injected into the dermis of the lips to increase the soft tissue bulk to improve the cosmetic appearance. [1] [11]

Although the aim of dermal fillers and botulinum toxin injectable agents can be similar (e.g., smooth facial wrinkles), they use different mechanisms of action to achieve it. Dermal fillers target static wrinkles that develop over time. These static wrinkles remain present regardless of facial expression. In general, dermal fillers achieve their effects by one of two mechanisms of action. A stimulator works to reverse elasticity and hydration loss in the skin by inducing new collagen and elastin production, whereas a volumizer provides immediate volume replacement to smooth fine lines and wrinkles. Many dermal filler products combine these mechanisms of action in one agent. [2]



Botulinum toxin injections[2]
Cosmetic botulinum toxin cosmetic injections target the dynamic lines of expression that result from repetitive facial movement. Botulinum toxin is a neurotoxin produced by the bacterium *Clostridium botulinum*, which contains the same toxin that causes botulism (food poisoning). Botulinum toxin injections are used to treat various neurological disorders and for cosmetic purposes. In cosmetic use, small injected doses block the ability of underlying facial muscles to contract to reduce existing wrinkles on the face. The effects of these treatments generally last three to four months. [1] [2]

History of dermal fillers
The use of paraffin and Vaseline injections for facial augmentation dates back to the 1800s. However, due to numerous complications associated with their use, there was a need to find safer, more reliable, and biocompatible materials. In 1893, autologous fat injections were used to correct facial defects. The success of these injections varied and heavily depended on proper training, sterile technique, and appropriate storage. Silicone use as a permanent facial filler remains controversial owing to the material's ability to migrate and form fistulas. In 1981, bovine (cow) collagen was the first agent to be approved for cosmetic injection by the US Food and Drug Administration (FDA). Recently hyaluronic acid use has increased in popularity due to its skin smoothing and volume-producing effects. [12]

Injectable dermal fillers
Dermal fillers, also known as soft tissue fillers, lip and facial fillers, injectable implants, or wrinkle fillers, are classified by Health Canada as medical devices.

- Dermal fillers that do not contain animal or human tissue or their derivatives are classified as Class III medical devices.
- Dermal fillers that are manufactured from or incorporate animal or human tissue or their derivatives are classified as Class IV medical devices. [13]

Some dermal fillers are naturally absorbed by the body over time (i.e., biodegradable), so the procedure may need to be repeated to maintain the desired effect. Successful results depend on the underlying tissue structure and the volume and type of filler used. The time the effect lasts depends on the type of filler material and the area treated. [14]

There are four basic materials used in dermal fillers:

- Autologous fat injections
- Collagen products
- Hyaluronic acid products, and
- Injections of a carrier material containing microspheres of another biocompatible material (e.g., polymethylmethacrylate [PMMA]). [1]

Most dermal fillers are available in disposable plastic syringes with a Luer Lock (screw connection) fitting, packaged with a sterilized needle gauge appropriate for the filler viscosity. Usually, more viscous fillers are used for deeper defects. Also, the depth of the defect determines the depth of injection. [15]

[2] Refer to Episode 54 for discussion on the use of botulinum toxin in dentistry.

Some dermal fillers contain lidocaine to decrease pain or discomfort during the injection. Materials used in dermal fillers are considered absorbable or nonabsorbable. [16]

Absorbable materials
Absorbable (i.e., temporary or biodegradable) materials include hyaluronic acid, calcium hydroxylapatite, and poly-L-lactic acid.

Hyaluronic acid
Hyaluronic acid is a polysaccharide present in body tissues such as skin and cartilage. It is able to combine with water and will swell when in gel form, causing a smoothing and filling effect. Sources of hyaluronic acid used in dermal fillers can be from bacteria or rooster combs (avian). In some cases, hyaluronic acid used in dermal fillers is crosslinked (chemically modified) to make it last longer. [16]

Hyaluronic acid products are the most commonly used dermal fillers in Canada. There are currently over 30 dermal fillers containing hyaluronic acid licensed for sale in Canada. The effects of this material last approximately 6-12 months, though it depends on factors such as:

- Age of the skin
- Severity of the facial defect
- Size of the area requiring corrective measures
- Specific type of cosmetic dermal filler used [1]

Calcium hydroxylapatite
Calcium hydroxylapatite (CaHA) is a type of mineral found in human teeth and bones. CaHA particles are suspended in a gel-like solution and then injected into the facial wrinkle. CaHA stimulates fibroblasts to produce collagen. The effects of this material last approximately 18 months. CaHA may be visible in x-rays and may obscure underlying features. [17] [18]

Poly-L-lactic acid
Poly-L-lactic acid (PLLA) is a biodegradable, biocompatible, synthetic polymer. This material has wide uses such as in absorbable stitches and bone screws. It provides soft tissue augmentation through stimulation of an inflammatory tissue response with subsequent collagen deposition. PLLA is a long-lasting filler material that is given in a series of injections over a period of several months. The effects of PLLA generally become increasingly apparent over a period of several weeks and its effects may last up to two years. [16] [17]

Nonabsorbable materials
Polymethylmethacrylate is a nonbiodegradable (permanent), biocompatible, synthetic polymer.

Polymethylmethacrylate
Polymethylmethacrylate (PMMA) is used in other medical devices, such as bone cement and intraocular lenses. When used as a dermal filler, PMMA microspheres (beads) are suspended in a gel-like solution that contains bovine collagen. PMMA

dermal fillers consist of 20% PMMA microspheres and 80% bovine collagen. PMMA microspheres provoke a foreign body reaction that stimulates fibroblasts to deposit collagen around the nonabsorbable microspheres. After the collagen degrades over three months, the microspheres encased by a fine fibrous capsule are left. [14] [17]

Indications for use
Indications for the use of dermal fillers include:

- Depressed scars (e.g., from surgery or trauma, or acne scars)
- Facial wrinkles and skin folds, such as nasolabial folds, marionette lines (melomental folds), and perioral lines (small wrinkles around mouth and lips)
- Augmentation (increased volume) of lips, cheeks, and chin
- Dermal atrophy
- Restoration and correction of lipoatrophy (facial fat loss) in individuals with human immunodeficiency virus (HIV) [14] [15]

Injection planes
Unlike botulinum toxin, dermal fillers are not injected in the muscles. Dermal fillers are ideally injected into the fat area because fat acts as a natural filler. The fat on the face is divided into two planes: superficial and deep fat. The superficial plane lies just beneath the skin, whereas the deep plane lies underneath the muscle layer.

Dermal filler results vary depending upon the plane of injection. Injecting into the superficial layer at a depth of 3 mm requires a small amount of filler to show visible results as there are less layers to elevate. Injecting into the superficial fat also helps to ensure the filler's impact lasts longer; whereas, injecting into the deep plane requires a larger amount of filler for visible results on the face. Fillers should be deposited in the correct plane to achieve the desired results. [19] [20]

Injection techniques
There are several dermal filler injection techniques, such as serial puncture, linear threading, cross-hatching, and fanning. The choice of the injection technique depends on the indication, its location, the filler substance, size of the needle, and the experience of the administrator. [17]

Serial puncture
Serial puncture, also known as the droplet, serial, multi-puncture technique, involves multiple injections placed close together along the length of a fold so the it forms a continuous pattern. Several small droplets of filler are placed into deeper layers of the outer skin. This technique is useful for acne scarring, shallow forehead rhytids (fine lines), philtrum enhancement, and nonsurgical rhinoplasty (i.e., to change the shape of the nose). [15] [20]

Linear threading
In linear threading, the full length of the needle is inserted into the tissues and slowly drawn backwards so the threads of filler are deposited along the fold or wrinkle. This technique is most commonly used for nasolabial folds or marionette lines. [15]

Cross-hatching
This technique involves cross-thread lines. Cross-hatching is similar to linear threading injection technique. With cross-hatching several parallel lines of dermal filler are spaced apart, then this is repeated at right angles to the original lines (similar to a grid pattern). This technique is used when large area corrections are required and is especially effective for filling the oral commissures. [15] [20]

Fanning
Fanning is similar to linear injection technique, except immediately before the needle is withdrawn, its direction is changed and a new line is injected forming a 'fan' shape. It is best for deep malar injections (injections in the cheekbone area). [15]

Contraindications
To help minimize the risks associated with cosmetic dermal fillers, individuals should avoid or postpone treatment if they have any of the following:
- Severe allergies or a history of anaphylaxis
- Allergies to collagen, eggs, animal products, bacteria, or lidocaine
- Inflamed or infected skin
- Bleeding disorders
- Active case of cysts, pimples, rashes, or hives
- Tendency to excessive scarring (e.g., keloids) [1] [14]

Needle-free dermal filler devices
Needle-free dermal filler devices used for cosmetic skin treatments are not authorized in Canada and may pose health risks. These small handheld medical devices or "pens" use high pressures to force dermal filler into the body without a needle. The user typically fills the pen with a product that is purchased separately (e.g., hyaluronic acid or other dermal fillers).

These devices are also known as hyaluron pens, hyapens, hyla-pens, fog injection devices, SERA pens, nebulizer injector guns or syringes, microinjectors, noninvasive injection pens, high pressure pens, or sprayer pens.

Health Canada has not authorized any needle-free dermal filler devices for sale in Canada. This means that the devices have not been evaluated for safety, effectiveness or quality. Needle-free devices are also not approved by the FDA in the US for the injection of dermal fillers.

These needle-free dermal filler devices are being used in spas and are being sold directly to consumers online and through esthetician training courses.

Potential side effects include:
- Inflammatory skin reactions
- Hematomas
- Abscesses
- Skin discolouration

If used improperly, these devices may have additional risks, including:

- Bacterial and fungal infection due to contamination during filling
- Spreading transmissible diseases due to cross-contamination between users
- Damage to skin, eyes, or blood vessels due to excessive pressure or operator error

Dermal filler procedures should only be performed with Health Canada approved fillers, using needles or cannulas, in a clinical environment by appropriately trained and licensed healthcare professionals.[3] [14] [21] [22]

Complications of dermal fillers

Injection of dermal fillers into orofacial tissues is becoming increasingly popular, consequently, dermal filler complications are becoming more common. Oral health clinicians may see clients with cosmetic filler-related oral lesions, highlighting the importance of recognizing such lesions and being aware of the adverse effects of fillers. Dermal filler complications should be considered within a differential diagnosis for unusual orofacial swellings or lesions.[4] [11]

Many adverse reactions with dermal filler injections are generally temporary, but some can last several months and may require additional treatment or procedures to correct. Mild to severe reactions might occur immediately after injection (e.g., erythema, edema) or may be delayed (days to more than a year). Delayed effects may include nodules, granuloma formation, low-grade infections, and migration of filler material. These may mimic other conditions (including neoplasms) and often the client will not consider them related to fillers injected weeks, months, or years ago. [11]

Some of the procedures used to correct an adverse reaction may lead to scars and other skin reactions. Since the PMMA microspheres used in dermal fillers are intended to be permanent, the treatment of potential side effects from these injections is more difficult and surgical removal may be the only solution. [1] [23] [24]

There has been a noticeable increase in the number of clients who present to oral and maxillofacial surgery departments for treatment of post-operative complications of dermal fillers. [12]

Some common adverse reactions from dermal filler injection include:

- Pain
- Tenderness
- Bruising
- Erythema
- Swelling or edema
- Itching

[3]Report complaints involving medical devices, including the sale of unauthorized devices, to Health Canada.

[4] Refer to page 17 of these Keynotes for research articles with images of adverse dermal filler reactions.

- Migration of filler material from the injection site[5]

Less common adverse reactions include:
- Nodules or granulomas that may need to be treated with injections, oral antibiotics, or surgically removed
- Abscesses
- Infection
- Skin discolouration or hyper-pigmentation
- Allergic reaction
- Improper placement of the material
- Inflammation (e.g., edema or erythema) may develop near the dermal filler injection site following viral or bacterial infections, vaccinations, or dental procedures
- Open or draining wounds
- Sore at the injection site

Rare adverse reactions include:
- Anaphylaxis
- Leakage or rupture of the filler material at the injection site or through the skin (which may result from tissue reaction or infection)
- Formation of permanent hard nodules
- Injury to the blood supply due to unintended injection into a blood vessel, resulting in necrosis (tissue death), vision abnormalities including blindness, or stroke. Signs or symptoms associated with injection into a blood vessel include blanching of the skin, change in vision, signs of stroke, or unusual pain during or shortly after the procedure. Immediate medical attention is required if a person experiences any of these signs and symptoms.
- Death [1] [14]

Adverse reactions associated with dermal fillers use [23] [24]

Adverse reaction	Signs and symptoms	
	Immediate or early adverse reaction*	Delayed adverse reaction**
Injection site reaction+	Erythema Edema Pain, tenderness Bruising Itching	Erythema Edema Pain, tenderness Nodule, abscess Systemic responses Biofilm[6]

[5] Material migration is quite common, resulting in nodularity of the soft tissues away from the site of injection; therefore, the association is not always clear initially. Moreover, the reaction may occur months to years after filler injection, even for temporary fillers (e.g., hyaluronic acid), making it difficult to establish this relationship. [11]

[6] Many bacterial species form biofilms, and as biofilms progress, they become more antibiotic and culture resistant. Although these infections are difficult to treat, the cure is removal of the dermal filler, which is not always possible. [24]

Adverse reaction	Signs and symptoms	
	Immediate or early adverse reaction*	Delayed adverse reaction**
Infection	Erythema Edema Pain, tenderness Acne papule formation Nodule, abscess Herpes outbreak	Biofilm Herpes outbreak Foreign-body granuloma
Hypersensitivity	Erythema Edema Pain, tenderness Nonfluctuant nodules	Filler material migration
Technical and placement errors	Bumps, lumps Asymmetries Contour irregularities Compromised muscle function Dysesthesia, paresthesia, anesthesia	Immune reactions Compromised muscle function Dysesthesia, paresthesia
Skin discolouration	Redness Whiteness Hyperpigmentation	Persistent discolouration Persistent scarring
Vascular compromise	Blurred vision Vision loss Pain Blanching	Tissue necrosis

* Occurring up to several days post-treatment
** Occurring weeks to years post-treatment
+ Atypical as a delayed adverse event

Factors related to complications

Several factors determine the likelihood of dermal filler complications, such as:

- Experience, training, and techniques of the individual administering the filler.
- Awareness and understanding of facial anatomy, planes, and structures.
- Utilizing a safe, steady and aseptic technique. There is some evidence to suggest that some reactions may be due to bacterial biofilms around the gel particles. It is therefore important to ensure a sterile, aseptic technique, avoiding injections during active infections and thorough cleaning of the skin before injection.
- Type of filler used. For example, temporary filler materials such as hyaluronic acid has a minimal foreign-body response, with a lower chance of significant adverse effects. Permanent fillers such as PMMA are more likely to elicit a long lasting and strong foreign-body reaction. [11]

Using a combination of filler types does not appear to increase the risk of an adverse reaction, although there is a greater likelihood of a stronger immune reaction.

Complication prevention

To help prevent complications, the clinician administering the dermal filler should conduct a careful client evaluation before providing any injectable cosmetic procedure.

Recent medical problems or existing and chronic conditions, allergies (e.g., hypersensitivity to dermal fillers, gram-positive bacterial protein, lidocaine or amide-type local anesthetics), and mental well-being (e.g., body dysmorphic disorder) should be screened. Individuals are not always forthcoming with their medical and cosmetic history, which can affect diagnosis and management of reactions. [23]

Risk factors that may increase risk of infection include:

- History of prior complications with soft tissue fillers
- Multiple prior filler treatments
- Poor personal hygiene
- Poor oral hygiene
- Immunocompromised state
- Chronic or recurrent skin conditions
- Current herpes labialis
- Uncontrolled diabetes
- History of previous surgery or permanent dermal fillers in the target area [23] [25]

Body dysmorphic disorder

A high proportion of individuals with body dysmorphic disorder (BDD) undergo cosmetic procedures in an attempt to 'fix' perceived defect(s) in their physical appearance. Clinicians administering dermal fillers should be aware of BDD symptoms. BDD is a mental health condition characterized by an excessive preoccupation with perceived flaws in appearance, such as flaws that appear minor or cannot be seen by others. Individuals demonstrating signs of BDD warrant referral for appropriate mental health evaluation and counselling. Insufficient familiarity with BDD can lead to unnecessary procedures on individuals whose dissatisfaction with their appearance is primarily psychological. [23] [26]

Signs and symptoms of BDD

Signs and symptoms of body dysmorphic disorder include:

- Extreme preoccupation with a perceived flaw in appearance.
- Attempting to hide perceived flaws with styling, makeup, clothing, hair, sunglasses.
- Comparing the disliked features to those of other people.
- Repeatedly checking the perceived defects in mirrors and other reflecting surfaces (e.g., windows, cell phone), or avoiding mirrors altogether.
- Repeatedly applying makeup, styling or combing hair, plucking hair, or shaving.
- Frequently asking others how they look or if they look okay. Alternatively, some repeatedly insist they look ugly or abnormal.
- Compulsively picking one's skin to try to make it look better.
- Frequently changing clothes to try to hide disliked body areas or to find a more flattering outfit.
- Excessively tanning to darken skin that is considered too pale or for other reasons (e.g., to try to minimize perceived acne).
- Excessively shopping for makeup, skin products, other products, or clothes to try to improve the appearance of the disliked body areas.

- Seeking cosmetic surgery, dermatologic treatment, or other cosmetic procedures with little satisfaction.
- Excessive selfies.
- Avoiding social situations. [27] [28] [29]

Post-treatment care

Post-treatment care to help minimize complications post-injection may include:

- Waiting at least 2 weeks before undergoing dental work, invasive diagnostic procedures, and surgical procedures, as the risk of bacterial contamination is highest during this period.
- Avoiding touching the treated area to prevent the introduction of bacteria.
- Refraining from applying make-up and avoid exposure of the wound to tap water following injection. The recommended time to wait before applying make-up varies from 5 minutes to 24 hours, but individuals should ideally use clean, unopened make-up where possible.
- Avoiding intensive physical exercise, sunbathing, saunas, tanning beds, facial massage, laser treatment, radiofrequency, and ultrasound facial therapy. [30] [31]

Dental radiography

Many of the filler materials used for facial rejuvenation have different radiographic presentations, which can present a dilemma when discovered incidentally by oral health clinicians. In some cases, differential diagnoses can lead to unnecessary investigations. This is especially true as some clients are reluctant to disclose a history of receiving cosmetic dermal filler treatment. [32]

A systematic review by Alsufyani et al. (2022) of radiographic features of facial cosmetic materials reported the most common material was calcium hydroxylapatite (CaHa), found incidentally. The materials were generally located within the upper cheek and zygoma, radiographically well-defined, and had no effects on the surrounding structures. The radiopacity of CaHa, which is a feature unique to CaHa compared to other cosmetic materials in the face, causes its frequent incidental finding on radiographic images (e.g., panoramic radiographs and dental cone-beam computed tomography [CBCT]). [32]

RCDSO

In May 2013, the Royal College of Dental Surgeons of Ontario Council (RCDSO) approved dermal filler and botulinum toxin injections by dentists intraorally for therapeutic or cosmetic purposes, or botulinum toxin extra-orally for therapeutic purposes, but only for procedures that are within the scope of practice of dentistry, and as long as they are trained and competent to perform the procedures. RCDSO states dentists are not authorized to inject dermal fillers or botulinum toxin extra-orally for cosmetic purposes as this is not within the scope of practice of dentistry.

Educational requirements for dentists who wish to use these substances include didactic and clinical components, and formal evaluation. The course should be

conducted by individuals with recognized education and training (preferably university-based) and considerable experience in parenteral administration[7] of these substances.

The didactic component should include:
- Pharmacology and physiological activity of these substances,
- Diagnosis of relevant conditions,
- Indications for use and other first-line treatment modalities,
- Contraindications for use,
- Related head and neck anatomy,
- Adverse reactions and their management, and
- Promote the critical evaluation of research and literature on related topics.

The clinical component should include:
- Hands-on, or
- Clinical simulation. [33] [34]

Applications in dentistry

Dermal filler use in dentistry includes:
- Treatment of black triangles as dermal fillers have been used to provide immediate volume to black triangles formed due to loss or inadequate interpapillary tissue between teeth or implants. Dermal fillers can be injected into the interdental papilla to plump it and close the interdental space. Treatment outcomes usually last for eight months or longer at which point the treatment needs to be repeated.
- Enhancing lip and perioral volume to help in retention of removable prostheses.
- Management of angular cheilitis by filling the perioral tissues.
- Re-establishing lip volume for proper phonetics.
- Treatment of a gummy smile as fuller lip volume can help mask excessive gingival display. Also, increasing evidence suggests that hyaluronic acid dermal fillers can be injected into the muscle to create a mechanical obstacle to muscle action to impair muscle movement and limit excessive lip elevation. [15] [17] [19] [35] [36] [37] [38]

Take home messages
- Since dermal fillers have been injected with increasing frequency over the years, oral health clinicians should be aware of the signs and symptoms of dermal filler complications to aid in their recognition, referral, and management.
- Inquire about history of dermal filler treatment when unusual radiographic features or suspicious soft tissue lesions are found.
- Remind clients not to buy or use unauthorized needle-free dermal filler devices, or receive services at spas or from estheticians using these devices.

References

[1] Government of Canada, "Cosmetic injections," 10 November 2015. [Online]. Available: https://www.canada.ca/en/health-canada/services/medical-procedures/cosmetic-injections.html. [Accessed 18 July 2024].

[7] Parenteral drug administration is any nonoral means of administration (i.e., via injection).

[2] A. Garg and R. Rossi, Dermal Fillers for Dental Professionals, Quintessence Publishing United Kingdom, 2021.

[3] R. Machado, L. Oliveira, H. Martelli-Júnior, et al., "Adverse reactions to the injection of face and neck aesthetic filling materials: A systematic review," *Medicina Oral Patologia Oral y Cirugia Bucal,* vol. 28, no. 3, pp. e278-e284, May 2023.

[4] L. Rittié and G. Fisher, "Natural and sun-induced aging of human skin," *Cold Spring Harbor Perspectives in Medicine,* vol. 5, no. 1, pp. 1-14, January 2015.

[5] Government of Canada, "Health Canada is warning Canadians about the potential risks of using homemade sunscreens," 19 July 2024. [Online]. Available: https://recalls-rappels.canada.ca/en/alert-recall/health-canada-warning-canadians-about-potential-risks-using-homemade-sunscreens. [Accessed 19 July 2024].

[6] M. Randhawa, S. Wang, J. Leyden, et al., "Daily Use of a Facial Broad Spectrum Sunscreen Over One-Year Significantly Improves Clinical Evaluation of Photoaging," *Dermatologic Surgery,* vol. 42, no. 12, pp. 1354-1361, December 2016.

[7] A. Hullett, "The Connection Between Smoking and Wrinkles, Explained," Healthline, 16 June 2023. [Online]. Available: https://www.healthline.com/health/smoking-wrinkles. [Accessed 20 July 2024].

[8] K. Lipa, N. Zajac, W. Owczarek, et al., "Does smoking affect your skin?," *Advances in Dermatology and Allergology,* vol. 38, no. 3, pp. 371-376, June 2021.

[9] M. Iida, Y. Kito, K. Tanabe, et al., "Smoking cessation affects human platelet activation induced by collagen," *Tobacco Induced Diseases,* vol. 17, no. suppl 1, 2019.

[10] T. Yazdanparast, H. Hassanzadeh, S. Nasrollahi, et al., "Cigarettes Smoking and Skin: A Comparison Study of the Biophysical Properties of Skin in Smokers and Non-Smokers," *Tanaffos,* vol. 18, no. 2, pp. 163-168, February 2019.

[11] L. Martin, P. Hankinson and S. Khurram, "Beauty is only mucosa deep: A retrospective analysis of oral lumps and bumps caused by cosmetic fillers," *British Dental Journal,* vol. 277, pp. 281-284, 23 August 2019.

[12] T. Ahmed, S. McCarthy, A. Cartner, et al., "Background and complications of dermal fillers: the increasing use of non-surgical facial aesthetics in dental practice," *Dental Update,* vol. 49, no. 8, pp. 670-674, September 2022.

[13] Government of Canada, "Guidance Document: Preparation of Premarket Medical Device Licence and Licence Amendment Applications for Dermal Fillers," 16 January 2017. [Online]. Available: https://www.canada.ca/en/health-canada/services/drugs-health-products/medical-devices/application-information/guidance-documents/guidance-document-preparation-premarket-medical-device-licence-amendment.html. [Accessed 19 July 2024].

[14] Food and Drug Administration, "Dermal Fillers (Soft Tissue Fillers)," 7 June 2023. [Online]. Available: https://www.fda.gov/medical-devices/aesthetic-cosmetic-devices/dermal-fillers-soft-tissue-fillers. [Accessed 19 July 2024].

[15] A. Gupta, M. Senta, G. Gupta, et al., "Botox & dermal fillers: Advancing in dentistry," *IOSR Journal of Dental and Medical Sciences,* vol. 23, no. 5, pp. 25-30, May 2024.

[16] Food and Drug Administration, "FDA-Approved Dermal Fillers," 9 November 2020. [Online]. Available: https://www.fda.gov/medical-devices/aesthetic-cosmetic-devices/fda-approved-dermal-fillers. [Accessed 20 July 2024].

[17] V. Patankar, ""Botox and dermal fillers: A new beginning in dentistry"- Review of literature," *IOSR Journal of Dental and Medical Sciences,* vol. 19, no. 5, pp. 23-32, May 2020.

[18] N. Zerbinati and A. Calligaro, "Calcium hydroxylapatite treatment of human skin: Evidence of collagen turnover through picrosirius red staining and circularly polarized microscopy," *Clinical, Cosmetic and Investigational Dermatology,* vol. 11, pp. 29-35, 2018.

[19] T. Sonome, V. Soni, S. Gupta, et al., "Botox and dermal fillers in orthodontics – A review," *Journal of Pharmacy & BioAllied Sciences,* vol. 14, no. suppl 1, pp. S60-S64, July 2022.

[20] D. Ashok, Gnanashanmugam and K. Sabapaty, "Dermal fillers in orthodontics," *European Journal of Molecular & Clinical Medicine,* vol. 7, no. 4, 2020.

[21] Government of Canada, "Needle-free dermal filler devices used for cosmetic skin treatments are not authorized in Canada and may pose health risks," 13 September 2019. [Online]. Available: https://recalls-rappels.canada.ca/en/alert-recall/needle-free-dermal-filler-devices-used-cosmetic-skin-treatments-are-not-authorized. [Accessed 21 July 2024].

[22] Food and Drug Administration, "FDA In Brief: FDA Warns Public and Health Care Professionals Not to Use Needle-free Devices for Injection of Dermal Fillers," 8 October 2021. [Online]. Available: https://www.fda.gov/news-events/press-announcements/fda-brief-fda-warns-public-and-health-care-professionals-not-use-needle-free-devices-injection. [Accessed 21 July 2024].

[23] S. Samizadeh and K. De Boulle, "Complications of toxins and fillers in facial aesthetics," *Primary Dental Journal,* vol. 12, no. 3, pp. 65-72, September 2023.

[24] F. Urdiales-Gálvez, N. Delgado, V. Figueiredo, et al., "Treatment of soft tissue filler complications: Expert consensus recommendations," *Aesthetic Plastic Surgery,* vol. 42, pp. 498-510, 5 January 2018.

[25] G. Goodman, S. Liew, P. Callah and S. Hart, "Facial aesthetic injections in clinical practice: Pretreatment and posttreatment consensus recommendations to minimise adverse outcomes," *Australasian Journal of Dermatology,* vol. 61, no. 3, pp. 217-225, 22 March 2020.

[26] L. Bowyer, G. Krebs, D. Mataix-Cols, et al., "A critical review of cosmetic treatment outcomes in body dysmorphic disorder," *Body Image,* vol. 19, pp. 1-8, December 2016.

[27] K. Phillips, "Signs & Symptoms of BDD," International OCD Foundation, 2024. [Online]. Available: https://bdd.iocdf.org/professionals/signs-symptoms/. [Accessed 20 July 2024].

[28] Mayo Clinic, "Body dysmorphic disorder," 13 December 2022. [Online]. Available: https://www.mayoclinic.org/diseases-conditions/body-dysmorphic-disorder/symptoms-causes/syc-20353938. [Accessed 20 July 2024].

[29] National Health Service , "Body dysmorphic disorder (BDD)," 18 October 2023. [Online]. Available: https://www.nhs.uk/mental-health/conditions/body-dysmorphia/. [Accessed 20 July 2024].

[30] W. Baranska-Rybak, J. Lajo-Plaza, L. Walker and N. Alizadeh, "Late-onset reactions after hyaluronic acid dermal fillers: A consensus recommendation on etiology, prevention and management," *Dermatology and Therapy,* vol. 14, pp. 1767-1785, 22 June 2024.

[31] D. Jones, R. Fitzgerald, S. Cox, et al., "Preventing and Treating Adverse Events of Injectable Fillers: Evidence-Based Recommendations From the American Society for Dermatologic Surgery Multidisciplinary Task Force," *Dermatologic Surgery,* vol. 47, no. 2, pp. 214-226, February 2021.

[32] N. Alsufyani, R. Aldosary, R. Alrasheed and M. Alsufyani, "Clinical and radiographic features of facial cosmetic materials: A systematic review," *Imaging Science in Dentistry,* vol. 52, no. 2, pp. 155-164, June 2022.

[33] Royal College of Dental Surgeons of Ontario, "Council adopts a new position on the use of botulinum toxin and dermal fillers by Ontario dentists," 1 September 2013. [Online]. Available: https://www.rcdso.org/en-ca/standards-guidelines-resources/rcdso-news/articles/3442. [Accessed 19 July 2024].

[34] Royal College of Dental Surgeons of Ontario, "Education requirements for the use of botulinum toxin and dermal fillers by Ontario dentists," 1 December 2013. [Online]. Available: https://www.rcdso.org/en-ca/standards-guidelines-resources/rcdso-news/articles/1380. [Accessed 19 July 2024].

[35] J. Mercado-García, P. Rosso, M. Gonzalvez-García, et al., "Gummy smile: Mercado-Rosso classification system and dynamic restructuring with hyaluronic acid," *Aesthetic Plastic Surgery,* vol. 45, pp. 2338-2349, 21 February 2021.

[36] M. Vieira, V. Rogerio, P. Roschel, et al., "Myomodulation using hyaluronic acid fillers as an efficient and innovative treatment for gummy smile: A case report," *Journal of Oral Biology and Craniofacial Research,* vol. 12, no. 3, pp. 376-380, May-June 2022.

[37] R. Livada and J. Shiloah, "What you need to know about dermal fillers," *Dimensions of Dental Hygiene,* 24 November 2021.

[38] A. Sinha, M. Hurakadli and P. Yadav, "Botox and derma fillers: The twin-face of cosmetic dentistry," *International Journal of Contemporary Dental and Medical Reviews,* article 131214, pp. 1-4, 2015.

Client Resources

Health Canada is warning Canadians about the potential risks of using homemade sunscreens, Government of Canada, July 19, 2024
https://recalls-rappels.canada.ca/en/alert-recall/health-canada-warning-canadians-about-potential-risks-using-homemade-sunscreens

Needle-free dermal filler devices used for cosmetic skin treatments are not authorized in Canada and may pose health risks, Government of Canada, September 13, 2019 https://recalls-rappels.canada.ca/en/alert-recall/needle-free-dermal-filler-devices-used-cosmetic-skin-treatments-are-not-authorized

Report complaints involving medical devices, including the sale of unauthorized devices, to Health Canada: https://www.canada.ca/en/health-canada/services/drugs-health-products/medeffect-canada/adverse-reaction-reporting/medical-device.html

Articles with Images of Adverse Reactions

Patterns of filler-induced facial skin ischemia: A systematic review of 243 cases and introduction of the FOEM scoring system and grading scale https://journals.lww.com/plasreconsurg/fulltext/2023/04000/patterns_of_filler_induced_facial_skin_ischemia__a.15.aspx

Fillers: Contraindications, side effects and precautions https://journals.lww.com/jcas/fulltext/2010/03010/fillers__contraindications,_side_effects_and.4.aspx

Complications of toxins and fillers in facial aesthetics https://journals.sagepub.com/doi/full/10.1177/20501684231197717

Beauty is only mucosa deep: A retrospective analysis of oral lumps and bumps caused by cosmetic fillers https://link.springer.com/article/10.1038/s41415-019-0622-y

Adverse reactions associated with dermal fillers in the oral and maxillofacial region: A Venezuelan experience https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10513972/

Filler migration after facial injection—A narrative review https://www.mdpi.com/2079-9284/10/4/115

Treatment of delayed-onset inflammatory reactions to hyaluronic acid filler: An algorithmic approach https://journals.lww.com/prsgo/fulltext/2022/06000/treatment_of_delayed_onset_inflammatory_reactions.42.aspx

Case series and review on managing abscesses secondary to hyaluronic acid soft tissue fillers with recommended management guidelines https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7716733/

Additional Resources

Adverse reactions to the injection of face and neck aesthetic filling materials: A systematic review, Machado, R; Oliveira, L; Martellli-Júnior; et al. *Medicina Oral Patologia Oral y Cirugia Bucal*, Volume 28, Issue 3, December 24, 2022, p e278-e284 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10181027/

Beauty is only mucosa deep: A retrospective analysis of oral lumps and bumps caused by cosmetic fillers, Martin, L; Hankinson, P; Khurram, S. *British Dental Journal*, Volume 227, August 23, 2019, p 281-284 https://link.springer.com/article/10.1038/s41415-019-0622-y

Background and complications of dermal fillers: The increasing use of non-surgical facial aesthetics in dental practice, Ahmed, T; McCarthy, S; Cartner, A; et al. *Dental Update*, Volume 49, Issue 8, September 2022, p 670-674 https://www.dental-update.co.uk/content/oral-and-maxillofacial-surgery/background-and-complications-of-dermal-fillers-the-increasing-use-of-non-surgical-facial-aesthetics-in-dental-practice

Botox & dermal fillers: Advancing in dentistry, Gupta, A; Senta, M; Guta, G; et al. *IOSR Journal of Dental and Medical Sciences*, Volume 23, Issue 5, May 2024, p 25-30 https://www.iosrjournals.org/iosr-jdms/papers/Vol23-issue5/Ser-10/G2305102530.pdf

"Botox and dermal fillers: A new beginning in dentistry"- Review of literature https://www.iosrjournals.org/iosr-jdms/papers/Vol19-issue5/Series-12/D1905122332.pdf

Botox and dermal fillers in orthodontics – A review, Patankar, V. *IOSR Journal of Dental and Medical Sciences*, Volume 19, Issue 5, May 2022, p 23-32 https://journals.lww.com/jpbs/fulltext/2022/14001/botox_and_dermal_fillers_in_orthodontics___a.12.aspx

Dermal fillers in orthodontics, Ashok et al. *European Journal of Molecular & Clinical Medicine*, Volume 7, Issue 4, 2022, p 1626-1629 https://ejmcm.com/uploads/paper/c9fba1ef3d705081ff604f0bf449c6d2.pdf

Complications of toxins and fillers in facial aesthetics, Samizadeh S; De Boulle, K. *Primary Dental Journal*, Volume 12, Issue 3, September 4, 2023, p 65-72 https://journals.sagepub.com/doi/full/10.1177/20501684231197717

Treatment of soft tissue filler complications: Expert consensus recommendations, Urdiales-Gálvez, F; Delgado, N; Figueiredo, V; et al. *Aesthetic Plastic Surgery*, Volume 42, January 5, 2018, p 498-510 https://link.springer.com/article/10.1007/s00266-017-1063-0

Facial aesthetic injections in clinical practice: Pretreatment and posttreatment consensus recommendations to minimise adverse outcomes, Goodman, G; Liew, S; Callan, P; Hart, S. *Australasian Journal of Dermatology*, Volume 61, Issue 3, March 22, 2020, p 217-225 https://onlinelibrary.wiley.com/doi/10.1111/ajd.13273

Late-onset reactions after hyaluronic acid dermal fillers: A consensus recommendation on etiology, prevention and management, Baranska-Rybak, W; Lajo-Plaza, J; Walker, L; Alizadeh, N. *Dermatology and Therapy*, Volume 14, June 22, 2024, p 1767-1785 https://link.springer.com/article/10.1007/s13555-024-01202-3

Adverse events reported from hyaluronic acid dermal filler injections to the facial region: A systematic review and meta-analysis, Colon, J; Mirkin, S; Hardigan, P; et al. *Cureus*, Volume 15, Issue 4, April 29, 2023 https://www.cureus.com/articles/148694-adverse-events-reported-from-hyaluronic-acid-dermal-filler-injections-to-the-facial-region-a-systematic-review-and-meta-analysis#!/

Fillers: Contraindications, side effects and precautions, Lafaille, P; Benedetto, A. *Journal of Cutaneous and Aesthetic Surgery*, Volume 3, Issue 1, Jan-Apr 2010, p 16-19 https://journals.lww.com/jcas/fulltext/2010/03010/fillers__contraindications,_side_effects_and.4.aspx

Filler migration after facial injection—A narrative review, Wollina, U; Goldman, A. *Cosmetics*, Volume 10, Issue 4, August 17, 2023, p 1-14 https://www.mdpi.com/2079-9284/10/4/115

Treatment of delayed-onset inflammatory reactions to hyaluronic acid filler: An algorithmic approach, Funt, D. *Plastic and Reconstructive Surgery - Global Open*, Volume 10, Issue 6, June 2022, p 1-6 https://journals.lww.com/prsgo/fulltext/2022/06000/treatment_of_delayed_onset_inflammatory_reactions.42.aspx

The aetiopathogenesis of late inflammatory reactions (LIRs) after soft tissue filler use: A systematic review of the literature, Bachour, Y; Kadouch, J; Niessen, F. *Aesthetic Plastic Surgery*, Volume 45, April 28, 2021, p 1748-1759 https://link.springer.com/article/10.1007/s00266-021-02306-3

Clinical and radiographic features of facial cosmetic materials: A systematic review, Alsufyani, N; Aldosary, R; Alrasheed, R; Alsufyani, M. *Imaging Science in Dentistry*, Volume 52, Issue 2, June 2022, p 155-164 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9226230/

An unusual soft tissue radiopacity – radiographic appearance of a dermal filler, Valiyaparambil, J; Rengasamy, K; Mallya, S. *British Dental Journal*, Volume 207, September 12, 2009, p 211-212 https://www.nature.com/articles/sj.bdj.2009.764

Radiographic features of facial cosmetic material: Report of two cases, Alsufyani, N; Alsufyani, M. *Case Reports in Dentistry*, Volume 2021, Issue 1, p 1-5 https://onlinelibrary.wiley.com/doi/10.1155/2021/7308636

Radiographic study of dermal fillers in the facial area: A series of 3 cases, Kwon, Y; An, C; Choi, K; et al. *Imaging Science in Dentistry*, Volume 48, Issue 3, September 2018, p 227-231 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6148037/

Imaging feature of cosmetic fillers in cone-beam computed tomography and its dental consideration, Lee, C; Choi, Y; Jeon, K; et al. *Head & Face Medicine*, Volume18 Article 24, July 8, 2022, p 1-7 https://head-face-med.biomedcentral.com/articles/10.1186/s13005-022-00327-0

Gummy smile: Mercado-Rosso Classification System and dynamic restructuring with hyaluronic acid, Mercado-García, J; Rosso, P; Gonzalvez-García, M; et al. *Aesthetic Plastic Surgery*, Volume 45, February 22, 2021, p 2338-2349 https://link.springer.com/article/10.1007/s00266-021-02169-8

Myomodulation using hyaluronic acid fillers as an efficient and innovative treatment for gummy smile: A case report, Vieira, M; Rogerio, V; Roschel, P; et al. *Journal of Oral Biology and Craniofacial Research*, Volume 12, Issue 3, May-June 2022, p 376-380 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9108743/

What you need to know about dermal fillers, Livada, R; Shiloah, J. *Dimensions of Dental Hygiene*, November 24, 2021 https://dimensionsofdentalhygiene.com/article/what-you-need-know-about-dermal-fillers/

Botox and derma fillers: The twin-face of cosmetic dentistry, Sinha, A; Hurakadli, M; Yadav, P. *International Journal of Contemporary Dental and Medical Reviews*, Article 131214, 2015, p 1-4 https://core.ac.uk/download/pdf/228420981.pdf