

Australian Society
of Orthodontists



University of Sydney



Class II Division 1 Malocclusions – *Early Diagnosis & Management*

PART 1

Creating Brighter Futures

Malocclusions are classified by both molar and incisor positioning. Angle defined a Class II as occurring when the lower first permanent molar is distal to the upper first permanent molar by at least the width of half a cusp¹. Class II is further subdivided into Divisions 1 and 2, based on maxillary incisor inclination. Class II malocclusions occur in approximately 25% of the population²⁻⁴ and are most prevalent in Caucasians of northern European descent⁵.

This article reviews treatment initiated during the mixed dentition, so called "early treatment".

Aetiology

Malocclusions involve a complex interplay between genetic and environmental factors. Twin studies have shown only partial concordance of Class II malocclusions⁶. Inherited growth patterns of the mandible⁷, causing the chin to grow downwards and backward can be a predisposing factor. Environmental factors such as habits, oral function, soft tissue actions and early tooth loss can further contribute. Persistent non-nutritive sucking (e.g. the thumb or "dummy") beyond the age of four⁸ is associated with a higher prevalence of excessive overjet and Class II primary canine and molar relationships^{9,10}.

An imbalance of forces from the oral soft tissues, such as tongue thrust habits, low muscular tonicity of the lips and poor tongue resting posture, can result in the displacement of teeth due to changes in equilibrium¹¹. Early tooth loss, particularly of the maxillary second deciduous molar and consequent mesial drift of the upper permanent molar(s) can also be a critical local factor in developing a Class II malocclusion.

Characteristics of Class II Malocclusions

Class II malocclusions result from many different combinations¹² of problems in the skeletal and dental components, often resulting in a convex facial profile with or without a lower lip trap (Figure 1).



Figure 1. Examples of patients with Class II malocclusion and exhibiting convex facial profiles, with and without a lower lip trap.

Skeletal

The skeletal components of a Class II malocclusion can involve a protrusive maxillary skeletal base and/or retrusive mandibular skeletal base. However, typically one finds skeletal mandibular retrusion and shorter total mandibular length¹³. In McNamara's¹² study of 277 Class II mixed dentition children, up to 85% had mandibular skeletal retrusion and almost half exhibited excessive vertical development further exacerbating mandibular retrusion¹⁴. Children with vertical growth patterns, such as in the centre photo in Figure 1, present particularly difficult problems to correct and often complete correction cannot be achieved, even with later orthognathic surgery.

Dental

The dental components of the Class II malocclusion can involve a protrusive maxillary dentoalveolus, a retrusive mandibular dentoalveolus, or both. Clinically, an Angle Class II molar relationship will be evident, with either proclined or retroclined upper incisors.



Figure 2. A Class II Division 1 malocclusion in the mixed dentition.

Class II Division 1 malocclusions exhibit increased overjet, and proclined upper incisors. The vertical relationship of the incisors can vary between open bite to deep overbite.

Class II Division 2 malocclusions have retroclined upper central incisors. They often present with an increased overbite and minimal overjet.

In the mixed and permanent dentition, the position and inclination of the upper central incisors will be the prime distinguishing feature between Division 1 and 2, as there are no other statistically significant dento-skeletal differences¹⁵.

Terminal Molar Relationship. In the deciduous and mixed dentition, a distal step between the upper and lower second deciduous molars (Figure 3) will result in a Class II permanent molar relationship. Bishara¹⁶ found that where the occlusion began with a distal step, none self-corrected into a permanent Class I molar relationship. Further, for flush terminal plane relationships, 44% developed into a permanent Class II. The presence of a mesial step indicates the smallest probability of a Class II molar relationship developing.

Colgate CARE COLUMN

Australian Dental and Public Health Leaders Commit to a Cavity-free Future

Every child born in 2026 should stay cavity free during his/her lifetime. Late 2013 saw experts in dentistry and public health come together to launch the Australian chapter of the global collaboration, the Alliance for a Cavity-Free Future. With national representation, the Australian chapter is the eighth to join the global movement.

The group reconvenes in February 2014 to develop and agree on action plans to support immediate and long-term dental caries prevention initiatives within the Australian dental industry.

Chaired by Assoc. Prof Wendell Evans from the Faculty of Dentistry at the University of Sydney and a member of the Global Expert Panel, and supported by Dr Susan Cartwright, Colgate Oral Health's Scientific Affairs Manager, the group representing 15 oral health experts thatw are committed to a cavity-free future.

Assoc. Prof Wendell Evans comments, "In Australia, tooth decay is still a neglected epidemic, with many Australians simply not realising that cavities are preventable and, in the early stages reversible. It is critical that we act and join together to promote integrated clinical and public health action in order to prevent decay initiation and to stop its progression in order to move towards a cavity-free future for all age groups."

As part of the Global Alliance, the Australian Chapter will work towards the integration of locally appropriate, comprehensive caries prevention and management systems, building upon the work being done by dental public health professionals. A long-term goal of the Global Alliance is to enable every child born in 2026 to stay cavity free during his/her lifetime. Stakeholders including those from primary health fields and government will be engaged with a view to raising awareness and improving dental health outcomes.

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You may wish to share this issue of Brighter Futures with your hygienists and other staff members.

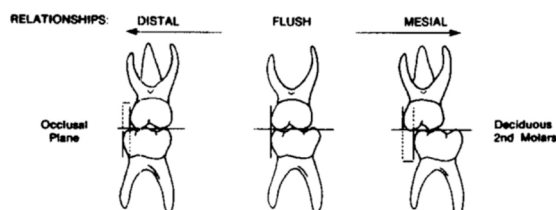


Figure 3. Distal step, flush terminal plane and mesial step occlusions of the deciduous dentition (Bishara 1988)¹⁶.

Arch Width. The maxillary dental arch width in young Class II patients is often, but not always, distinctively narrow compared to those with a Class I occlusion¹³. If a transverse discrepancy exists, it is present from an early stage of dental development, and does not self-correct¹⁷.

Soft Tissue Characteristics

Soft tissue characteristics will vary with incisor position. Class II division 1 malocclusions, with a significantly retrognathic mandible and increased overjet, will see the lower lip being trapped behind the upper incisors and the upper lip curling up over the roots of the maxillary incisors. Such lip incompetence (lip trapping) maintains or worsens the overjet.

In contrast, in Class II division 2 malocclusions, the orbicularis oris and mentalis muscles are often well-developed and very active, explaining the lingually inclined upper central incisors. The deep bite characteristic, from over-closure, causes the upper incisors to sit behind the lower lip, producing a lower lip curl¹⁷⁻¹⁹.

Treatment Modalities

Should early treatment be deemed appropriate the choice of appliance(s) will depend on the specific problems identified²⁰.

Maxillary Expansion

Because maxillary transverse deficiency presents early in a number of Class II patients, early treatment may aim to correct this. There is some evidence that a slow rate of expansion (0.5mm per week) allows a more physiological response with less relapse^{21,22}, especially when an actual posterior crossbite is not present. However, when posterior crossbites are present, more severe cases are better managed with rapid correction (0.5mm per day)²³. Expansion can be achieved with fixed (Hyrax, Haas, Minne, Quad-helix, nickel-titanium coils) (Figure 4) or removable expanders²⁴. Class II correction appliances such as Twin Blocks and Herbst appliances usually have maxillary expansion built into them.



Figure 4. Quad-helix slow maxillary expander (a) before and (b) after.

Mandibular Growth Modification

Functional appliances, by positioning the mandible forward and down, alter masticatory muscle action to transmit forces to the dentition and skeletal base. They are normally used when the Class II is due to mandibular retrognathism or a retruded lower dentition. Correction can occur through various mechanisms involving the teeth, jaws, dentoalveolus, condyles and glenoid fossa²⁵. However, dentoalveolar corrections are still the most common component of correction for most functional

appliances. Functional appliances that are widely used internationally include the Activator, the Bionator²⁶, Twin Block²⁷, and the Herbst appliance²⁸ (Figures 5 to 8). A locally developed magnetic variation is the Sydney Magnoglide²⁹ (Figure 9).

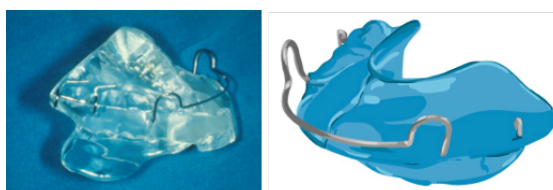


Figure 5. Activator.



Figure 6. Bionator.



Figure 7. Clark's Twin Block.



Figure 8. Herbst appliance.

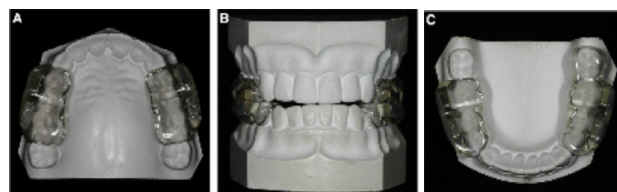


Figure 9. Sydney Magnoglide design, bonded magnetic functional appliance (Phelan 2012)²⁹.

Maxillary Growth Modification

Maxillary protrusion may be addressed using Headgear, which utilises extra-oral anchorage. 350-450 grams of force per side are applied for 10-12 hours per day to restrain the forward and downward maxillary skeletal and dento-alveolar growth. Correction occurs as the mandible is allowed to grow forward in relation to the restrained maxilla²⁰. There are three types of Class II headgear, each having a different vertical effect on the maxillary dentofacial complex³⁰⁻³² (Figure 10).

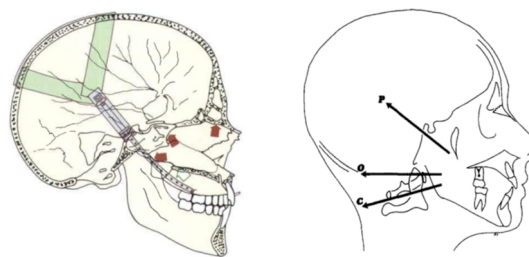


Figure 10. Headgear restrains maxillary growth to correct Class II (Proffit 2007)³⁰. Types of headgear: P—parietal, O—occipital, C—cervical (Jacobson 1979)³¹.

BRIGHTER FUTURES

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Space Maintenance and Space Regaining

Where a Class II permanent molar relationship is developing, or will develop due to early loss of particularly an upper deciduous molar, appliances can be used to maintain or regain space. Appliances such as a maxillary lingual arch (Figure 11), Nance holding arch, transpalatal arch, distal shoe, band and loop, a removable retainer or partial denture can be used. If the upper molar has already moved forward it can be distalized using space regaining appliances, e.g. a removable appliance, headgear³³, pendulum appliance³⁴, Jones Jig³⁵ or nickel-titanium open coil springs on fixed braces³⁶ (Figure 12).



Figure 11. (a) Maxillary lingual arch space maintainer. (b) Removable appliance. (c) Bonded wire.



Figure 12. Methods to regain space. (a) Removable appliance with active screws. (b) Open coil spring on fixed appliances. (c) Pendulum appliance

Habit Intervention and Control

Where a habit, e.g. thumb sucking, is a significant aetiological factor in a developing Class II (Figure 13), steps should be taken to break the habit. The critical time for stopping the habit is with the eruption of the permanent incisors. Essentially the child must understand the consequences of their habit and be keen to stop. Initially, a discussion at an adult level with the young patient may suffice²⁰. However, where the act is subconscious, despite a desire to stop, reminder methods (e.g. tape on the thumb which they suck) or appliances (e.g. a banded palatal crib cemented on the first permanent molars, Figure 14) can be used along with positive reinforcement³⁷.



Figure 13. The effect of thumb-sucking on the developing dentition.

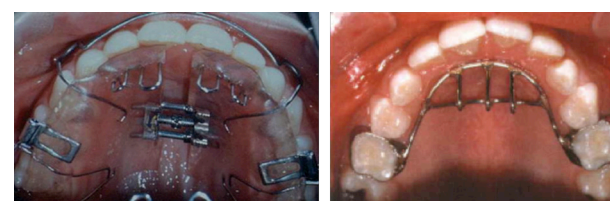


Figure 14. A crib as a reminder to interrupt the thumb-sucking habit: (a) removable or (b) fixed.

Part II of this publication will address the rationale and considerations for early management of Class II division 1 malocclusions. It will also address some controversies that have been perpetuated over the last few decades.

References available on request