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Original Article

Finishing occlusion in Class II or Class III molar relation: Therapeutic Class II and III

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The most frequent extraction regime consists of the removal of upper and lower premolars. Depending on anchorage requirements, camouflage treatment options, surgical intervention, or the absence of teeth in only one arch, it may become necessary to finalise the occlusion with a one-dental-unit discrepancy between the upper and lower dental arches. Guidelines are presented for finishing occlusions in Class II or Class III molar relation.
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Introduction

Several authors have described guidelines for a "normal" occlusion. With regard to the relation of cusps to fossae and embrasures, Andrews[1] supported the distal limit of occlusion as the ideal goal of orthodontic treatment; that is, that a tooth occludes with two opposing teeth in occlusion. Stuart[2] described a mesial (tooth-to-tooth) and distal (tooth-to-two teeth) limit of the interdigitation of teeth in a good occlusion. Roth[3] reviewed both types of occlusion and proposed that in orthodontic cases teeth be treated to the distal limit.

Non-extraction is the preferred goal in orthodontic treatment whenever possible,[4] but this goal cannot always be achieved and may not always be in the best interest of the patient. Extraction of first premolars is the usual choice in dealing with moderate-to-severe orthodontic crowding where teeth need to be removed. A perceived advantage of extracting second rather than first premolars is that the space is available further distally in the arch, meaning that less anchorage is provided, which should result in more mesial movement of the molars. The disadvantage in the final occlusion is the poor contact area between the lower first molar and the lower first premolar.[4]

On the other hand, the patient may be missing upper second premolars, or upper lateral incisors. Hypodontia (other than third molars) has been investigated by many authors. Rolling and Poulsen[5] reported hypodontia in a Danish school population as occurring in 0.16 per cent of the children, with two out of every three congenitally missing teeth being upper or lower second premolars or upper lateral incisors. Hobkirk *et al.*[6] found similar results, reporting that the teeth most commonly absent in the permanent dentition were the second premolars (3%), followed by the upper lateral incisors (2%). A Japanese population study found that

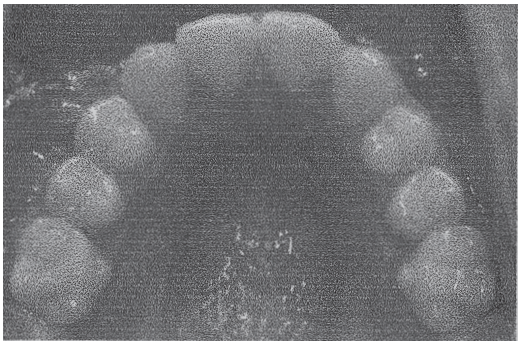


Figure 1a. Mesiodistal relationship of the upper first premolar and the canine.



Figure 1b. Mesiodistal relationship of the upper second premolar and the canine.

lower lateral incisors were the most common missing teeth.[7] Heredity is one of the possible factors associated with congenitally missing mandibular incisors.[8]

Different modalities have been used to treat malocclusions that stem from problems associated with hypodontia. The decision as to which form of treatment is used is based on anchorage, aesthetic and space requirements, camouflage versus treatment, or whether surgical intervention is to be performed. The treatment philosophy of closing spaces and obtaining a stable occlusion thereby prevents the removal of dental units in the opposing arch or the use of a prothesis, and may result in the orthodontist having to finish the occlusion in a therapeutic Class II or Class III molar finish. According to Postema,[9] orthodontic space closure is the treatment of choice since it should result in a lasting, natural and healthy dentition; however, this solution may result in anatomical, functional and aesthetic problems, such as poor interdigitation, alteration in lateral guidance of the teeth and unaesthetic gingival margin heights in the smile line. Prosthetic and implant procedures as an alternative are very demanding procedures in terms of cost and interdisciplinary management and require long-term maintenance. Considering these options, a comprehensive diagnosis and treatment plan is mandatory to achieve the most satisfactory clinical result.

If compensatory extractions are not done or are not suitable, a "therapeutic" Class II or Class III occlusion will result. Extractions are often not necessary in both arches. For example, it may be necessary to extract only the upper first or second premolars to relieve the crowding and satisfy arch space requirements. On the other hand, extractions may be necessary in the lower arch only; the decision being based on either anchorage, aesthetic and space requirements, camouflage treatment options, or the possibility of surgical intervention. The treatment philosophy of consolidating maxillary or mandibular spaces and obtaining a stable occlusion, thereby preventing the removal of dental units in the opposing arch or the use of a prosthesis, may result in having to finish the occlusion in a Class II or Class III molar relation. If this latter course is chosen, an awareness of the static, aesthetic and functional considerations associated with the final molar relation will allow the orthodontist to achieve the best possible occlusion for the patient. Presented below are the problems and guidelines associated with finishing such cases.

Therapeutic Class II: Maxillary first premolar extraction cases

Static equilibrium

A. Continuity of the dental arch

In the maxillary arch, the coronal morphology of the mesial surface of the second premolar does not have a canine curvature as does the maxillary first premolar (Figure 1). For this reason, the approximal surfaces of the second premolar and the canine do not form a precise contact area, which may cause functional problems but must be accepted in some therapeutic Class II cases. Further, as the contact area between the teeth is less than ideal, there may be increased interproximal retention of food. Also, the contour of the gingival papilla between the maxillary canine and second premolar may not be aesthetic, especially if a diastema, due to the small mesiodistal dimension of the upper second premolar, is present between

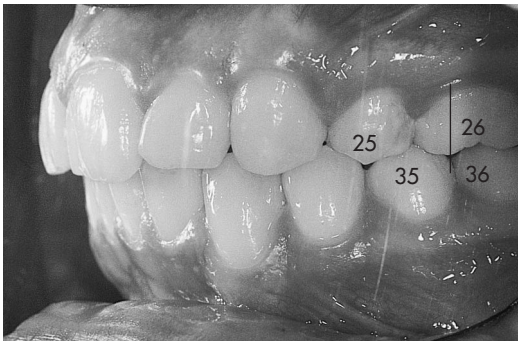


Figure 2a. Occlusion of the 25 and 26 cusps against the 35 and 36

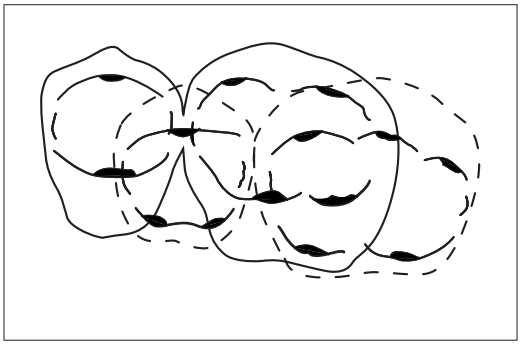
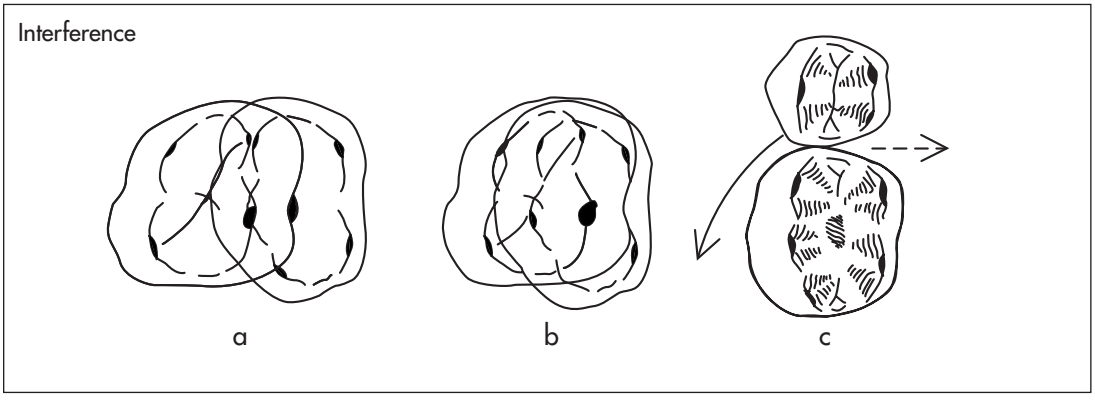


Figure 2b. Occlusal view of cusps-to-fossa relationship of 25 and 26 to 35 and 36.



Figures 3a and b. Class I cusp-to-fossa contacts between upper and lower first molars. a: working side; b: balancing side; c: movement of upper first molar palatal cusp through embrasure in Class II. (Solid line indicates non-working side; dotted line indicates working side movement.)

the teeth. This less than ideal contact area and the gingival condition may act as a plaque trap, leading to increased periodontal problems.

B. Continuity of coronal form

The maxillary first premolar, when situated against the maxillary canine, is an essential element in achieving an aesthetic smile. The maxillary second premolar has a shorter clinical crown than the first premolar and is more rounded on its buccal surface. The tip of the buccal cusp also is more rounded, and when situated next to the canine may compromise the aesthetics of the smile.

C. General form of the dental arch

The distance between the maxillary first molar and the maxillary canine is made shorter in premolar extraction cases, resulting in a decreased transverse dimension across the molars; the intercanine width, however, is not altered.

D. Inter-arch equilibrium

At the molar level, the occlusal relations between the mandibular and maxillary teeth in the posterior segments are changed as they occlude in a Class II relation. Under these conditions, the mesiobuccal cusp of the maxillary molar articulates in the embrasure between the mandibular first molar and second premolar (Figures 2a and b). The distobuccal cusp of the maxillary molar articulates with the mesiobuccal groove of the mandibular molar, which extends farther occlusally than does the distobuccal groove. Also, the central fossa stays unoccupied.[10]

E. Bolton's discrepancy

With the absence of upper first premolars against an intact lower arch, a tooth-size discrepancy is often observed because of the smaller mesiodistal dimensions of the upper second premolar. In order to obtain a precise contact area between the teeth in the maxillary arch, it may be necessary to reduce tooth substance from both the mesial of the lower second premolar and the distal of the lower first premolar. Alternatively, small residual spaces may be eliminated by composite build-ups on the distal surfaces of maxillary teeth. Arch length may also be increased by rotation of the maxillary molars (see below).

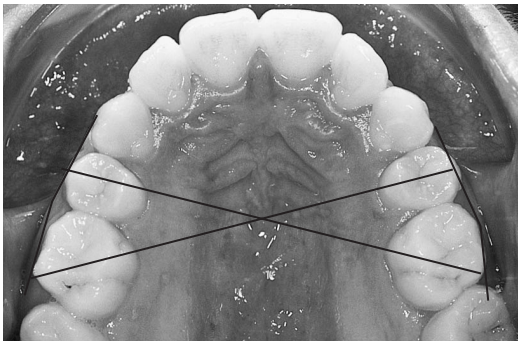


Figure 4. Reduction of "toe-in" on maxillary first molars.

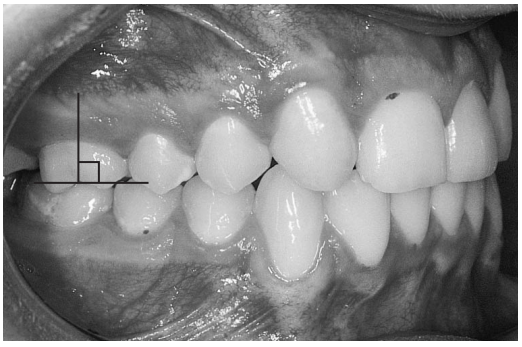


Figure 6. 5° tip eliminated from the upper right first molar by either seating the molar band more gingivally mesially or by placing a bend in the wire.

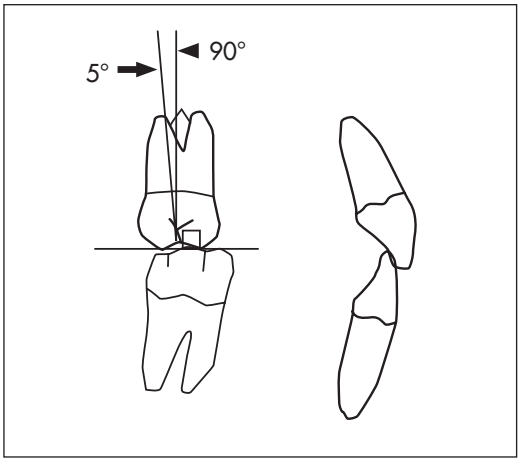


Figure 5. Class I molars.

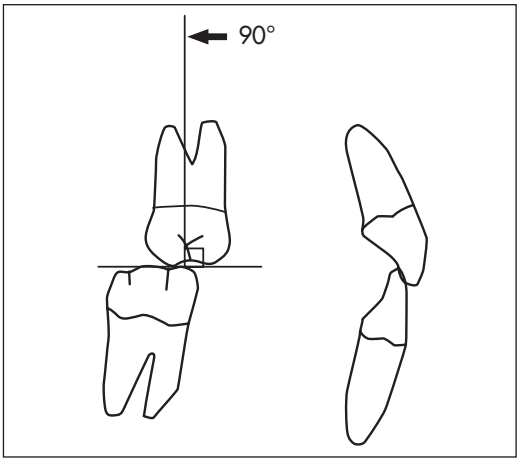


Figure 5. Class II molars.

Dynamic equilibrium

Protrusion

In protrusion, the movements in a therapeutic Class II case remain the same as in a Class I case.

Lateral movements

Working side: In a normal Class I molar occlusion, the mesiopalatal cusp of the maxillary first molar occludes into the lingual cusps of the mandibular molar. In therapeutic Class II cases, the mesiopalatal cusp of the maxillary first molar slides between the embrasure of the mandibular first molar and the mandibular second premolar. Occlusal contact occurs between the external face of the mesiopalatal cusp of the maxillary first molar and the internal face of the mesiolingual cusp of the mandibular first molar. Hence archwire "toe-in" must be decreased in the maxillary molars to avoid primary contact points and surfaces.

Balancing side: In a Class I occlusion, the mesiopalatal cusp of the maxillary first molar occludes in the distobuccal groove of the mandibular first molar; whereas, in therapeutic Class II cases, it occludes between the embrasures of the second premolar and first molar of the mandibular arch, and the contact is with the mesiobuccal cusp of the lower molars. Therefore, we may need to introduce more buccal root torque or, alternatively, grind the mesiopalatal cusp of the maxillary first molar to reduce interference.

Maxillary teeth

Upper molars

In order to achieve a less accentuated Curve of Wilson, both the first and second maxillary molars need to be given greater buccal root torque to reduce their interference with the lower teeth during function. Archwire "toe-in" also needs to be decreased in the maxillary first and second molars to reduce the facial prominence of the buccal cusps, as well as to increase maxillary arch length to compensate for the Bolton's discrepancy resulting from the single arch extractions (Figure 4).



Figure 7. "Toe-in" on the mandibular molars has been reduced.

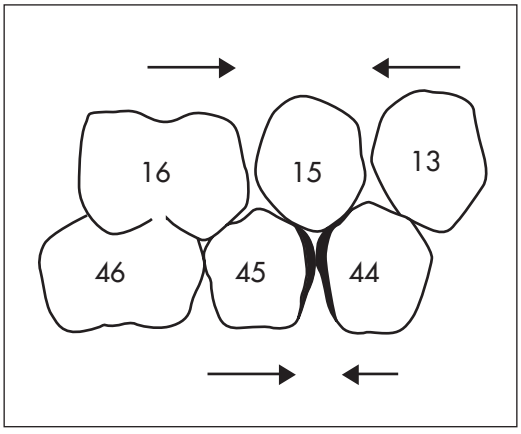


Figure 8. To obtain tight interproximal contacts between the second upper bicuspid and the upper first molar and canine, it is often necessary to reduce tooth structure from the lower bicuspids (shaded areas).

Crown angulation also is significant. In a Class I relation, the maxillary first molar has an angulation of 5 degrees; whereas, in order to improve buccal interdigitation in a therapeutic Class II relation, it is recommended to maintain this at 90 degrees to the occlusal plane (that is, zero degrees angulation) (Figures 5 and 6). This can be achieved by placing the molar band unevenly on the maxillary molar, with the distal end more occlusally placed. Schwartz[10] recommends that the angulation of the first maxillary molar be negated by seating the mesial of the molar band more gingivally; however, this has the tendency to increase the height of the mesial cusps, resulting in premature contact and a poor occlusion.

Upper second premolar

The maxillary second premolar has a more occlusal mesial marginal ridge than the maxillary first premolar. This is because it has to accommodate the smaller buccal cusp of the lower second premolar in a Class I occlusion. In therapeutic Class II cases with extracted maxillary first premolars, reduction of the height of this marginal ridge may be required in order to obtain a better occlusion with the larger buccal cusp of the mandibular first premolar.

Mandibular teeth

Lower molars

In order to reduce interferences, less lingual root torque must be placed on the lower molars to reduce the height of the buccal cusp. In the mandibular arch, "toe-in" needs to be reduced in the molars in order to reduce premature occlusal contact. No adjustment to the tip of the lower molars is required. It may also be necessary to grind the occlusal prominences of the buccal and lingual distal cusps of the lower molar in order to accommodate the distopalatal cusp of the upper first molar. The depth of the buccal groove on the mandibular first molar can also be deepened and the height of buccal cusps reduced.

Lower premolars

To obtain good contact between the approximal surfaces of the maxillary teeth, it may be necessary to reduce tooth substance in the lower arch; in particular, the mesial surface of the lower second premolar and the distal surface of the lower first premolar (Figure 8).

Therapeutic Class II: Missing maxillary lateral incisor cases

Maxillary canine reshaping

Aesthetics are already reduced in cases where the canines are used to replace missing maxillary lateral incisors. It therefore becomes necessary to improve the appearance of the canines by reshaping them. This may involve mesial and distal tooth surface reduction, grinding the cusp and the cingulum and adding composite on the mesio-incisal corner. The facial surface of the canine is more rounded than the lateral and this too can be reduced, in turn reducing the need to offset the canine, or reduce the cingulum in order to achieve better contact with the lower incisors. The aesthetics of the smile may also be reduced by the difference in colour between the central incisors and canines, the canine tending to be darker.

Maxillary premolar reshaping and gingival recontouring

Grinding of the palatal cusp will improve the appearance of the smile as it makes the premolar look more like a canine as well as decreasing the incidence of early contact during lateral excursions. Mesial rotation of this tooth will increase its facial prominence, and negative torque will reduce palatal-cusp interference. If the upper first premolars have a decreased gingival exposure compared with the canines, they may require a gingivectomy to appear more aesthetically pleasing.

Therapeutic class III: Missing lower incisors

Upper first molar

The central fossa of the maxillary first molar needs to be deepened, and the transverse bridge needs to be removed in order to accommodate the disto-buccal cusp of the mandibular first molar. Once again, more negative torque needs to be given to the upper first molar to avoid excursive interferences from the palatal cusp.

Upper second premolar

The palatal cusp of the upper second premolar needs reduction as it occludes in the central fossa of the lower first molar. The biggest problem is on the buccal groove of the lower first molar; this needs to be deepened to fit the palatal cusp of the upper second premolar during excursive movements.

Mandibular teeth

Lower premolars

The premolars may need more buccal root torque to raise the occlusal height of the buccal cusp, and torque may need to be reduced in the molars to avoid premature contact as a result of the buccal cusps being too high.

Lower canines

In cases where lower incisors have been extracted, or in cases with missing lower central incisors where the canines are used as replacement lateral incisors, the tip of the canines may require alteration by tipping them mesially. Also, the amount of negative torque in the canines needs to be reduced (that is, lingual root torque). The canine may need to be reshaped by grinding off the cusp edge, and its facial aspect reduced to give it the appearance of a lateral incisor.

Discussion

This paper has attempted to present the basic tenets of finishing in a Class II or Class III molar relation, and its effects not only on the position of the molars but also on the other teeth in the arch, as well as their relationship with the opposing teeth. An understanding of the basic morphology and functional variations within the occlusion will allow us to manage less common dental situations in a way that will produce occlusions that can function and appear as aesthetically normal as possible.

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