

# **Role of Dermal Fillers in Aesthetic Dentistry**

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## **Abstract**

Dermal fillers are gel like substances which are injected beneath the skin. It is also used to soften creases and enhance facial contour. The potential promise of the role of dermal fillers in Aesthetic dentistry involves important clinic uses. Dermal fillers are an important tool in the armamentarium of an aesthetic surgeon in the management of ageing skin. A surge within the use of fillers has been witnessed thanks to increasing awareness among people, easy availability of fillers and increased enthusiasm amongst the dermatologists and plastic surgeons to use this modality. In this era of evidence-based medicine and litigations against doctors, Oral Surgeons should be vigilant about different acts of omission and commission in the use of fillers. Dermal fillers have revolutionized the sector of cosmetic dermatology, as evidenced by the presence of an outsized number of products within the market. Even though fillers have been classified as a cosmetic device and have been FDA approved only for wrinkle management, they have been used for several other aesthetic and non-aesthetic indications too. This article briefly discusses the dos and don'ts with reference to dermal fillers. The review is done to fulfill the need to evaluate prevailing awareness regarding the application of dermal fillers in dentistry. Further, the review aims to establish the differences between filler injections in a dental procedure. The review also aims to consolidate recent advances in dermal fillers and its subsequent role in cosmetic dentistry. Search engines like NCBI- pubmed, mesh, google scholar were used to review articles since the year 2000 which were consolidated and analysed. The review provided an extensive outlook regarding the popularity, extent of use, demand and its advanced administrative techniques in aesthetic dentistry.

**Keywords:** *Dermal Fillers, Aesthetic Dentistry, Fillers, Facial Enhancement.*

## **Introduction**

Dermal fillers are agents which can be injected beneath the skin in order to restore or enhance facial aesthetics<sup>1</sup>. According to a study by Al Hamdan<sup>2</sup>, it is proved to be an effective non surgical solution when

compared to invasive cosmetic surgical procedures<sup>3</sup>. Common comparison between filling agents like hyaluronic acid versus mechanism of action of botulinum toxin is always a debate in terms of efficiency<sup>4</sup>. Botulinum toxin is a purified protein which is harmless to facial muscles thereby preventing wrinkling of skin<sup>5</sup>. However, there are significant differences between botox and dermal fillers in terms of durability, composition and mode of application<sup>6</sup>.

Considered to be one of the popular facial rejuvenation treatments, which can be a cost-effective way to look younger without surgery or downtime, there are multiple options of FDA approved filler products recommended for surgical use<sup>7</sup>. Hyaluronic acid fillers are the common temporary fillers used, hence are mostly recommended for first-time filler patients<sup>8</sup>. These are

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believed to typically last for 6 to 18 months<sup>9</sup>. Injections to the lips are expected to wear out a little faster than those present in the nasolabial folds<sup>10</sup>. Certain hyaluronic acid fillers, like VOLUMA, are deciphered to last longer, but are limited to certain areas, such as the buccal region<sup>11</sup>.

Synthetic fillers tend to last much longer, since they are not readily absorbed by the body. They can be a great alternative for an indicative patient. Fat injections are expected to last indefinitely when compared to the synthetic fillers however, some of the injected fat is expected to not survive<sup>12</sup>. Initially, one could attempt to overfill the treatment area, resulting in a fuller look that will gradually settle into a more natural appearance later<sup>13</sup>. Alternatives to dermal fillers include topical lotions, microdermabrasion and chemical peels. This review aims to differentiate the role of dermal fillers and its varied applications and limitations in modern dentistry<sup>14</sup>.

## **TYPES OF DERMAL FILLERS IN AESTHETIC DENTISTRY**

### **Biodegradable fillers**

Biodegradable fillers are impermanent agents that can last for a limited time of volume augmentation, from months up to 12 months, but will eventually be metabolized by the body. Some of the quantity effect is thanks to a transient inflammatory response to skin fillers with associated edema. However, these volume effects will diminish soon after injection.<sup>3</sup> Subsequent fibroblast activation and neocollagenesis are often another two factors for volume augmentation, but they only end in partial filler engraftment into the encompassing tissue. Current biodegradable fillers stimulate neocollagenesis for more sustained aesthetic improvements and carry a coffee risk of adverse events or serious complications. Although permanent agents offer significant clinical benefits, short-term of volume effect, simple correction and sometimes reversible within the event of adverse effects make biodegradable fillers attractive to patients and plastic surgeons worldwide.

Generally, biodegradable filler spread on the market currently includes: mucopolysaccharide (HA), bovine collagen, calcium hydroxylapatite (CaHA) and injectable poly-L-lactic acid (PLLA).

### **Platelet rich plasma:**

Platelet-rich fibrin matrices derived through the collection and centrifugation of blood, is approved by the FDA as a medical device designed for the safe and rapid preparation of autologous platelet-rich plasma (PRP) for use in orthopedic surgery. For cosmetic applications, PRP is injected into the face to stimulate cell proliferation via the discharge of growth-promoting proteins<sup>3</sup>. Histological examination shows activated fibroblasts and new collagen deposition at the site of injection<sup>5</sup>. Injection is an office-based procedure used to fill scars and rhytides with only minor transient ecchymosis and edema. Additional studies are required to evaluate the efficacy and safety of platelet-rich fibrin matrices for soft-tissue augmentation<sup>15</sup>.

### **Injectable poly-l-lactic acid:**

Injectable PLLA is biocompatible, biodegradable, biostimulatory, synthetic filler that has got to be injected into the reticular dermis or subcutaneous fat. Animal studies have revealed that PLLA are ready to stimulate the proliferation of dermal fibroblasts with subsequent endogenous production of collagen. Histological studies in humans have shown gradual dissolution of the injected PLLA and dermal in-growth of type I collagen over 8 to 30 months after injection. PLLA is gradually degraded by nonenzymatic hydrolysis into water and CO<sub>2</sub> over approximately 9 to 24 months.<sup>16</sup>

Short-term adverse events, including swelling, bruising, erythema, pain, inflammation, and pruritus, are frequently, but they usually disappear in a few days. The rate of granuloma formation has been reported as high as 44%. The formation of granuloma greatly influences patient's appearance. Treatment of granulomas includes surgical excision and intralesional injection of corticosteroids. Surgical excision isn't recommended except as a final resort. The corticosteroids used to treat granulomas need to be injected repeatedly. There are also severe systemic adverse effects, which is very rare, with only one case reported as an anaphylactic reaction necessitating treatment interruption.<sup>17</sup>

### **Calcium hydroxylapatite (CaHA):**

CaHA may be a biocompatible, biodegradable, resorbable and biostimulatory filler that contains

microspheres which may stimulate the endogenous production of collagen. The product features a texture resembling native soft tissue and migration is minimal. Histopathologically, microspheres of CaHA stimulate almost no foreign body reaction and that they appear bluish in color and round or oval in shape. It is suggested that the microspheres of this implant are degraded by enzymatic breakdown instead of phagocytosis. Injectable microspheres of CaHA are successfully used for correction of lipoatrophy of HIV patients receiving antiprotease treatment and for smoothing moderate wrinkles<sup>3</sup>. When this agent is injected within the lips, it tends to induce a high incidence of nodules. Migration to a distant location from the injection site, a foreign body granulomatous reaction, seen as blue-gray microspheres in the extracellular matrix or within multinucleated giant cells has also been reported<sup>6</sup>.

#### **Poly lactone based dermal filler:**

A promising new biodegradable collagen stimulatory filler, composed of 70% aqueous carboxymethylcellulose (CMC) gel carrier and 30% synthetic polycaprolactone (PCL) microspheres has recently been introduced to the market. Its unique tuneable longevity gives the dermal filler variable durations for up to 4 years and is therefore ideal for those seeking long-lasting results.<sup>18</sup>

The PCL-based dermal filler is proved to be safe and sturdy in use in facial treatment and in hand rejuvenation during a clinical test. However, further clinically study and safety study should be introduced before it might be finally used as a bio stimulatory filler in human.<sup>18</sup>

#### **Cross linked cmc:**

Five-eight chemically cross-linked CMC is now available as skin filler for the correction of facial defects and imperfections. It was first used in the pharmaceutical industry since the 1960s as an excipient and for drug delivery. A commercially available product supported cross-linked CMC is Erelle™ (Total Action, Bioitech Italy Ltd, Rome, Italy). It consists of a non-particulate, viscoelastic, monophasic gel supported cross-linked CMC in isotonic saline. One study of CMC injection in 350 patients with 3-year follow-up revealed that CMC could effectively and durably correct nasolabial wrinkles for 9-12 months<sup>4</sup>.

#### **Autologous fat:**

Fat grafting is revolutionizing cosmetic surgery by providing methodologies to less invasively transfer adipose tissue. The initial attempts at soft-tissue augmentation revolved round the surgical use of autologous fat to reconstruct facial scars in 1893. It then were largely used for nasolabial folds injection, forehead augmentation, temporal augmentation, mid face lift. PRP and cell-assisted lipotransfer using adipose-derived stem cells have recent been developed to enhance the survival rate of fat grafting<sup>19</sup>. Adverse effects include prolonged edema and ecchymosis which can fade several days after injection. There is also a risk of necrosis and infection<sup>20</sup>.

#### **Permanent fillers**

Permanent fillers include polymethyl-methacrylate (PMMA), silicone, polyacrylamide hydrogel, polyvinylpyrrolidone-silicone suspension, polyalkylimide gel, polyvinylhydroxide microspheres suspended in polyacrylamide gel. Permanent fillers are non-resorbable and will provide long-lasting revolumization results. They could also induce fibrogenesis and collagen production, but complications like granulomas are more frequent in injection with such filler<sup>21</sup>.

#### **Paraffins:**

Paraffins were initially used for aesthetic procedures to revive facial volume and contours, but complications like granulomas and paraffinomas years after treatment have restricted their use for aesthetic treatment.<sup>22,23</sup>

#### **Silicones:**

No silicone product for soft tissue augmentation has been approved by the FDA. The major indication for FDA-approved products is detachment of the retina with removal of the fabric after reattachment. In soft tissue augmentation, removal of silicone isn't performed. The use of liquid silicon is off label. Adverse effects have also been noted after use for tissue augmentation. After illegal silicone injection, the silicone embolism syndrome has been observed with potential fatal outcome in 24% of patients. Symptoms and signs of the "silicone syndrome" include dyspnea, fever, cough, hemoptysis, pain, hypoxia, alveolar hemorrhage, and altered consciousness.<sup>24,25</sup> they need almost been

abandoned nowadays.

### **Poly methyl – methacrylate:**

PMMA is rigid, transparent and colorless, thermoplastic permanent skin filler with low cost, easy accessibility, and potential to realize lasting results. PMMA injections are related to several side effects; especially they'll cause some undesirable effects within the eyelids and periocular region.

First-generation polymerized PMMA microspheres are purified with diameter greater than 20 µm, which may produce foreign body granulomas. Complications of PMMA injection were classified as nodular masses, inflammation, allergies and skin hypopigmentation. The most affected sides were the lips (46%), followed by periocular, nasolabial folds, forehead, and cheeks. PMMA injection to the periocular region may lead to erythema, hardening of the local tissues, edema, and formation of nodules and eyelid malposition, which are associated with fibrotic nodules, giant cell inflammation<sup>26</sup>.

### **Polyacrylamide gel (aquamid):**

Aquamid has been used extensively for soft tissue augmentation and body contouring for two decades. Aquamid may be a biocompatible and nonabsorbable hydrogel consisting of 97.5% water and a couple of 5% cross-linked polyacrylamide (PAAG). The gel is manufactured through polymerization of the acrylamide monomers and N, N'-methylenebisacrylamide. Aquamid is currently approved in several countries in Europe, European Conformity marked in Europe in 2001 for facial augmentation and minor body contouring,

After injection, the implant is encapsulated and surrounded by fibroblasts and microphages, theoretically preventing migration. Many studies have supported the usage of Aquamid for the treatment of varied rhytides, facial contouring, and correction of HIV lipoatrophy.

For the past decade, Aquamid has gained popularity as injectable filler. Similar to other facial fillers, there are reported cases of inflammation, nodule and granuloma formation, and delayed hypersensitivity reactions.<sup>27</sup>

### **Polyvinylpyrrolidone - silicone suspension :**

This is a permanent filler comprised of particles of

polymerized silicone elastomer, 100-600 µm in size, dispersed during a carrier of polyvinylpyrrolidone .The suspension has been mostly used for lip augmentation and therefore the correction of facial rhytids. It should be injected in the subcutaneous tissue<sup>21</sup>.

Polyvinylhydroxide microspheres suspended in polyacrylamide gel:

This is a permanent filler composed of co of a suspension of 6 polyvinyl hydroxide microspheres suspended in 2.5% polyacrylamide gel and has been used mostly for lip augmentation .<sup>28</sup>

## **APPLICATION OF DERMAL FILLERS IN AESTHETIC DENTISTRY**

### **Enhancement of micro aesthetics**

Therapeutically dermal fillers could be administered during the treatment of angular cheilitis<sup>29</sup>It can be further used during volumerisation of interdental papilla loss (black triangles)and others<sup>30</sup> Dermal fillers is known for its long history of use in facial aesthetics <sup>30</sup> At present, temporary options vary from hyaluronic acid,calcium hydroxyapatite ,polylactic acid and PMMA <sup>31</sup>

Hyaluronic acid is considered to be one of the extensively used dermal fillers. It's primary application involves subperiosteal augmentation . It is done to aesthetically enhance esthetics.<sup>1</sup>It involves specific triangular spaces below the tooth contact <sup>2</sup>According to the study done by Abdul Jabbar MH et al, 2011<sup>1</sup>. Hyaluronic acid is considered to be the chief requirement in the overlay technique procedures. <sup>3</sup>

### **Enhancement of macro esthetic profile**

Enhancement of macro esthetic profile is highly influenced by the type of dermal fillers used. Dermal fillers can be primarily employed for facial soft tissue augmentation as mentioned earlier. <sup>4</sup>This can be correlated to the role of implants in micro aesthetics. <sup>5</sup>The procedures can be coupled with intra oral procedures to provide especially during the fabrication of prosthesis.<sup>6</sup>result in outstanding patient outcomes. <sup>31</sup>

Dermal fillers can be used to support the maxillary corners to partially edentulous patients especially in the cases of missing canines<sup>14</sup>. Lip augmentation involves support provision to lips ,shortening of lip length ,repose

and appearance of fuller maxillary lip<sup>32</sup>. It can also be incorporated in typical dental procedures in edentulous patients which can be extended to dentate as well<sup>19</sup>.

### RECENT ADVANCES IN DERMAL FILLERS IN AESTHETIC DENTISTRY

Ideal advance training methods along with experience and maintenance of the same proves extraordinary clinical results in clinical dentistry<sup>33</sup> Further, safety during the use of dermal fillers can be constantly monitored by maintenance of long track record which will result in outstanding patient outcomes

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As mentioned earlier, **Hyaluronic acid** is a naturally occurring substance which is a predominant component of human skin.<sup>12</sup> It helps keep skin plump and hydrated. HA fillers are typically soft and gel-like. The results are temporary, lasting 6 to 12 months or longer before the body gradually and naturally absorbs the particles. Most HA fillers are infused with lidocaine to help minimize discomfort during and after treatment.<sup>34</sup> **FDA approved HA fillers include:**

- Juvéderm products: Juvéderm XC, VOLUMA, VOLBELLA, VOLLURE
- Restylane products: Restylane, Restylane Silk, Restylane Lyft, Restylane Refyne, and Restylane Defyne
- Belotero Balance<sup>35</sup>

**Calcium hydroxylapatite** is a naturally occurring substance, which is a primary component of our bones.<sup>36</sup> When used in a filler, the calcium particles are nearly microscopic and suspended in a smooth gel.<sup>36</sup> The consistency of a CaHA filler is typically thicker than that of a hyaluronic acid filler and typically last longer as well, about 12 months for most patients.<sup>37</sup> Calcium hydroxylapatite is also reported to help stimulate natural collagen production, and it is typically used for deeper lines and wrinkles. **FDA approved CaHA fillers include Radiesse.**<sup>38</sup>

**Poly-L-lactic acid** is a biocompatible, biodegradable synthetic substance. It has been used for many years in medical devices, such as dissolvable stitches.<sup>39</sup> Poly-L-lactic acid products are technically classified as

“collagen stimulators,”<sup>40</sup> as their main mechanism to smooth fine lines is by helping your skin rebuild natural collagen—the filler gel itself dissipates a few days after treatment. Poly-L-lactic acid is typically used to treat deep facial wrinkles, and results can last more than 2 years.<sup>41 42</sup> **FDA approved Poly-L-lactic acid fillers include Sculptra Aesthetic.**<sup>38</sup>

**Polymethylmethacrylate (PMMA)** is a synthetic, biocompatible substance that has been used in medicine for much of the last century.<sup>43</sup> In dermal fillers, PMMA takes the form of a “microsphere” or tiny ball, that remains beneath the skin indefinitely to provide continued support.<sup>44</sup> PMMA fillers will also contain collagen, a naturally occurring substance in the skin that provides structure and firmness.<sup>45</sup> **FDA approved PMMA fillers include Bellafill (formerly known as Artefill).**<sup>46</sup>

### COMPLICATIONS AND CONTRAINDICATIONS

Various patient related, skin related and systematic factors create a major impact during the administration of dermal fillers<sup>38</sup>. Hence contraindications should be known and instructions of use for the chosen filler is an essential criteria which is to be strictly adhered to.<sup>47 48</sup> Patients with multiple allergies and a history of anaphylaxis are advised not to be treated without prior care.<sup>49</sup> Moreover, prospective patients having abnormally thin skin, skin atrophy due to administration of corticosteroids or also due to long term topical/ peroral steroid use are commonly advised not to undergo such treatments.<sup>50</sup>

Conditions like anetoderma, vermiculate atrophoderma, rheumatoid arthritis associated with skin thinning in the dorsum of the hand are contraindicated for superficial or medium depth placement fillers. One of the previous studies<sup>51</sup>, suggests that candidates with very eyelids, cheeks and many fine wrinkles are also contraindicated for fillers.<sup>52</sup>

### STRATEGIES TO DEAL WITH COMPLICATIONS

Numerous complications can be prevented during intraoral treatment by exacerbating the infections adjacent to the region to be treated.<sup>53</sup> Otherwise, which might result in complications due to the

presence of pathogenic substance/ organism at the site of administration. <sup>51</sup>If a patient is suffering from an ongoing skin infection located close to site of filler administered, then it is required not to treat the patient till the subsidence of the ongoing infection.<sup>7</sup> Various such conditions include viral infections like HSV, perioral human papillomavirus, mollusca contagens, bacterial infections- streptococci<sup>28</sup>, yeast infections - extensive pityrosporum folliculitis. Physicians are suggested to make a convincing judgement based on the proximity to the treatment area. <sup>48</sup>

### Conclusion

Consolidated concepts from major aspects of dermal fillers and its role in aesthetic dentistry reveals efficient outcomes at dental practice. However, it is essential to administer the same with required care and precautions.

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