

# A Review on ASSESSMENT AND TREATMENT STRATEGIES FOR CLASS III MALOCCLUSION

Dr. Kalai Selvi A.<sup>1</sup>, Dr. Gnanashanmugam<sup>2</sup>, Dr. M.S. Kannan<sup>3</sup>

<sup>1</sup>Post Graduate Student, <sup>2</sup> Professor, Department of Orthodontics and Dentofacial Orthopaedics, <sup>3</sup> Professor and Head of Department, Sree Balaji Dental College and Hospital, Pallikaranai, BIHER, Chennai

## ABSTRACT

*Class III malocclusion is a malocclusion that is Very easy to identify but is often difficult to treat. So a successful treatment plan for correcting class III malocclusion depends on an accurate assesment and diagnosis. So this article is an overview of various methods of assessing class III malocclusion and the management of the same.*

**Keywords:** True Class III, Pseudo class III, Assesment and Management.

## 1. INTRODUCTION:

Class III malocclusion represents a pre-normalcy where the mandible is in a mesial relation to the upper arch. British Standards Institute in 1983 defined Class III incisor as when the lower incisor edge lies anterior to the cingulum plateau of the upper incisors. class III molar relation is when the mesiobuccal cusp of the maxillary 1st permanent molar occludes in the embrassure between the lower 1st and 2nd permanent molars.<sup>1</sup>

## 2. DISCUSSION:

### Classification:

- <sup>1</sup>Angle classified class III malocclusion into:

#### 1. True or skeletal class III

- mandibular hypertrophy
- Marked shortening of midface
- combination

#### 2. Pseudo or functional or postural class III

- Occlusal prematurities
- Premature loss of deciduous posteriors
- Enlarged adenoids

#### 3. Class III, Subdivision

- Class III on one side and class I on other

- <sup>2</sup>Dewey's modification of Class III

Type 1: Well aligned teeth on dental arches. Edge-edge relationship

Type 2: Crowded mandibular incisors.

Type 3: Crowded maxillary incisors, underdeveloped maxilla. Anterior cross bite present.

- Tweed divided class III malocclusion into two categories Pseudo class III malocclusion with normally shaped mandible and under developed maxilla and skeletal class III malocclusion with

large mandibles<sup>3</sup>.

- Moyers further classified class III malocclusion according to cause of the problem. Osseous, muscular or dental in origin<sup>4</sup>.

### 3. Etiology:

#### 1. Skeletal :

**A. Environmental :** Airway problems like enlarged tonsils & nasal blockage, Scarring from Cleft lip and palate as a result of surgical repair , Hormonal like in acromegaly, Some syndromes caused by environmental as well as genetic reasons such as Crouzons, Aperts, and Cleidocranial dysostosis.

**B. Genetic (Litton et al 1970)<sup>5</sup>:** 1/3 of patients with severe class III have a parent with class III problems but there is no detected autosomal dominant or recessive method of transmission.

#### 2. Soft tissue:

The Soft tissue indeed may act to reduce the severity of CLIII, Lower incisor retroclination is adaptive due to soft tissue forces and tongue might procline upper labial segment. Exception in high angle case where there is tongue to lower lip seal and macroglosia that worsen the CLIII.

#### 3. Dental factors:

Rarely Upper labial segment retroclination and lower labial segment proclination.

Hypodontia or microdontia in the upper arch

Impacted upper teeth

#### 4. Habits: Tongue thrusting, mouth breathing, etc

### Features of Class III Malocclusion:

- **Skeletal features**

1. *Cranial base features:*

- A. Short cranial base length.

- B. Decrease cranial base angle resulting in forwards position of mandible.

2. *AP relationship*

- A. Mainly skeletal class 3 base relationships but it could be Class I even

- B. Guyer, Ellis, Behrents and McNamara (1986) stated that 55% of class 3 malocclusions had maxillary deficiency as one of the components of the malocclusion. Mandibular prognathism in 45% of cases.

3. *Vertical relationship*

- A. Guyer, Ellis, Behrents and McNamara (1986) stated that 59% of class 3 malocclusions had reduced or neutral lower facial heights and that 41% had increased lower facial heights.<sup>6</sup>

4. *Transverse relationship*

- A. The maxillary skeletal base widths were (statistically) significantly smaller in the class 3 than in the class I group (Chen et al 2008)

- B. Skeletal asymmetries, particularly in conjunction with mandibular prognathism, are also relatively common in class III malocclusions (Severt and Proffit, 1997).

**Cephalometric skeletal values** revealed Reduced cranial base angle, Increased saddle angle, Obtuse gonial angle, Reduced ANB, Normal or increase MMP angle and lower face height, Increased mandibular length, Reduced maxillary length

- **Soft Tissue Features:**<sup>7</sup>
  - 1.Orbital rim hypoplasia
  - 2.Increase scleral show
  - 3.Check bone flattening
  - 4.Malar hypoplasia in midface deficiency
  - 5.Paranasal hallowing
  - 6.Obtuse NLA
  - 7.Reduced incisor show at smile
  - 8.Increase buccal corridor dark space
  - 9.Upper lip looks thin with reduced vermilion border show while lower lip may be full and pendulous
  - 10.Obtuse LMA
  - 11.Prominent chin
  - 12.Concave or straight profile with anterior divergence.
  - 13.Increased throat length
  
- **Dental features**
  - 1.Class III incisor relationship
  - 2.Mostly Class III molar relationship. It could be class I or even class II. The same applied for canine relationship.
  - 3.Tendency to or full reverse Overjet,
  - 4.Reduced Overbite, Anterior open bite may exist
  - 5.Maxillary arch probably crowded, mandible unlikely to be so but usually spaced.
  - 6.Incisors compensate for Skeletal base, i.e. Proclined maxillary incisors, retroclined mandibular incisors
  - 7.Transverse discrepancy expressed in a form of tendency to posterior cross bite. It could be unilateral or bilateral with or without displacement

**Pseudo Class III malocclusion**

Kwavang and Lin conducted a cephalometric study comparing the characteristics of patients with Class I, pseudo ClassIII and skeletal Class III malocclusion.

Most of the cephalometric measurements suggested that pseudo Class III malocclusion is an intermediate form between class I & III malocclusion. The only exception was the gonial angle, which was more obtuse in skeletal Class III sample. Measurement of gonial angle in pseudo Class III was found to be similar to Class I sample. This is main key point in pseudo and Class III malocclusion.<sup>8</sup>

**Assesment of pseudo and True class III**

- **PSEUDO CLASS III**

**Molar relation:** CO: class I or III CR: Class I

**Maxillary incisors:** Retroclined

**Mandibular incisors:** Proclined

**Gonial angle:** Nearly a right angle with a average near 120<sup>0</sup>

**Facial profile:** CO: Straight or concave  
CR: Straight

**Skeletal Relationship:** Normal

**The arc of mandibular closure:** An early occlusal interference causes anterior shift of mandible

**ANB Angle :** Normal

• **SKELETAL CLASS III**

**Molar relation:** CO AND CR: class III

**Maxillary incisors** Proclined

**Mandibular incisors** Retroclined

**Gonial angle** Obtuse angle with a range between 130 & 140

**Facial profile:** CO: Straight or concave  
CR: Straight or concave

**Skeletal Relationship :** Retrognathic maxilla,  
Prognathic mandible or combination of both

**The arc of mandibular closure:** smooth without any occlusal interferences

**ANB Angle :** Negative or Decreased

**Assesment of Maxillary deficiency and Mandibular prognathism:**

	Maxillary deficiency	Mandibular prognathism
<b>Frontal Assesment</b>	Tendency to show sclera	Normal show of sclera
	Sallow paranasal form	Normal paranasal form
	Narrow alar base width	Normal alar base width
	Tendency of upper lip to be thin	Normal upper lip
	Normal chin projection	Prominent chin
	Normal to decreased lower facial height (LFH)	Normal, increased or decreased lower facial height (LFH)
<b>Profile Assesment</b>	Nasolabial line-Subnasale: subnasale-tip of nose ,usually not 1:1 ratio	Normal
	Nasal tip down	Normal
	Obtuse nasolabial angle	Normal nasolabial angle
<b>Smiling Assesment</b>	Less incisor visible	Good
<b>Cephalometric Assesment</b>	Normal to decreased total facial height	Increased total facial height
	Short Pty-ANS	normal
	Facial concave	Anterior divergent
	Normal ramus width	Narrow
	Gonial angle normal	obtuse
<b>Occlusal Assesment</b>	Tendency toward crowding and missing teeth in the upper	Spacing in lower arch
	Transverse deficiencies noticeable in maxillary arch	Normal

## Growth status assessment for class III patients

Mandibular skeletal maturity can be assessed by means of a series of biologic indicators:

1. History (is the patient changing shoes)
2. Growth chart like an increase in body height (Nanda, 1955; Hunter, 1966)
3. Biological parameters like:
  - Skeletal maturation of the hand and wrist (Bjork, 1967) or cervical vertebral maturation (CVM) method. Franchi 2000, Beccteti 2002 & 2005<sup>9</sup>
  - Dental development and eruption (Bjork, 1967)
  - Chronological age
  - Secondary sexual features like Menarche, breast, and voice changes (Tanner 1962)

## Monitoring the growth of mandible

1. Serial Clinical measurements like Overjet
  2. Serial Study models
  3. Serial Photograph or 3D stereo photogrammetry
  4. Serial Ceph (not justified)
  5. Growth Treatment Response Vector (GTRV) analysis
- Ngan (2005) has described this as a method of determining whether a class 3 malocclusion can be treated by camouflage or if surgical treatment will be required at a later date.

It is calculated from two serial cephalometric radiographs at least one year apart.

GTRV analysis is performed in early permanent dentition. This gives clinicians to decide whether the malocclusion can be camouflaged by orthodontic or by surgical intervention once the growth is completed. The GTRV ratio was calculated by using formula

## **GTRV = Horizontal growth changes of maxilla/ Horizontal growth changes of mandible**

GTRV ratio in normal individual is 0.77 mm at age 8-16 year.

In case of Class III patient having GTRV Ratio 0.33-0.88 mm maxillary deficiency it can be successfully camouflaged with orthodontic treatment

Class III patient with excessive mandibular growth with  $GTRV < 0.38$  then orthognathic surgery is indicated.<sup>10</sup>

## 4. MANAGEMENT OF CLASS III MALOCCLUSION:

### Treatment options for class III malocclusion

*McIntyre in 2004 listed the possible treatment options for class III malocclusion as follows:<sup>11</sup>*

1. Accept
2. Interceptive treatment
3. Growth modification
4. Orthodontic camouflage
5. Orthodontic decompensation and orthognathic surgery
6. Compromised orthodontic treatment

### Treatment strategies according to dental age<sup>12</sup>

#### -In primary dentition

There is no evidence to suggest that orthodontic intervention during the primary dentition avoids, or reduces, the complexity of later orthodontic treatment.

## **-In early mixed dentition**

### **1.Incisor crossbites** due to retained primary incisors

Treatment :extract retained primary teeth

### **2.Premature contact and mandibular displacement or incisors erupted in cross bite relationship, then**

- Extract or grind cusp tips (usually primary canines)
- Posterior onlay to overcome the posterior crossbite that caused displacement.
- .Procline maxillary permanent incisors using an upper removable appliance (URA) or a fixed appliance (4 x 2 appliance which is well tolerated less dependent on compliance (Sandler, 2001)
- .Anterior cross elastics, Reynolds method 1978
- .Expand by URA or Quad helix

### **Hagg et al (2004) and Ngan (2005) cited the reasons for early treatment<sup>13</sup>**

- A. To eliminate CR-CO discrepancies which may cause: periodontal damage , occlusal wear ,and TMJ problems.
- B- To provide a more favourable environment for growth and development of the maxilla and mandible with a reduction in dental compensation because remodelling may occur in the joint as the postured position which will act as functional appliance and making correction of the crossbite more difficult at a later date.
- C- To provide space for the eruption of the buccal segments as a result of proclination of the upper incisor so the canines and premolars can be guided into a class 1 relationship
- D- Psychological benefits resulting from improved dental and facial appearance.

## **-Mid-Late mixed dentition**

Class III incisors with deep overbite and mild/moderate skeletal Class III: *Protraction face mask and rapid maxillary expansion can be given.*

**Evidence based effectiveness of Face Mask 2010<sup>14</sup>**

□*Mandall*, Early Class III orthopaedic treatment with protraction face mask in patients less than 10 years of age is skeletally and dentally effective in the short term 15 months. (After 15 months of treatment, children undergoing early facemask therapy had 1.3 degrees more forward movement of SNA, almost 2 degrees less forward movement of SNB and an overall ANB improvement of around 2.6 degrees when compared to the control group. In addition, the overjet improved by more than 4 mm and the relative PAR score by more than 40% in the facemask compared to the control group. Thus, early class III protraction facemask treatment in patients under 10 years of age would seem to be skeletally and dentally effective in the short-term)

□*Mandal 2012*: Early Class III orthopaedic treatment with protraction face mask in patients less than 10 years of age is skeletally and dentally effective after 3 years of treatment.<sup>15</sup>

□*Mandal 2016 RCT*: Early class III protraction facemask treatment reduces the need for orthognathic surgery (Thirty six percent of the PFG needed orthognathic surgery, compared with 66% of the CG). The odds of needing surgery was 3.5 times more likely when protraction facemask treatment was notused (odds ratio = 3.34 95% CI 1.21–9.24).<sup>16</sup>

□*Masucci 2011*: RME/FM therapy led to successful outcomes in about 73% of the patients. Significantly improved sagittal dentoskeletal relationships. These favourable changes were mainly due to significant improvements in the sagittal position of the mandible, but the maxillary changes reverted completely in the long term. This treatment does not induced a tendency of bite opening or increased vertical relationship.<sup>17</sup>

## **-Early permanent dentition**

**1. Mild/moderate skeletal discrepancy with no concern about facial appearance or growth :** Procline maxillary permanent incisors using URA/fixed appliance or Camouflage skeletal pattern using fixed appliances with or without extraction.

**With concern about facial appearance or growth**

A. Postpone treatment decision until skeletal growth completed.

B. sometime, Align maxillary arch with fixed appliance and relieve crowding, accepting Class III incisor relationship will require orthognathic surgery in adulthood

**2. Severe skeletal discrepancy or a concern about facial appearance**

A. Accept malocclusion will require combined orthodontic treatment/orthognathic surgery in adulthood

B. Align maxillary arch with fixed appliance and relieve crowding, accepting Class III incisor relationship will require orthognathic surgery in adulthood

**-Adult treatment**

**1. Mild/moderate skeletal discrepancy**

A. no concern about facial appearance

Procline maxillary permanent incisors using URA/fixed appliance

Camouflage skeletal pattern using fixed appliances

B. concern about facial appearance

Compromised treatment by aligning the Upper arch with or without extraction and if possible align lower arch on non-extraction base to keep the cop of decompensation if the Combined orthodontic treatment/orthognathic surgery decided later

**2. Severe skeletal discrepancy with no concern about facial appearance**

Compromised treatment by aligning the Upper arch with or without extraction and if possible align lower arch on non-extraction base to keep the cop of decompensation if the Combined orthodontic treatment/orthognathic surgery decided later

**3. Severe skeletal discrepancy with a concern about facial appearance**

Combined orthodontic treatment/orthognathic surgery

## **5. CONCLUSION:**

Class III treatment requires decisions to be based not only on the morphological traits that present as orthodontic problems, but also on those that warrant consideration for their possible psychological and quality-of-life impact.

**SOURCE OF FUNDING: SELF**

**CONFLICT OF INTEREST: NIL**

**ETHICAL CLEARANCE: NOT APPLICABLE**

## **6. REFERENCES:**

- [1] Angle EH. Classification of malocclusion. Dent Cosmos 1899; 41:248-64,350-7
- [2] Dewey M. Classification of malocclusion. Int J Orthod 1915;1(3):133-147.
- [3] Tweed CH. Clinical orthodontics. St Louis: Mosby; 1966. p. 715-26.
- [4] Moyers RE. Handbook of orthodontics. 4th ed. Chicago: Year Book Medical Publishers; 1988. p. 410-5.
- [5] Litton SF, Ackermann LV, Isaacson RJ, Shapiro BL. A genetic study of class III malocclusion. Am J Orthod. 1970;58(6):565-577.

- [6] 6.Guyer EC, Ellis EE, McNamara JA, Behrents RG. Components of Class III malocclusion in juveniles and adolescents. *The Angle Orthodontist*. 1986 Jan 1;56(1):7-30.
- [7] 7.Franchi L, Baccetti T. Transverse maxillary deficiency in Class II and Class III malocclusions: a cephalometric and morphometric study on postero-anterior films. *Orthodontics & craniofacial research*. 2005 Feb;8(1):21-8.
- [8] 8.Lin JJ. Prevalences of malocclusion in Chinese children age 9-15. *Clin Dent* 1985;5:57-65.
- [9] 9. Baccetti T, Franchi L, McNamara JA. Reproducibility of the CVM method: a reply. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2010 Apr 1;137(4):446-7
- [10] 10. . Ngan P, Hagg U, Yiu C, Merwin D, Wei SH (1997) Cephalometric comparisons of Chinese and Caucasian surgical Class III patients. *Int J Adult Orthodon Orthognath Surg* 12, 177-188
- [11] 11. McIntyre GT. Treatment planning in Class III malocclusion. *Dental update*. 2004 Jan 2;31(1):13-20.
- [12] 12. . Ngan PW, Sung JH. Treatment strategies for developing and nondeveloping Class III malocclusions. In: Nanda R, editor. *Esthetics and biomechanics in orthodontics*. 2nd ed. Philadelphia: Elsevier; 2015. p. 246-92.
- [13] 13.Ngan P. Early timely treatment of Class III malocclusion. *Semin Orthod*. 2005;11(3):140–145.
- [14] 14.Mandall N, DiBiase A, Littlewood S, Nute S, Stivaros N, McDowall R, Shargill I, Worthington H, Cousley R, Dyer F, Mattick R. Is early class III protraction facemask treatment effective? A multicentre, randomized, controlled trial: 15-month follow-up. *Journal of orthodontics*. 2010 Sep;37(3):149-61.
- [15] 15.Anne Mandall N, Cousley R, DiBiase A, et al. Is early class III protraction facemask treatment effective? A multicentre, randomized, controlled trial: 3-year follow-up. *JOrthod*. 2012;39(3):176–185.
- [16] 16.Mandall N, Cousley R, DiBiase A, et al. Early class III protraction facemask treatment reduces the need for orthognathic surgery: a multi-centre, two-arm parallel randomized, controlled trial. *J Orthod*. 2016;43(3):164–175.
- [17] 17. Masucci C, Franchi L, Defraia E, Mucedero M, Cozza P, Baccetti T. Stability of rapid maxillary expansion and facemask therapy: a long-term controlled study. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2011 Oct 1;140(4):493-500.