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Augmenting the Chin

Aesthetic nurse prescriber Anna Baker discusses the practical considerations for non-surgical injectable augmentation of the chin

The aesthetic appearance of the face is significantly influenced by the underlying skeletal structure. An attractive face requires balance and proportion of a number of facial features,[1] which include the nose, lips and neck in the lower face.[2] If projection of the chin or width is inadequate, the neck and jowl soft tissues may appear prematurely aged.[3] Appropriate aesthetic treatment of the chin can influence the appearance of the face and neck, whilst a number of effective approaches are acknowledged (autologous fat, chin implants and boney osteotomy of the chin).

Whilst surgical techniques are accepted and well established, the use of non-surgical dermal filler is growing in popularity with both men and women as a preferable treatment option. The assessment and analysis of the lower facial region is key to a successful non-surgical aesthetic outcome. A variety of dermal fillers and associated techniques are described within the literature, underpinned by sound anatomical studies describing the anatomy of this region, to support the clinician in achieving a safe outcome. This article will focus on the practical considerations of the use of dermal fillers, supported by a detailed exploration of the salient anatomy.

Anatomy

The anatomy of the face in relation to non-surgical aesthetic procedures is a specialist area of growing interest, owing to the unique senescent changes that manifest across all facial anatomic regions. There is a growing emergence of anatomical literature, underpinned by cadaveric findings that continue to shed new light on this developing area, profoundly influencing a clinician's awareness and understanding of injectable techniques and subsequent choice of product, and/or treatment.[4]

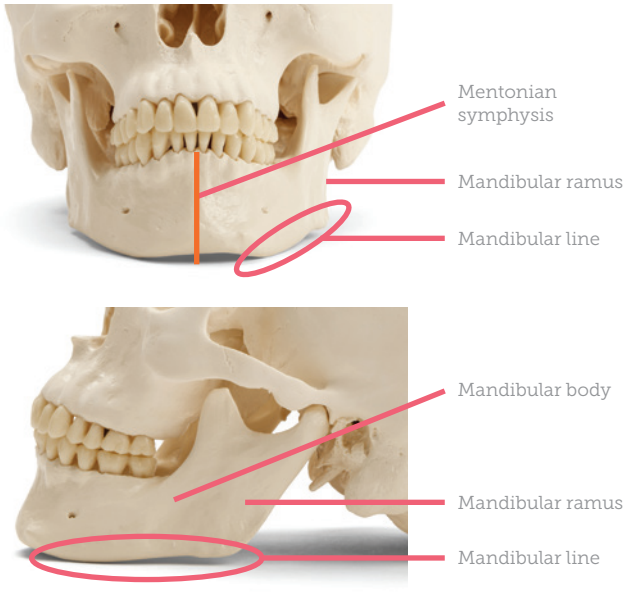

Figure 1: Anatomical features of the mandible[5]

Skeletal ageing

The facial skeletal changes are well established and clearly defined in the literature. Bone is a dynamic, sensitive and changeable tissue, with growth that takes place from birth until the hormonal influence ceases, consolidating at approximately 15-18 years of age.[6] Conversely, bone remodelling allows bone architecture to adapt to meet changing mechanical needs, and involves removal of mineralised bone by osteoclasts and formation of bone matrix through osteoblasts.[7] Shaw *et al.* described morphological findings from 120 dentulous Caucasian subjects (60 men and 60 women), demonstrating that the mandibular length and height decreased significantly in both sexes.[8] Equally, with the onset of age, the chin becomes more anterior, oblique, and shorter,[9] which is significant when analysing the face and planning appropriate treatment, as the boney foundation supports the position of overlying soft tissue. The protrusion of the chin further reduces by approximately 3-4mm by the age of 60 in males and females.[1] The most centrally projecting aspect of the chin is the pogonion,[3] whereas the menton is the most inferior component of the chin.[10]

Ligaments

The mandibular ligament is one of two major facial ligaments. It supports the facial soft tissues, develops minimal laxity between its origin and connects with the superficial musculo-aponeurotic system (SMAS),[8] demarcating the transition from the labiomandibular fold above, and jowl below.[9] The jowl develops as a result of distension of the roof of the lower premasseter space with resultant descent of the soft tissues below the body of the mandible.[11] The more pronounced the jowl appears, the more apparent the dimpling or tethering may be evident, which is the mandibular ligament. This tethering can be apparent in some individuals in a much younger age group, potentially as young as the mid-twenties,[12] owing to anatomical variation, noticeable with mimetic expression.[11,12] This is a key concept and essential to recognise as it may affect the aesthetic appearance of the chin. The dimpling and tethering effect cannot be effaced with dermal fillers or botulinum toxin (BoNT-A) and may only be corrected surgically.[13]

Fat compartments

Gierloff *et al.* describes findings of distinct subcutaneous fat compartments in the mentolabial region, extrapolated from their small cohort cadaveric study, which included nine[9] unembalmed specimens (five female, four male) between 72 and 89 years.[13] A single layer of fat was identified in the region of the labiomandibular fold, with the labiomandibular crease lying between the labiomandibular fold compartment and the jowl fat.[13] Furthermore, the labiomandibular fat pad (medial to the marionette line) undergoes a loss of volume along the lateral edge (parallel to the marionette fold), which can further emphasise the line.[14] The medial edge of the depressor anguli oris (DAO) muscle follows the course of the crease, which can be used as a landmark to identify the lateral border of the chin for augmentation.[13] In addition, two distinct fat compartments were also identified in the mental region from this study. The superficial chin fat was located; this reaches superiorly, almost to the mentolabial sulcus and is delineated laterally by the labiomandibular fat and inferiorly by the superficial portion of the submentalis fat, which was the second fat compartment found. The submentalis fat consists of a superficial and a deep

portion. The deep portion is located along the supraperiosteum and is covered by the mentalis muscle. Topographically, it can be located underneath the mentolabial sulcus, and the superficial, inferior portion of this fat compartment is located immediately under the skin, and accentuates the shape of the mentum.[15]

Facial muscles-mentum

The mental and perioral area is composed of a number of muscles, which closely interdigitate with each other.[4] These are described below.

Orbicularis oris

The orbicularis oris muscle has a distinctly different morphology to orbicularis oculi, and is much more than a sphincter, consisting of numerous muscle fibres surrounding the mouth.[4] It is described in the literature as having two parts, a lower and upper part, which blend to the modiolus.[16] It consists partly of fibres derived from the buccinator muscle, and forms the deeper component of the orbicularis, with the medial fibres merging at the angle of the mouth; some of which have arisen from the maxilla, passing to the lower lip, and others from the mandible to the upper lip.[16] The most superior and most inferior fibres of the buccinator traverse across the lips, from side to side, without decussation.[17] Superficial to this musculature, is a second communication between the levator and the DAO, which cross each other at the corner of the mouth, with those from the levator passing to the lower lip and those from the depressor to the upper lip, to be inserted into the skin near the median line.[18] Additional fibres from the zygomaticus major, DAO and levator labii superioris blend with the transverse fibres previously described, travelling in an oblique direction.[18] The orbicularis oris closes and projects the lips and is innervated by buccal branches from the facial nerve.[14]

Depressor anguli oris

The depressor anguli oris arises from the inferior border of the mandible where its fibres converge superiorly, inserting into the corner of the mouth.[16] It is a large, triangular shaped muscle, which is responsible for pulling the corners of the mouth downwards on contraction and is innervated by the mandibular branch of the facial nerve. At its origin, it fuses with the platysma, and at its insertion with the orbicularis oris and risorius muscle.[19]

Depressor labii inferioris

The depressor labii inferioris (DLI) muscle originates from the line of the mandible, superiorly to blend with the lower lip and helps to depress the lower lip when contracted. The muscle is innervated by the mandibular branch of the facial nerve.[16]

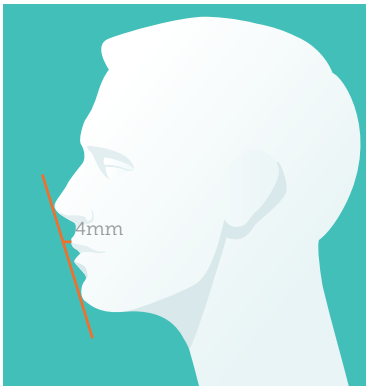

Figure 2: Ricketts' E-pass line. It should be at least 4mm from the upper lip and at 2mm from the lower lip.[23]

Mentalis

The fibres of the mentalis muscle traverse vertically from the superior deep origin in the mandible to the inferior superficial cutaneous insertion in the medial aspect of the chin.[4] The muscle fibres are orientated medially and inferiorly, creating a V-shaped triangle which contains deep fat in its medial portion and connects laterally with the DLI.[18] The mentalis muscle raises and protrudes the lower lip, and causes adherence of the skin to the subcutaneous tissue, which can create a dimpling effect on the skin of the chin. The dimpled appearance of the chin, which is due to the hypercontraction of the mentalis muscle,[9] is often accentuated with age, in part due to the boney changes which show the mentolabial crease becoming pronounced, as the area of attachment for the mentalis reduces. This causes the mentalis to contract giving a dimpled appearance to skin attachments.[13]

Vasculature

Whilst the practitioner is wise to be anatomically aware of the plane and distribution patterns of the labial arteries when treating the lips, the inferior branch of these arteries is important when augmenting the chin. Cotofana *et al.* noted that the inferior labial artery, in general, runs inferior to the vermillion border of the lower lip,[20] which is an important consideration when assessing points of chin augmentation to avoid unnecessary trauma to the labial vasculature.[9] Equally, the mental artery, a terminal branch of the inferior alveolar artery which arises from the first part of the maxillary artery, emerges from the mental foramen to supply the chin region.[21] In addition, the mental nerve, a sensory branch of the third division of the trigeminal nerve, exits the mandible through the mental foramen which can be located approximately inferior to the first premolar tooth.[1]

Facial analysis

Physical examination of the chin should include clinical assessment and tactile inspection of the chin, lips, nose and teeth.[1] The face should be assessed when animated and at rest to closely examine the level of activity evident from the mentalis muscle, and surrounding soft tissue support.[11] The chin should be observed and accurately photographed in all dimensions; anteroposterior, superoinferior, transversely, and obliquely, to allow analysis of the contour and projection of the chin as it relates to the lips, nose, marionette region and soft tissues of the neck.[1] The mandible may be small or positioned more posteriorly (retrognathia), or the chin itself may be small (microgenia), in the vertical or horizontal dimension.[11] In addition, the lower aspect of the face must be analysed with regard to a retropositioned chin and to rule out mandibular dimorphism, such as micrognathia (vertical and horizontal mandibular hypoplasia), as well as retrognathia (retracted mandible relative to the maxilla), that can be associated with dental occlusion abnormalities, most commonly Angle class II dental malocclusion.[22] Such cases may potentially require orthognathic surgery.[20]

A number of chin analysis techniques are described in the literature.[22] There is one method that can be used to assess the vertical height of the chin and it determines the ratio between the distances from the subnasal point, upper lip and the chin to lower lip. This ratio should be 1:2.[23] The position of the lips in relation to the nose and chin was described by Ricketts through the E-pass line, which is traced through the highest point of the nasal tip, to the most prominent portion of the chin.[23] The E-pass line should be at least 4mm from the upper lip and at 2mm from the lower lip.[23]

Retrusion of the chin is a condition that is commonly encountered in patients requesting rhinoplasty, many of which may be unaware of their microgenia as many individuals view themselves directly in the mirror, rather than obliquely or laterally.[24] In individuals with deficient projection of the chin, the nose may appear to overly project, despite appropriate nasal proportion to the face.[24]

In addition, Anston and Smith propose that individuals may generally

manifest a weakness on the left side of the chin, compared to the right.[24] The authors suggest possible explanations for this phenomenon can include either genetic transmission, or human masticatory patterns as individuals tend to preferentially chew on the right side of their mouths, irrespective of whether they are right or left handed.[24] This could trigger hypertrophy of the right masticatory components, including the mandible.[24] The literature is consistent in recommending that to obtain a detailed history of past trauma, orthodontic treatment, temporomandibular joint dysfunction, or prior facial or oral surgery, as patients with underlying skeletal abnormalities may require initial orthodontal treatment.[11]

Technical considerations

Chin projection and shape are generally regarded as key characteristics of facial attractiveness, particularly in men.[25] Conversely, when analysing female attractiveness, it is commonly reported that a small or narrow chin may be associated with a more feminine appearance,[1] yet, studies demonstrate varying ethnic preferences continue to emerge.[5,16] In an Asian population, Liew considers to combine treatment of the chin using dermal filler with the use of BoNT-A on the bulk of the masseter to reduce the width of the lower face. This can facilitate the transition from a short and square face to an oval face, which is usually desired in this population.[5] Equally, Braz *et al*. describes the use of hyaluronic acid dermal filler to the prejowl sulcus with BoNT-A to the depressor anguli muscle, the depressor inferioris labii muscle and the mentalis muscle, to smooth the muscle contraction and restore the contour of the prejowl region with the use of dermal filler.[16]

The skin of the chin is considered thick, measuring between 2,000-2,500µm in most adults,[1] which is an important consideration when using a cannula or needle to ensure correct depth placement of injectate. Both 27 gauge needle and 25 gauge cannula for depot placement are described within the literature to achieve a 3D sculpting and shaping of the chin, for example, providing volume to the lateral aspect of the chin (adjacent to the lateral pogonoin).[26,27]

A volumising dermal filler with a high G Prime, or elasticity, which describes how the filler is able to retain its shape when a force is applied, can effectively shape and contour the chin, which may potentially require restoration to the whole zone, including the lateral oral commissure, marionette zone and prejowl sulcus.[28]

A dermal filler technique commonly employed to the chin can be made by a bolus injection, on the supraperiosteal plane, often in the medial aspect to give central projection, deep to the mentalis muscle. This aids the treatment to give deep support to the medial deep and superficial submentalis fat and is favourable in both males and females.[16,28] Equally, a superficial, linear approach may be employed to soften the appearance of a defined mental crease. Relaxation of the mentalis muscle initially with BoNT-A will improve the aesthetic outcome as a combined treatment in this indication, prior to placement of dermal filler. An effective example of this combination may be used to project the chin and reduce the depression of the mandibular line in front of the jowl. Use supraperiosteal bolus placement, with the use of cannula from the mandibular line to the commissure with a fan technique, above the muscle in the subcutaneous layer. Some literature advocates product placement within each layer of the chin to increase the lifting effect.[4,11]

The aesthetic endpoint will be established when the augmentation of the chin appears harmonious to the other anatomical regions of the face. A balanced approach is always required, which may require treatment of more than apparent volume loss of the chin itself, with BoNT-A. A useful and effective adjuvant-assessment is key, and will vary significantly between individuals.

Conclusion

Effective non-surgical augmentation of the chin requires an advanced and current awareness of the anatomy of the lower face, in conjunction with a detailed analysis of the full face to formulate the most appropriate treatment pathway. Performed correctly, the combination of BoNT-A and/or dermal filler, can create a balanced outcome that complements all aspects of the lower face and neck.

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