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Genioplasty

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The human face has enchanted mankind for a very long time. Psychological studies have shown that even as babies we are drawn to faces and that nine minutes after being born, when we can barely focus our eyes, we prefer to gaze at faces than any other object.[1] Our faces forms an integral part of our lives and each face can be considered as "custom made". All faces have two eyes, a nose, two cheeks, a mouth, two ears and a chin, and yet we all manage to somehow look extraordinary different. Our facial features have evolved in response to the environmental changes of different parts of the world and today each of the myriad faces in the word is an expression of subtle genetic mutations.

Although the chin is a prominent feature of a face, it has no clearly defined function. The need for a strong biting action gradually became redundant with the discovery of fire -- about 700,000 years ago. Cooking and tenderizing food removed the need for a large strong jaw. It seems therefore that the chin is simply a remnant of our once larger jaw.

The chin, however, forms an integral part of the total facial esthetics and any deformity of the chin will disturb the balance and harmony between the various facial components. The chin is often subconsciously associated with "character" or "personality. A retruded oval shaped chin is generally regarded as a sign associated with femininity, while a strong, square chin with masculinity.[2,3]

Genioplasty procedures are most often performed as part of the orthognathic surgical correction of dentofacial deformities and the clinical and radiographic evaluation of the chin should therefore form part of the total orthognathic assessment of the patient. For the purpose of this paper the text will concentrate only on the evaluation of the chin, its relation to other facial structures in a "normal" position and the esthetic changes that can be affected by surgery.

Clinical evaluation of the chin

The face should always be evaluated with the teeth in occlusion and the lips in repose.*Frontal analysis (Fig 1)*

The shape, form and size of the chin should be in harmony with the particular facial type and gender of the patient. The mandible should have a well-defined smooth inferior border, from angle to chin, with a definite separation of the lower third of the face from the neck.

Transverse dimensions: Individuals with leptoprosopic (narrow and long) facial features also often have transversely deficient, "pointed" chins that seems separate from the mandible while dolicoprosopic (broad and wide) faces often have strong broad chins.

Vertical dimensions: The height of the lower lip stomion (Stms) to the labiomental fold should be equal to the distance from the labiomental fold to soft tissue menton (Me'). The lower lip and chin should comprise two thirds of the lower facial height with a length of 40 ±2 for females and 44 ±2 for males measured from lower lip stomion (Stm) to soft tissue menton (Me').

Symmetry: The symmetry of the chin is evaluated in relation to both the facial as well as the dental midline of the mandible.*Profile analysis (Fig 2a)*

The main contributing factors responsible for the chin shape or contour is the anteroposterior position of the lower lip, the depth and height of the labio-mental fold, and the shape of the chin button. Harmonious combination of the above three structures in combination of the cervico-mental area, will go a long way in achieving an attractive and an esthetically pleasing chin. The head should be in natural posture when the profile is evaluated.

Labiomental fold: The labiomental fold forms an angle between the lower lip and a line tangent to the superior convexity of the chin and should be ±130. The angle is usually acute in Class II cases and obtuse in Class III cases.

Lip-chin-submental angle: This angle is formed by the lip-chin line (labrale inferius and pogonion) and submental tangent and should be ±126 degrees for males and ±121 degrees for females. The angle is obtuse in deficient chins and acute in anteroposterior excessive chins. Lower lip procumbence, excessive submental fat and increased submental bulk will increase the lip-chin-submental angle.

Chin-neck length: This measurement is made from the submental neck point to soft tissue menton (Me) and should be 42 ±4. In general this measurement will be increased in Class III cases and decreased in Class II cases.

Chin throat angle (cevico-mental angle): The chin-neck angle is formed by a submental tangent and a neck tangent (126 degrees in males and 121 degrees in females). Individuals with microgenia or mandibular deficiency will have an obtuse angle while individuals with macrogenia or mandibular excess will have an acute angle.

Radiographic evaluation

i) Lateral cephalometric analysis (Fig 2b)

Analysis of the lateral cephalometric radiograph is essentially designed to measure relationships between various hard and soft tissue structures of the craniofacial complex. It is a helpful guide for diagnosis and treatment planning, predicting treatment results and to assess soft tissue and hard tissue changes resulting from treatment.

Facial contour angle: The angle of facial convexity is contained between lines drawn from G¥ to Sn (upper facial plane - UFP) and a line connecting Pogonion (Pog) and Sn (lower facial plane - LFP). The mean angle for females is -12 to -14 degrees and for males -11 to -13 degrees.

Facial angle: This angle is formed by the Frankfort horizontal plane and a line drawn from Nasale and Pogonion (mean 82 to 95 degrees).

E-line: The esthetic plane is drawn from the tip of the nose (Pronasale) to Pogonion (Pog). The upper lip should be 4mm behind the line, while the lower lip should be 2mm behind it. The profile behind the esthetic plane should form a reasonably symmetric Cupid's bow.

ii) Postero-anterior cephalometric analysis:

This radiograph will assist in differentiating between asymmetry of the maxilla, the mandible, the chin and the dentition. Occlusal cants and its role in causing facial asymmetry can also be identified on this radiograph.

Cephalometric planning and prediction of results

Although a genioplasty a can be performed as a single surgical procedure, the planning of a genioplasty procedure is often done in conjunction with other orthognathic surgical procedures to optimize functional and esthetic results. The visual treatment objective is developed from the lateral cephalometric radiograph tracing in conjunction with all the data obtained from the systematic patient evaluation to make the visual objective as accurate and realistic as possible. Soft tissue response is influenced not only by skeletal repositioning but also, surgical technique and control of soft tissue during surgery. The ratio of soft tissue changes associated with surgical advancement of the chin is 0.9 to 1.0[4] and for surgical reduction 0.6 to 1.0.[5]

The soft tissue esthetic result can be affected by varying the design of the genioplasty osteotomy. By varying the height of the osteotomy the shape and position of the chin prominence can be varied while by changing the angle of the osteotomy the height of the chin and the depth of the labiomental fold can be controlled (Fig 3 & 4).

Surgical technique (fig 5)

The genioplasty osteotomy is performed through an intra oral incision placed in the lower labial sulcus and extending from canine to canine. The bone in the mental area of the mandible is exposed by subperiosteal dissection and reference marks are then placed on the bone in the midline and approximately 10mm lateral to the midline. The osteotomy is performed using an oscillating saw and is carried through both cortexes including the lower border of the mandible. Care should be taken to avoid the mental nerve and the often long root apexes of the lower canine teeth. The versatility of the procedure allows the surgeon to correct chin deformities in all three dimensions. The chin prominence can be increased or reduced horizontally, the height of the chin can be increased or decreased, while a narrow pointy chin can be widened or a broad chin narrowed by changing the design of the osteotomy. Once the chin segment has been placed in the planned position it can be fixated by either tricortical bone screws or plates and screws. The mentalis muscles are then reapproximated followed by careful symmetrical suturing of the mucosa[6].

Clinical Cases

Anteroposterior chin deficiency (microgenia) (Fig 6 & 7)

Anteroposterior augmentation of the chin by sliding genioplasty is the most common operation to correct an anteroposterior deficient chin[7,8]. Treatment of mandibular anteroposterior deficiency by means of genioplasty will compromise the esthetic result. Patients with mandibular antero-posterior deficiency will often have Class II malocclusions and will require mandibular advancements. The sliding genioplasty for chin augmentation has distinct advantages above the use of alloplastic materials. Some unwanted sequelae associated with the use of alloplastic materials are: poor chin contour esthetics, resorbtion of bone and occasionally teeth under the implant, mobility to palpation, both early and late infection, non infectious inflammatory responses and unpredictable soft tissue response[9,10,11,12,13]. In figure 6 and 7 the improved esthetics in the chin and submental area is demonstrated following mandibular advancement and chin augmentation by means of genioplasty.

Anteroposterior excess (macrogenia) (fig 8)

This chin deformity is mostly caused by skeletal prominence of the symphysis, however, excessive soft tissue thickness may also lead to an unesthetic chin projection. When the chin is antero-posteriorly reduced the clinician should take care not to reduce or flatten the labiomental fold resulting in unesthetic chin shape. Keep in mind that chin shape is more important than chin position.

Vertical chin excess (fig 9)

When the lower facial height is increased the clinician should differentiate between vertical maxillary excess and vertical mandibular excess. In cases where the maxilla is vertically excessive: the interlabial gap will be increased, the upper incisor exposure under the upper lip increased and patient will often have a gummy smile. The height of the chin will be excessive when: the lower two thirds (Stm-Me) of the lower facial half (Sn-Me) exceeds the normal ratio of 1:2 = Sn-Stm: Stm-Me, while the lower half of the facial (Sn-Me) will be excessive in relation to the upper half (N-Sn < Sn-M e) (see Figures 2a and b).[14]

Vertical chin deficiency (fig 10)

Vertical deficiency of the anterior mandible will lead to a decrease in the lower facial height relative to the midface height. Vertical chin deficiency should be differentiated from vertical maxillary deficiency and deep bite cases. All three these dentofacial deformities will clinically and cephalometrically as a diminutive or "squashed" lower facial third, vertically shorter than the middle third. The lower two thirds (Stm - Me) of the lower facial height (Sn - Me) is relatively short in relation to the upper third (Sn - Stm) (see Figures 2a and b).[15]

Transverse chin deformities

There are relatively few guidelines to aid the clinician in evaluating the width of the chin. The transverse dimension of the chin should be related to the patient's bigonial and bizygomatic widths. The general shape of the head (brachicephalic and dolicocephalic) and face (europrosopic and leptoprosopic). The face may also be described as round, oval, square, narrow, tapering or a combination of the above shapes and the chin outline should be in harmony with the facial shape.

Transverse deficiency (Fig 11)

The chin may be widened in the posterior area by sectioning the chin segment in the midline and rotating the segments outward, while the anterior part of the chin may be widened by lateral repositioning of the segments and placement of a bone graft in the defect in the midline.

Transverse excess (Fig 12)

The chin can be narrowed or made more tapered by sectioning the chin segment in the midline and removing a triangular section of bone from the lingual aspect. A bone plate on the anterior surface of the segment before mobilization will allow the segment to be "bent" narrower. A very square, broad chin may be narrowed by removing a rectangular section of bone in the middle of the chin segment. The segments are then moved medially and fixated.

Chin asymmetry (fig 13)

Asymmetry of the chin is rarely an isolated entity and is most often part of mandibular asymmetry. Facial asymmetry is certainly a challenging deformity to assess and to correct as the deformity, generally, result from a truly three dimensional skeletal abnormality. The chin may be asymmetric to the dental or facial midline. Correction in this case will require a horizontal osteotomy of the chin sliding the chin to the left or right until the chin midline and facial midline match. The cant of the lower border of the chin may differ from the cant of the occlusal plane or inter-pupillary plane. Correction of the lower border cant will be influenced by the relative height of the chin and may involve unilateral vertical reduction or augmentation or a combination of the above performed on the left and right side.

Submental liposuction (fig 14)

The submental area plays an important role in the overall esthetics of the chin e.g. the lip-chin-submental angle, submental- neck angle, chin-neck length, etc16. Excessive fat add to poor chin esthetics and submental liposuction or lipectomy should be considered as an adjunct procedure to enhance chin esthetics.[17]

Conclusion

The assessment and successful treatment of chin deformities are challenging and certainly demands both, a scientific and an artistic approach. The knowledge of facial proportions, as well as the familiarity with the anatomy and physiology of the tissues in the peri-oral region enables the general dentist to identify dentofacial deformities, and specific chin deformities which will allow him or her to inform their patients regarding the diagnosis and treatment possibilities for correction. OH

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Oral Health welcomes this original article.

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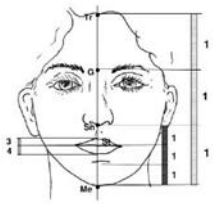

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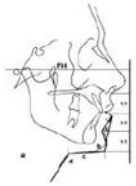
Caption: Figure 1--The face is divided into thirds: Trichion (Tr...



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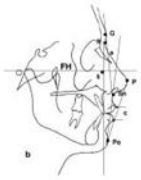
Caption: Figure 2a --a. Labio-mental fold (±130 degrees) is usua...



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Caption: Figure 2b--a. Facial contour angle is formed between th...

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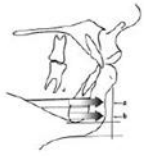
Caption: Figure 3--The horizontal osteotomy design for genioplas...



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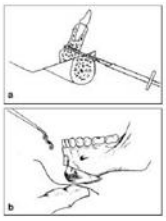
Caption: Figure 4--The height if

the labio-mental fold can be co...



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Caption: Figure 5--The chin segment may be internally fixated by...

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Caption: Figure 6--a,b

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Caption: Figure 6--. A patient with a convex profile and Class I...

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Caption: Figure 7--a,b,

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Caption: Figure 7--a. The three quarter view of a patient suffer...

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Caption: Figure 8--a,b

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Caption: Figure 8--a. Note the prominent chin button and deep la...

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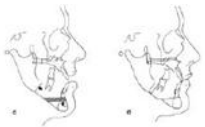
Caption: Figure 9--a,b



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Caption: Figure 9--a. The disproportionate increase of the lower...

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Caption: Figure 10--a,b

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Caption: Figure 10--a. A patient with a Class II mal occlusion, ...

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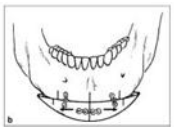
Caption: Figure 11--a,b



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Caption: Figure 11--a. The transverse chin deficiency is demonst...

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Caption: Figure 12--a,b

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Caption: Figure 12--a. The patient's mandible and chin appears l...

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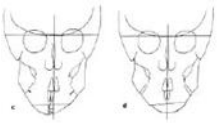
Caption: Figure 13--a,b



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Caption: Figure 13--a. By drawing a line from Glabella (G), Pron...

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Caption: Figure 14--a,b

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Caption: Figure 14--a. A patient with an anterior open bite malo...

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