

Class III Malocclusion: A Challenge in Dentofacial Orthopaedics

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Abstract: Class III malocclusion is one of the most difficult malocclusion to understand and to treat. The studies conducted to identify etiological features of class III malocclusion showed that the deformity is not restricted to jaws but involves total craniofacial complex. Class III malocclusions have strong hereditary components. Functional influences play secondary or adaptive roles. Differential diagnosis is important for proper treatment of class III malocclusion. This article reviews etiology, diagnosis, treatment plan for class III malocclusion.

Keywords: Class III malocclusion, Mandibular prognathism, camouflage.

1. Introduction

Class III malocclusion has been the subject of interest in many investigations, because of the challenges in its treatment. Angle (1899) classified the malocclusions based on occlusal relationships, considering the first permanent molar as the "key" of occlusion (1). Class III malocclusion is defined in cases that mandibular first molar is positioned mesially relative to the first molar of maxilla. A complicating factor for diagnosis and treatment of Class III malocclusion is its etiologic diversity. Its origin can be skeletal or dentoalveolar. The skeletal manifestation can be due to mandibular anterior positioning (prognathism) or growth excess (macrognathia), maxillary posterior positioning (retrognathism) or growth deficiency (micrognathia), or a combination of mandibular and maxillary discrepancies.

2. Etiology and Prevalence

A wide range of environmental factors have been suggested as contributing to the development of Class-III malocclusion. Among those are enlarged tonsil, difficulty in nasal breathing(2), congenital anatomic defects(3), disease of the pituitary gland(4), hormonal disturbances, a habit of protruding the mandible, posture, trauma(4) and disease, premature loss of the sixth-year molar(4) and irregular eruption of permanent incisors or loss of deciduous incisors. Other contributing factors such as the size and relative positions of the cranial base, maxilla and mandible, the position of the temporomandibular articulation and any

displacement of the lower jaw also affect both the sagittal and vertical relationships of the jaw and teeth. The position of the foramen magnum and spinal column and habitual head position may also influence the eventual facial pattern. The etiology of Class- III malocclusion is thus wide ranging and complex. The prevalence of Class III malocclusion has been described between 1%(5) to over 10%(6), depending on ethnic background, sex, and age of the sample as well as the diagnostic criteria used.

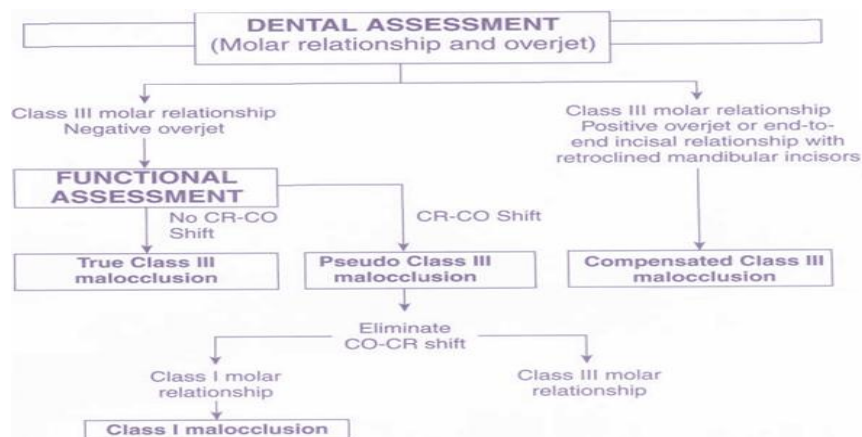
3. Features of Class III Malocclusion

Skeletal	Extra-oral clinical	Intra oral features
Short anterior cranial base	Concave profile	Class III molar relation
Short and retrusive maxilla	Prominent chin	Narrow upper arch
Protrusive mandible	Lips - competent/incompetent	Cross bite is present in anterior and posterior region
Obtuse gonial angle	Deviated path of closure	Proclined maxillary incisors
Long posterior cranial base		Retroclined mandibular incisors

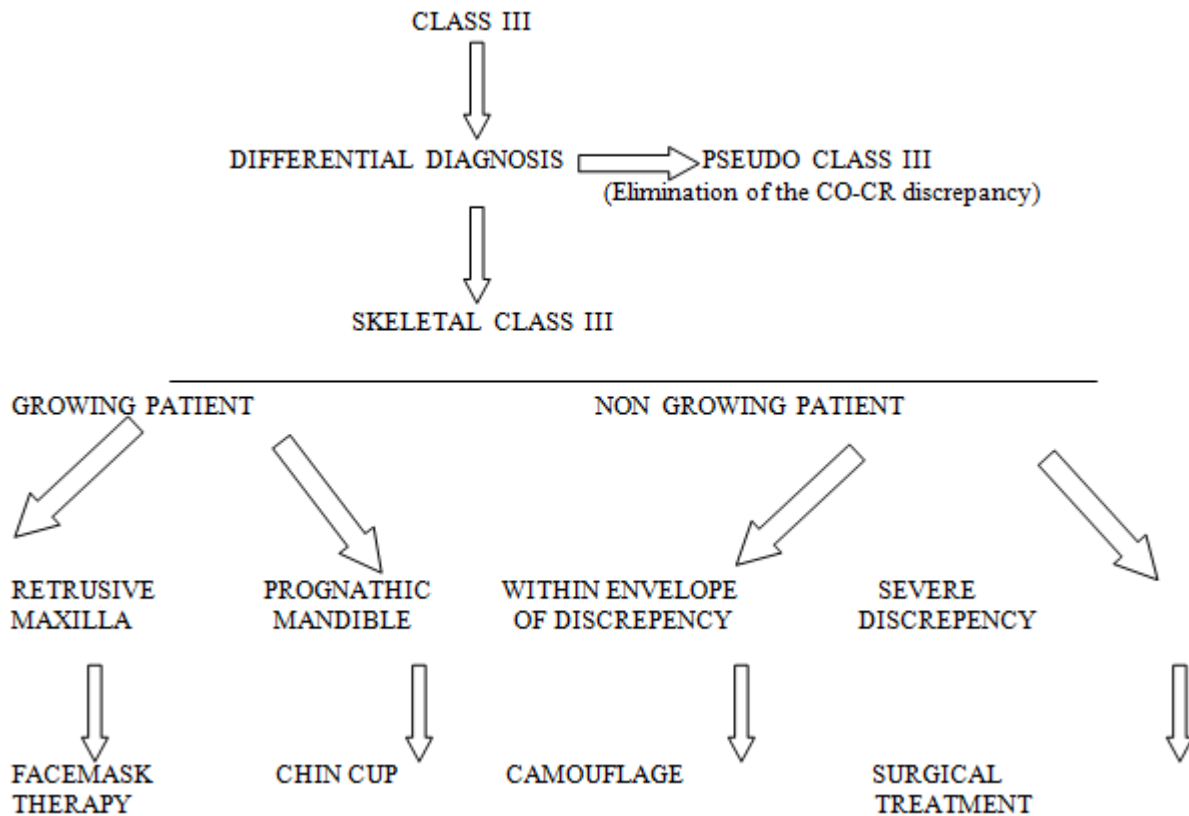
Consequences of class III malocclusion:

- 1) Incorrect loading of teeth
- 2) Disturbances in functional equilibrium
- 3) Impairment of chewing and speech functions
- 4) Difficulty of prosthetic replacement
- 5) Esthetic problems

Differential Diagnosis



Treatment Modalities



Treatment of Pseudo class III

The removable appliance with auxiliary springs can be used successfully to move one or two teeth in the mixed dentition. However, patient cooperation is required for successful treatment. The maxillary lingual arch with finger springs is recommended when patient cooperation is questionable.

Treatment of skeletal class III in Growing patients :

Growing patient with maxillary deficiency

Features :

Extraoral Examination:

- 1) Thin upper lip
- 2) Narrow alar basal width
- 3) Normal chin prominence
- 4) LAFH reduced
- 5) Incisal visibility is less
- 6) Nasal tip down
- 7) Obtuse nasolabial angle
- 8) Chin normally related to nose tip

Occlusal relationship:

- 1) Class III molar relationship
- 2) Crowding and missing upper anterior
- 3) Maxillary arch constricted

Cephalometric findings:

- 1) Reduced LAFH
- 2) Maxillary molar distal to key ridge
- 3) Reduced distance from PTV to upper 6
- 4) Normal ramus width
- 5) Normal gonial angle
- 6) IMPA normal

Protraction face mask:

The reverse pull facemask was first described in Germany more than 100 years ago by Delaire. It was modified later by Petit, by increasing the amount of force generated by appliance and decreasing the overall time. McNamara described maxillary splint bonded to posterior dentition. Petit facemask is made up of a rigid frameworks which is single rod running in the midline.

A sequence of elastic of increasing force is used, until a heavy orthopaedic force of 14 ounces is delivered to maxillary complex. Mask is worn for 14 hrs per day for 4-6 month. A positive overjet of 4-5 mm should be achieved before discontinue face mask. Overcorrection is recommended.

Retention phase – simple retention or Fr – III or chin cup

Adjuncts to face mask (Profitt 4 th edition)

The application of force to purposefully ankylosed deciduous canines has been suggested as a method of direct transmission of force to the circummaxillary sutures. The application of this technique to facemask therapy has been shown to be clinically viable, however, the anchor teeth inevitably resorb as their permanent successors erupt. This limits the time available for treatment and restricts the facemask option to a younger age group. Osseointegrated implants are an alternative method of obtaining attachment of a traction force directly to the maxilla.

Chin cup –

Chincup therapy is applicable when a growing patient has a skeletal Class III malocclusion with a large mandible; lacks maxillary recession, an acute cranial base angle, a long-face

syndrome, and symptoms of temporomandibular disorders; and orthognathic surgery is not an option.

Patient selection in growth modification in cases of mandibular excess:

- 1) A low mandibular plane angle with short or normal anterior face height.
- 2) Anterior crossbite produced at least in part by a functional shift.
- 3) Symmetric mandibular growth.
- 4) A relatively mild skeletal discrepancy.
- 5) No familial history of prognathism.

Frankel III

Frankel is indicated in mild cases of class III in the early mixed dentition and deciduous dentition. Like the other frankel appliances Frankel III is a deficiency appliance that deals with deficiency of maxillary arch. Upper labial lip pads serve to-

- 1) Eliminate restrictive pressure of upper lip on the maxilla
- 2) To exert tension on the tissue and periosteal attachments for stimulating bone growth
- 3) To transmit upper lip force to the maxilla via the lower labial arch for a retrusive stimulus. However this effect is minimal.

The labial bow rests against the mandibular incisors and makes a positive contact with them unlike the labial bows of same appliance used for treating class II. The protrusion bow of the appliance passes behind the upper incisors to stimulate slight to moderate forward movement of these teeth. The close adherence to the buccal shields and the lower labial wire to the mandibular basal bone and lower incisors give a firm grip on the mandibular dentoalveolar structures. So it is not locked to the maxilla by the cross over wires.

Construction bite is taken with keeping the vertical dimension only enough to allow maxillary incisors to move labially past the mandibular incisors and to facilitate lip closure with minimum strain.(7)

Reverse bionator-Balters

It has the following differences from the standard bionator design.

- 1) Palatal bar configuration runs forward rather posteriorly. This stimulates tongue to remain in a retracted position. It contacts the anterior palate encouraging maxillary growth.
- 2) Labial bow runs in front of lower incisors rather than upper incisors. The wire may be passive or exert light pressure.
- 3) Bite is taken in the most retruded position with 2 mm inter incisal opening.
- 4) Lower acrylic portion is extended from canine to canine

Adult Patient – Orthodontic Therapy Or Orthognathic Surgery

Eisenhaner et al (8) have step wise discriminant analysis for the various dento -skeletal variables to answer this question . This multivariate approach suits best and dento alveolar

deviations. The variables selected were WITS appraisal, SN(linear), M/M ratio, lower gonial angle.

Individual score = $-1.805 + 0.09 \times \text{WITS} + 0.044 \times \text{SN} + 5.689 \times \text{M/M ratio} - 0.056 \times \text{Go. lower}$

CRITICAL SCORE – 0.023

- $0.023 < \text{I.S} \rightarrow \text{ORTHODONTIC THERAPY}$
- $0.023 > \text{I.S} \rightarrow \text{ORTHODONTIC SURGERY}$

Camouflage treatment:

Patients with no growth remaining must be camouflaged by orthodontic tooth movement or fixed appliances. Camouflage treatment is the displacement of teeth relative to their supporting bone to compensate for an underlying jaw discrepancy. The strategy to camouflage a Class III malocclusion usually involves proclination of the maxillary incisors and retroclination of the mandibular incisors to improve the dental occlusion, but it might not correct the underlying skeletal problem or facial profile.

The problem is that most Class III patients already have some dental compensation that developed during growth. Typically, the upper incisors are at least somewhat proclined and protrusive relative to the maxilla, whereas the lower incisors are upright and retrusive relative to the chin. To correct an anterior crossbite with orthodontics alone, further protraction of the upper incisors and retraction of the lower incisors would be necessary. As upper incisors are tipped forward, their inclination becomes an esthetic problem.

But torquing the roots forward is difficult and stresses the anchorage. For all practical purposes, labial root torque to the upper incisors means that more retraction of the lower incisors is necessary. Retracting the lower incisors tends to accentuate the prominence of the chin, not camouflage it. Extraction of two lower first premolars, corrects the malocclusion, but it almost always produces an esthetically undesirable result. Extraction of mandibular second premolars is a way to reduce the amount of lower incisor retraction that would occur.

Controlling the closure of this extraction space is more difficult in adults than in younger patients. So, if the lower arch is crowded, extracting one incisor eliminates the crowding but keeps the incisors in about the same place while maxillary incisors are advanced. The fit of the teeth should be checked with a diagnostic setup before one lower incisor extraction is selected as a camouflage plan.

Mandibular incisor extraction

The results of the various studies indicate that one single mandibular incisor extraction may be a good orthodontic treatment alternative in selected adult cases with tendency toward or established mild-to-moderate Class III malocclusion with reduced overjet and overbite. The anterior occlusion was improved in all cases and the esthetic outcome was generally satisfactory, with preserved gingival papillae between the three mandibular incisors as a result of stripping when necessary. The incisor extraction decision was supported by a large intercanine width, relatively minor crowding, some mandibular anterior tooth

size excess, and normal rather than triangular incisor shape. It is emphasized that the orthodontic treatment may become relatively time consuming. Careful torque control of all mandibular teeth, particularly the canines, is required throughout the treatment period.

Jiuxiang Lin [9] studied patients with severe skeletal Class III malocclusion in the permanent dentition and concluded that.....

Successful treatment effects can be obtained with nonsurgical treatment in severe skeletal Class III malocclusion in the permanent dentition. Tip-Edge and Begg techniques allowed a larger range of tipping movement of teeth and significant but limited skeletal change. A remarkable soft tissue change was noted after the treatment, the concave facial profile changed to a straight profile

Class III elastics are often used in fixed orthodontic treatment to correct the anteroposterior relations of the occlusion. Class III elastics, however, effectively move teeth in all 3 planes of space, not just in an anteroposterior direction. Vertical extrusion is a prominent part of the tooth movement, whether or not it is desired. It is hard to apply eccentric forces and to correct midline discrepancies and an interarch relationship simultaneously with only intermaxillary elastics during conventional orthodontic treatment.

In addition to retracting the lower teeth and proclining the uppers incisors, Class III elastics elongate the lower incisors and upper molars. These vertical changes rotate the occlusal plane down posteriorly and up anteriorly. These elastics also can cause transverse changes that tend to widen the molars and roll their crowns lingually. Proclining the upper incisors and extruding the upper molars increases the facial height of the patient. Increasing the lower anterior facial height by extrusion of molars may not always be a stable situation in adult patients. In some cases, which show a long anterior facial height and shallow overbite, such reactions to Class III elastics as extrusion of upper molars and proclination of the upper dentition should be prevented or minimized.

To prevent these unwanted changes, absolute anchorage can be applied to the upper molar area to use as a hook for Class III elastics. The entire lower dentition can be distalized successfully by using an implant as a hook for elastics.

Surgical Camouflage

Reduction genioplasty

If a prominent chin is a major part of the patient's problem, reducing it surgically seems a logical option. With a lower border osteotomy, it is quite possible to slide the chin posteriorly. When the chin is moved back, the soft tissues are relaxed, and great technical skill is needed to keep from producing wrinkles and a general flaccidity of the soft tissues. Because the esthetic result is unpredictable, it is less likely to be useful as the sole treatment procedure for Class III patients.

Onlay grafts:

Onlay grafts in the paranasal, alar base, and/or zygomatic areas. This is the more practical approach. Onlay grafts can be isolated procedures but are more likely to be used in conjunction with orthognathic surgery

Soft Tissue Procedures:

Submental lipectomy with platysma muscle plication:

This reduces excess tissue folds in the neck but cannot totally compensate. Use reduction cheiloplasty to eliminate the excessive bulk of the lower lip that sometimes persists in patients who had a severe jaw discrepancy.

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