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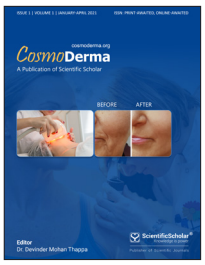

Review Article

Tackling submental fat – A review of management strategies

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ABSTRACT

The fullness in the submental region due to fat is associated with low self-esteem and negative perception of oneself. It is responsible for what is colloquially called the "Double chin." Associated with an aging neck, weight gain, or genetics, it is an area many-a-time resistant to improvement with diet and exercise. The submental-cervical angle is an important parameter to determine facial attractiveness. An obliteration of the same due to an increase in neck volume as due to skin laxity, excessive fat, loss of muscle tone, submandibular gland hypertrophy, or the skeletal framework of the mentum and jaw, leads to an unattractive profile. Tackling the submental fat due to its easy approachability is a treatment sought for by a large demographic who want to put their best, sculpted jaw forward in pictures in this "selfie-era." There are several modalities to address the excess fat in the submental area and this is a short review on the management strategies for the same. An overview of the anatomy is also presented to understand the dynamics of the structures involved.

Keywords: Submental fat, Double chin, Minimally invasive treatments, Lipolysis

INTRODUCTION

An attractive facial profile, among other parameters, includes a cervicomental angle of between a certain range. An angle outside of this range leads to unattractiveness giving a fullness to the submental region. An increase in the volume of the submental area leads to a negative self-perception of attractiveness.[1]

There are different causes other than the presence of fat that results in a more obtuse cervicomental angle, namely, laxity and loss of muscle tone due to aging, genetic factors, hormonal imbalance, retrognathia, and hypertrophic salivary glands, which obscure the mandibular outline.

Different studies show a range from 90° to 120°of cervicomental (also known as submental-cervical) angles which are considered ideal. In a study conducted by Naini *et al.*, it was concluded that a submental-cervical angle of 90–105° was considered acceptable, but those beyond 105° up to 120° and beyond 120° were considered unattractive and very unattractive, respectively.[2] Having an angle of 90° is considered to be an extreme of the normal variation. Beyond 120° the angle was considered to give the neck a visual appearance of a "double-chin."[3]

ANATOMY

1. The submental triangle [Figure 1] is an unpaired triangle in the anterior triangle of the neck. It is bound by the chin at its apex, the hyoid bone at its base, and the anterior bellies of the digastric muscles as its lateral borders. The floor is formed by the mylohyoid muscle
2. The submental artery, a branch of the facial artery runs between the mylohyoid muscle and the mandible, is the arterial supply to the region
3. The contents of the triangle are the submental glands, the mylohyoid nerve that runs parallel to the submental vessels, the submental veins that join to form the anterior jugular vein, the submental artery, and pre- and post-platysmal fat
4. A dissection of 20 cadavers showed the mean weight of the pre- and post-platysmal fat to be 8.4 g and 3.7 g, respectively. In 15% of them, the post-platysmal fat that lies above the mylohyoid muscle and deep to the platysma was >50%.[4]

Only the pre-platysmal fat can be addressed with non-surgical modalities.

MANAGEMENT

Both non-invasive and invasive treatment options are used to treat submental fat (SMF).

Non-surgical

Injectable deoxycholic acid (DCA)

DCA is a by-product of intestinal bacteria acting on the primary bile acids discharged by the liver.[5] However, DCA is also a surfactant which can alter the integrity of the cell membrane and ultimately break it down.[5,6] When it is injected in optimal dosage, DCA can be cytotoxic and dissolve the cell completely. Subcutaneous injection causes localized adipolysis and tissue necrosis. After cell disintegration, there is macrophage recruitment which clear any cellular fragments and fibroblasts following which neocollagenesis is stimulated.[7]

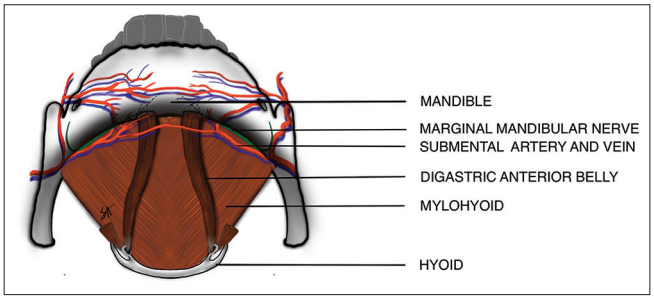

Figure 1: Submental triangle anatomy.

DCA is available as sodium deoxycholate and is currently the only United States Food and Drug Administration (USFDA) approved treatment for moderate submental adipose tissue.[8]

Several studies have been conducted to measure the efficacy of DCA. Refine 1 ATX-101 trial was a randomized, double blind, and placebo controlled study done on 500 patients who were either injected with DCA or Saline. The study found that over 70% of the DCA subjects and 18.6% of placebo subjects found a ≥1-grade composite response, whereas 13.4% of the DCA subjects and 0% of placebo subjects found a ≥2-grade composite response ($P < 0.001$ for both). A smaller cohort also underwent magnetic resonance imaging for evaluation. About 46.3% of DCA subjects of the cohort showed a response versus only 5.3% of the placebo – making the proportion more than 8 times.[9]

Side effects of DCA include injection site swelling, pain, bruising, and anesthesia lasting up to 4 days. About 4.3% of patients suffered temporary mandibular paresis lasting for a mean of 31 days which settled without complications.[9] There may be other associated complications of skin necrosis if the injections are given too superficially.

Cryolipolysis

Cryolipolysis acts by causing apoptosis of fat cells by cooling. Cryolipolysis – caused panniculitis used for fat reduction was first described by Manstein *et al.* in 2008.[10,11] No immediate changes are seen on contact with the cool temperature. However, within 3 days, the inflammatory process begins due to apoptosis of fat cells. Within the next 2–4 weeks, phagocytosis of the lipids takes place by macrophages and other phagocytes.[10,12] No changes have been observed in lipid profile.

In a study conducted by Suh *et al.*, cryolipolysis showed a reduction in SMF in nine out of ten subjects with a mean reduction of 4 mm (range 0–13 mm) as measured by caliper. High-resolution ultrasound also showed a reduction in the subcutaneous fatty layer.[13]

Another study by Kilmer *et al.*[14] used a prototype small volume applicator on 60 patients. Results were measured by blinded reviewers as well as by ultrasound. After one or two treatments, 6 weeks apart, 83% of the subjects reported satisfaction with this treatment. A study involving 464 subjects who had undergone cryolipolysis also experienced an improvement in skin texture and laxity post-procedure.[15]

Side effects typically seen are swelling, anesthesia, bruising, and erythema. Paradoxical adipose hyperplasia has been reported as a rare event.[16]

Radiofrequency (RF)

RF makes use of alternating electrical current to increase intermolecular motion and thereby collisions.

The resistance of the tissues is used to create thermal energy which is not transferred. Both monopolar and bipolar devices can be used. Bipolar RF devices can cause controlled localized heating of dermal tissue, sparing the epidermis.[17,18] On exposure to heat, the structure of collagen unravels and shortens resulting in tighter, compacter collagen. There is also stimulation of neocollagenesis.[19,20] Chawvavanich *et al*. treated 22 patients with submental laxity with RF every 2 weeks. Progress was recorded with three-dimensional photographs. All patients showed a statistically significant decrease in fat volume by 6th month of treatment.[21]

Inappropriate power and depth or inadequate number of sessions used may lead to unsatisfactory results.

Ultrasound

High-intensity-focused ultrasound is commonly used as a non-invasive method to treat SMF. Laubach *et al*. first demonstrated the effects of a prototype intense focused ultrasound device on post-mortem skin. The skin showed highly confined thermal damage in the dermis seen as thermal cell necrosis and collagen denaturation.[22] Oni *et al*. investigated the effects of a micro focused ultrasound device on the lower face of 103 adults. Ninety-three patients completed the study – out of which 65.6% of patients were satisfied with the results. Blinded reviewers assessed that 58.1% of patients showed improvement.[23] The use of ultrasound devices spares the epidermis and provides heat in the dermis. Sparing of the epidermis minimizes adverse outcomes such as bruising, pain, and blisters. Thermal damage to the dermis leads to new collagen formation and thereby, tightening of the skin.[24] Suh *et al*. obtained biopsy specimens from patients who had undergone ultrasound tightening. The specimens showed an increase in dermal thickness and collagen fibers.[25]

Ultrasound also is advantageous as it is independent of skin color and chromophores.

Inappropriate depth may lead to suboptimal results. The marginal mandibular nerve should be avoided to prevent paralysis of the lower lip muscles.

Threads

Threads help to stimulate collagen synthesis by means of a tissue-suture interaction. The thread-induced fibrosis also helps to provide a lift.[26,27] Barbed and monofilament threads are available. The "barbs" help to lift and anchor the sagging tissue. A study conducted by Wanitphakdeedecha *et al*. on 27 Thai patients using absorbable barbed threads showed that lifting effect provided by the threads was seen up to 6 months, while some patients showed the lifting effect even at the 12-month mark. Neocollagenesis was most likely initiated around the 1st month post-implantation.[26] Lifting helps in obliterating the look of the fatty neck by stretching it. Polydioxanone (PDO) threads also help with lipolysis. Monofilament PDO threads may also be used to tackle SMF by causing stretching and lipolysis.[27] Threads can be combined with other modalities to achieve optimum clinical results.

Adequate number of threads and insertion in the right plane is important to deliver the desired results.

Surgical

Liposuction or suction lipectomy is the gold standard for SMF reduction. It removes fat deposition along with improvement of the contour. The patient may be under local or general anesthesia. To perform this, an aspiration cannula is used with a small incision of 1–2 cm. Complications are usually rare; however, they can be disfiguring. Ecchymoses can lead to partial or total necrosis of the skin. If a hematoma is formed, it can cause airway obstruction. Cervical fasciitis may also occur. Scar contractures are another complication which would have to be treated by further surgical management (zetaplasty).[28]

Combination

Liposuction and laser lipolysis

The results of liposuction are usually enhanced using laser lipolysis. Laser-assisted lipolysis was approved by USFDA in 2006. Laser lipolysis helps to reduce adipose tissue and stimulate neocollagenesis leading to improvements in neck contour and rhytids. It also has a reduced recovery period. Usually, tumescent liposuction is done of SMF as it will help to eliminate large amounts of fat.[29] Badin *et al*. demonstrated that laser-induced thermal damage caused coagulation of vasculature, damage to membrane of adipocytes, and reorganization of collagen. Badin *et al*. also found laser lipolysis to be less traumatic and improved the post-procedure recovery time.[30] Both 1064 nm and 1320 nm wavelengths have been used. McBean and Katz also used 1064 and 1320 sequentially.[31]

DCA and cryolipolysis

Jalian *et al*. conducted a study with sequential treatment of cryolipolysis and DCA. Subjects underwent two sessions of cryolipolysis and one session of Kybella. About 100% of subjects showed a ≥1 grade improvement, and 71.4% showed a ≥2 grade (Clinician Rated SMF Rating Scale improvement).[32]

CONCLUSION

SMF can be tackled in various ways. This resistant-to-diet and exercise area when treated, gives the face its lost attractiveness and also improves self-perception. The limitation to using minimally-invasive techniques is that the post-platysmal fat is not completely addressed. Camouflaging the heavy look of the neck by stretching and lifting also helps to achieve a less-bulky look. All of the above modalities are worthy of tackling sub mental fat as reported in the literature.

Declaration of patient consent

Patient's consent not required as there are no patients in this study.

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Conflicts of interest

There are no conflicts of interest.

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