Smile Alignment: Mastering Class II Malocclusion Treatment

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Abstract

Class II malocclusion is a common orthodontic problem characterized by a discrepancy in the anteroposterior relationship between the maxilla and mandible. Effective management of this condition requires a comprehensive understanding of its etiology, accurate diagnosis, and a strategic approach to treatment. This abstract reviews the key considerations in managing Class II malocclusion, emphasizing the importance of timing, treatment modalities, and biomechanical principles.

Class II malocclusion can result from genetic, environmental, and growth factors, necessitating a thorough diagnostic process that includes clinical examination, cephalometric analysis, and model analysis. Treatment can be timed as a one-stage or two-stage process, depending on the patient's growth phase and severity of the malocclusion.

Various treatment modalities are discussed, including growth modification techniques such as functional and extraoral appliances, orthodontic appliances like braces and clear aligners, and temporary skeletal anchorage devices. For severe skeletal discrepancies in adults, orthognathic surgery combined with orthodontic treatment is often necessary.

In conclusion, the management of Class II malocclusion requires a tailored approach that considers the patient's unique needs, growth potential, and specific characteristics of the malocclusion. By employing a combination of treatment modalities and adhering to biomechanical principles, clinicians can achieve functional, stable, and esthetic results.

Keywords: Class II Malocclusion, Compliance, Myofunctional appliance

INTRODUCTION

To recognize a malocclusion, a clinician needs to understand ideal and normal occlusions. People with ideal occlusions have all 32 adult teeth in excellent relationships in all three planes of space. The tip of the mesio-buccal cusp of the upper first molar fits into the buccal groove of the lower first molar, and the tip of the upper canine crown fits into the embrasure between the lower canine and first premolar .Teeth, moreover, are normally angled in the mesiodistal plane, normally inclined in the buccolingual plane, and aligned without being spaced, rotated, or crowded along the crests of the alveolar processes (Andrews 1972).[1]

The correction of sagittal discrepancy has been considered a common goal for the patient and the orthodontist. A large proportion of clinical situations is not a single entity and is often associated with significant skeletal and dental imbalances in sagittal plane. Traditionally, orthodontic assessment and diagnosis is mainly based on Angle's sagittal classification of malocclusion.

The sagittal discrepancies essentially include Class I, Class II and Class III malocclusions; however, defining any one of these malocclusions is difficult because this arbitrary categorization consists of various abnormalities. In their original interpretation and understanding, these abnormalities represent the anteroposterior relationship between the maxillary and the mandibular first permanent molars as described by Edward H. Angle.[2]

'Class II' is a broad term designated to a set of various abnormalities that could be either simple or most complex. It is not a single clinical entity, rather it consists of various components of the craniofacial complex having variations in size, shape and position.[3] There are many different types of Class II patients with significant variations in skeletal, dental and soft tissue morphology.[4]

Patient compliance is one of the determinants of the use of various treatment options that are available in modern orthodontic practice. Lack of compliance in the present orthodontic patient population has been a major concern for the orthodontists. Over the few years, the percentage of patients exhibiting poor compliance has been increased tremendously, with only about 10% demonstrating excellent compliance. The clinician must be aware of the fact that patient compliance usually decreases when longer duration treatment is required.

Recently, a great variety of noncompliance appliances and techniques that are less dependent on patient compliance have been proposed in order to correct Class II malocclusion either by advancing the mandible in a more forward position or by distalizing the maxillary molars into a Class I relationship.

Etiology

The etiology of malocclusion is a fascinating subject about which there is still much to elucidate and understand. Theoretically, malocclusion can occur as a result of genetically determined factors which are inherited, or environmental factors, or a combination of both inherited and environmental factors acting together. For example, failure of eruption of an upper central incisor may arise as a result of dilaceration following an episode of trauma during the deciduous dentition which led to intrusion of the primary predecessor—an example of environmental etiology.

Caries (an environmental factor) has led to early loss of many of the deciduous teeth then forward drift of the first permanent molar teeth may also lead to superimposition of the additional problem of crowding[5].

Clinical Examination and Functional Assessment

Improvement in facial profile is the most important factor considered by most patients seeking orthodontic treatment. Therefore, the focus of orthodontic treatment should be to achieve pleasing facial profile and soft tissue characteristics rather than just cephalometric norms.

In the past few years, the scope of orthodontic assessment and treatment has been expanded, and the ability of the orthodontist to remarkably improve the patient's facial appearance has also been considerably enhanced[1].During the process of clinical examination, while evaluating patient's profile, it is important to study total profile, lip projections and nasolabial angle.

Objectives of treating Class II Div 1 Malocclusion

1. Aesthetics
2. Oral health
3. Function
4. Stability.

Objectives of treating Class II Div 2 Malocclusion

Class II division 2 malocclusion is one of the most challenging occlusal anomalies to manage due to the underlying aetiological skeletal and soft tissue factors. A recent Cochrane review was unable to find any high-quality evidence to advocate any treatment approach over another and much of the evidence around treatment effectiveness comes from case series, clinical experience, and expert opinion. Stable correction of a Class II division 2 incisor relationship has two key components to prevent re-eruption of the incisors after treatment :

1. Correction of the inter-incisal angle.
2. Reduction of the increased overbite.

MANAGEMENT OF COMPLIANT CLASS II PATIENTS

Functional appliances are most commonly used for the treatment of Class II division 1 malocclusions. If the arches are well aligned at the start of treatment, and the only problem is an anteroposterior discrepancy between the arches, then the functional appliance alone may be sufficient. In these cases, it is wise to slightly overcorrect the malocclusion to allow for some relapse and ask the patient to wear the appliance at night until the end of their growth period.

Functional appliances are often used as a first phase of treatment, followed by a second phase of fixed appliances. The functional appliance corrects, or at least reduces, the skeletal discrepancy in a process known as growth modification or dento-facial orthopedics. By correcting the anteroposterior problems with the functional appliance, the amount of anchorage required during the fixed appliance stage is reduced. However, since functional appliances also cause some tilting of the teeth, a significant part of the correction caused by a functional appliance is probably orthodontic camouflage.

TYPES OF REMOVABLE FUNCTIONAL APPLIANCES

- Activator and its modifications
- Balters' bionator
- Frankel functional regulator
- Twin block appliance

TREATMENT OF SKELETAL CLASS II DIVISION 1 MALOCCLUSION

There are three basic approaches to the treatment of Class II, division 1 malocclusion.

They are:

1. Growth modification
2. Camouflage
3. Surgical correction

1) CORRECTION OF MAXILLARY EXCESS:

A) HEADGEAR

Class II malocclusion exhibiting maxillary excess or prognathism can be intercepted by the use of face bow with headgear to restrict further maxillary growth. The maxillary excess in these patients can present as excess in the antero-posterior dimensions characterized by protrusion of the midface and excessive overjet.

It has been found that 400-600 grams of force per side applied for 12-16 hours a day produces favorable skeletal changes. The intermittent forces produce less tooth movement and are also less damaging to the periodontium. In addition, the intermittent force allows the children to wear them at home once they come back from school. The headgear consists of the head cap or a neck strap and a facebow that is attached intraorally to the maxillary molar on either side and extraorally to the neck strap or the head cap[6].

MANAGEMENT OF MAXILLARY EXCESS WITH MANDIBULAR DEFICIENCY

In some patients, Class II malocclusion is complicated by the presence of both maxillary prognathism as well as mandibular deficiency. In such patients a functional appliance such as activator with headgear is used to restrict maxillary growth and promote mandibular growth.

B) ACTIVATOR

The 'activator' is a loose fitting appliance, which holds the mandible forward due to the extended lingual flanges coming from the maxillary plate as a single piece appliance made of heat cure acrylic. The only wire component is a labial bow. The original appliance consists of a combined upper and a lower plate at the occlusal plane only one-wire elements was used i.e. A labial arch for upper anterior teeth[7] (Fig No 1).

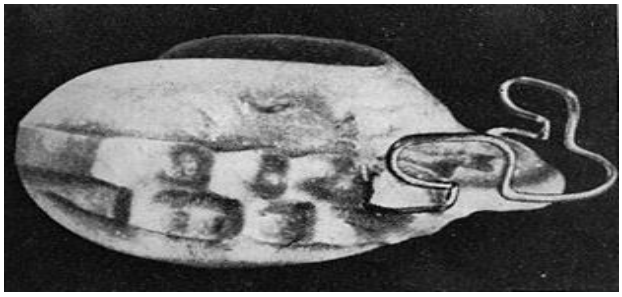

Fig No 1: Activator

C) FRANKEL APPLIANCE

Most significant development in removable functional appliance as far as orthodontics in North America is concerned is the Functional regulator of Rolf Frankel. Frankel drew from the concept of mandibular forward posturing plus the oral screen of Karaus. By reducing the size of oral screen, Frankel designed the appliance to be worn full time. Frankel intended to use oral vestibule, as a basis for treatment. Treatment in the transverse plane, as well as the traditional sagittal plan was his realistic goal[8].

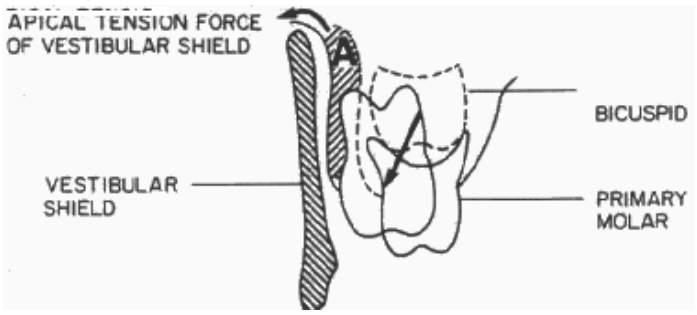

Fig No 2: Schematic view of the influence of vestibular shields on eruptive path and the dentoalveolar development.

The prime factor in success of his appliance was to stimulate the normal function and at the same time eliminates the lip trap, hyperactive mentalis, aberrant buccinators and orbicular actions. He called it an "exercise device".

Use of Frankel Appliance

Major use of the Frankel appliance is for Class II Division malocclusion.

Also effective in Class II Division 2 malocclusion, class III and open bite problems.

Frankel has designed four basic variations of the FR appliance:

FR1 - For correction of class I and class II division 1 malocclusion

FR2 - For correction of class II division 1 and 2 malocclusion

FR3 - For correction of class III malocclusion

FR4 - For correction of open bites and bimaxillary protrusions

Mode of action of the Frankel appliance

a) FR is not a tooth-moving appliance (i.e. FR is a tissue borne appliance)
b) FR withholds muscle pressure from the developing jaws and surrounding area having its arena of operation largely in the vestibule surrounding the alveolar bone.
c) Changes with FR in transverse dimensions is achieved by relief of force from the neuromuscular capsule (the buccinator mechanism)
d) Changes with FR in sagittal posturing is an entirely tissue borne manner[8].

D) TWIN BLOCK

William C.Clark developed twin block appliance in 1997 as a two-piece appliance resembling Schwarz double plate and a split activator. Twin block are bite blocks that effectively modify the occlusal inclined plane to induce favorably directed occlusal force by causing a functional mandibular displacement[9].

Occlusal Inclined Plane

The occlusal inclined plane is the fundamental functional mechanism of the natural dentition. Cuspal inclined planes play an important part in determining the relationship of the teeth as they erupt into occlusion. Occlusal forces transmitted through the dentition provide a constant proprioceptive stimulus to influence rate of growth and trabecular structure of the supporting bone (Fig No: 3).

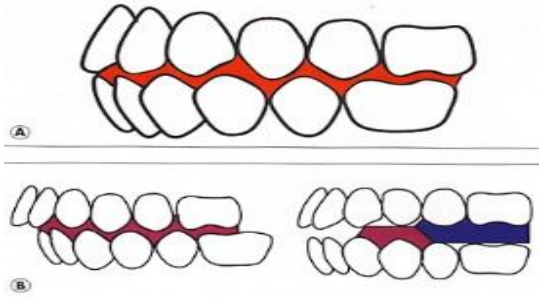

Fig No: 3 -Twin block modify the occlusal inclined plane to guide the mandible forward to correct occlusion.

Twin Block Appliance Therapy

Twin blocks are designed for fulltime wear to take advantage of all functional forces applied to the dentition including the forces of mastication.

It consists of upper & lower bite blocks that interlock at a 70^{o} angle. Wearing bite blocks is rather like wearing dentures and patients can eat comfortably with appliances in plane.

Advantages of Twin Block In comparison to other functional appliances, Twin blocks with occlusal inclined planes give greater freedom of movement in anterior and lateral excursion and cause less interference with normal function. The functional mechanism is very similar to the natural dentition. Another motivating factor is that the appearance is noticeably improved when twin blocks are fitted and the absence of lip, cheek or tongue pads places no restriction of normal functions[9].

Management of Class II Malocclusion

Classification of the noncompliance appliances used for Class II correction

During orthodontic treatment, the cooperation or compliance of the patient is a major factor for a successful treatment outcome. According to Haynes, compliance, as it relates to healthcare, is the "extent to which a person's behavior (in terms of taking medications, following diets, or executing lifestyle changes) coincides with medical or health advice."

During the last decades, many appliances and techniques that reduce or minimize the need for patient compliance have been introduced in order to correct Class II malocclusion. It should be noted, however, that these noncompliance treatment modalities are not solely indicated in patients with minimal compliance but can also be applied to compliant patients.

The noncompliance appliances used in Class II correction present some common characteristics:

- The forces applied in order either to advance the mandible or to move molars distally are produced by means of fixed auxiliaries, either intra- or intermaxillary.
- Almost always, they require the use of dental and/or palatal anchorage such as multibanded fixed appliances, lingual or transpalatal arches, and modified palatal buttons.
- In the majority of these appliances, and especially those used for molar distalization, much use is made of resilient wires, such as super-elastic nickel-titanium (NiTi) and titanium molybdenum alloys (TMA). However, anchorage loss often occurs during molar distalization with these modalities and represents a major negative aspect of their application.

Depending on their mode of action and type of anchorage, all these appliances can be classified into two categories.

1) Intermaxillary Noncompliance Appliances

which derive their anchorage in an intermaxillary manner, act in both maxillary and mandibular arches in order to advance the mandible.

e.g. the Herbst appliance (DentaurumInc., Ispringen, Germany), the Jasper Jumper (American Orthodontics, Sheboygan, WI) , the Adjustable Bite Corrector (OrthoPlus Inc., Santa Rosa, CA), and the Eureka Spring (Eureka Orthodontics, San Louis Obispo, CA, USA) .

2) Intramaxillary Noncompliance Appliances

which derive their anchorage in an intramaxillary or absolute anchorage manner, act only in the maxillary arch in order to move molars distally.

e.g. the Pendulum Appliance, the Distal Jet (American Orthodontics, Sheboygan, WI) , repelling magnets, the Jones Jig (American Orthodontics, Sheboygan, WI) , and palatal implants.

Overview of the Intermaxillary Noncompliance Appliances

The intermaxillary noncompliance appliances can be further classified according to the features of the force system which is used to advance the mandible. In this way, they can be classified into four main categories:

- Rigid intermaxillary appliances (RIMA)
- Flexible intermaxillary appliances (FIMA)
- Hybrid appliances (combination of RIMA and FIMA)
- Appliances acting as substitute for elastics.

Palatally Positioned Implants Used as Anchorage for Molar Distalization

Several implant systems have been used for maxillary molar distalization. These include the Graz Implant-Supported Pendulum (GISP), the Bioresorbable Implant Anchor for Orthodontics System (BIOS Implant System), the Straumann Ortho system, the Frialit-2 Implant System, the Oric Implant System, short epithetic implants, anchorage screws, mini-screws and the On plant System[10].

Bioresorbable Implant Anchor for Orthodontics System (BIOS Implant System)

Glatzmaier and colleagues were the first to introduce an implant supported force system for molar distalization, the BIOS Implant System. This consists of a biodegradable implant body and a variable metal abutment as superstructure. The implant body is fabricated from biodegradable polylactide and provides sufficient anchorage for 9–12 months until degraded. The design and dimensions of the BIOS implant originate from the ITI-Bonefit Screw Implant (Straumann, Waldenburg, Switzerland) with a fixture length of 6 mm[11].

Graz Implant-Supported Pendulum

Byloff et al described the use of the Graz Implant-Supported Pendulum (GISP) (Mondeal Medical Systems, Tuttlingen, Germany) to distalize the maxillary first and second molars in adults. The GISP consists of two parts: the anchorage plate, which is fixed to the palatal bone via four mini-screws and incorporates two cylinders, and the removable part, which is a Pendulum type appliance. The Nance button of the Pendulum Appliance has two cylindrical slots in the palatal surface, which correspond to the two cylinders of the anchorage plate. The system can be loaded 2 weeks after surgical placement, actively distalizes maxillary molars consecutively, serves as an active anchor unit, and provides stability against rotational movements. When the desired molar distalization has been achieved, the GISP can be

used to maintain the molar position, not only passively but actively by exerting counteracting forces to the mesial forces exerted on the molars during retraction of the anterior teeth, thus providing active anchorage[12].

Orthognathic Surgery

Treatment of Class II malocclusion was by mandibular advancement surgery. The most common mandibular advancement surgery done is the bilateral sagittal split osteotomy. Class II malocclusion can be treated by a combination of maxillary and mandibular surgeries, maxillary surgery alone or by mandible surgery solely depending on the underlying skeletal discrepancy.

DISCUSSION

The literature describes several methods for correcting Class II malocclusion during growth, including fixed orthodontic appliances and removable aligners combined with intermaxillary elastics, extraoral appliances, temporary skeletal anchorage, functional appliances, and various types of fixed and removable protraction appliances.

Orthodontic research has extensively investigated the optimal timing and approach for treating Class II malocclusion, considering whether to use a one-stage or two-stage treatment process.

Treating Class II malocclusion in adults poses unique challenges, as growth modification is not an option: **Comprehensive orthodontic treatment**: Often combined with dental extractions to manage crowding and achieve a functional occlusion. **Orthognathic surgery**: To correct skeletal discrepancies and improve facial esthetics.

CONCLUSION

Treating Class II, division 2 malocclusion in adults is notoriously difficult. Adhering to sound biomechanical principles to implement the treatment plan is the most reliable way to achieve consistent results with minimal complications. Treating skeletal Class II malocclusion during growth with a Bionator or an extraoral appliance yields predictable results. This approach brings about changes in facial growth patterns, establishes functional occlusion, ensures long-term stability, and achieves satisfactory facial esthetics. By applying the biomechanical concepts presented and using arch-wires specifically designed for particular objectives, clinicians can achieve the desired outcomes.

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