

Analysis of a Class II therapeutic failure

Dr. Larry W. White examines a common outcome of the removal of maxillary and mandibular premolars in Class II malocclusions

Abstract

Dr. Charles Tweed had enormous influence in orthodontics by developing a rationale for the extraction of premolars and the Tweed Triangle, which he used as a diagnostic and treatment-planning instrument. He used the premolar extraction spaces to center the mandibular incisors in the alveolus at an angle of $90^\circ \pm 3^\circ$ to the mandibular plane, and then positioned the maxillary incisors to occlude properly with them.

Dr. Tweed's skill and expertise allowed him to build a large cadre of imitators, and the removal of maxillary and mandibular first premolars became an accepted protocol in the treatment of Class II malocclusions and remains largely unquestioned by orthodontists to the present time.

Nevertheless, within the past decade, doubt has arisen about the efficacy of such a protocol, and the current article will offer an illustration of a common outcome of the removal of maxillary and mandibular premolars in Class II malocclusions.

Introduction

The enormous influence and innovation of E. H. Angle continues to this day in orthodontics. Even his treatment protocol of non-extraction therapy has seen a recent resurgence that challenges the removal of premolars for the correction of malocclusions. Tweed was not the first to challenge Angle's narrow prescription for universal nonextraction^{1,2}, but he

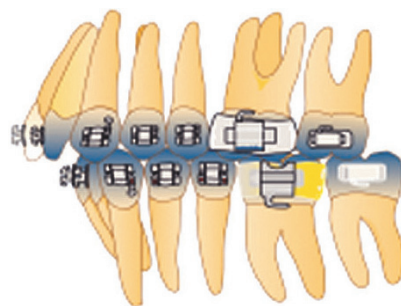


Figure 1: Typical Class II malocclusion

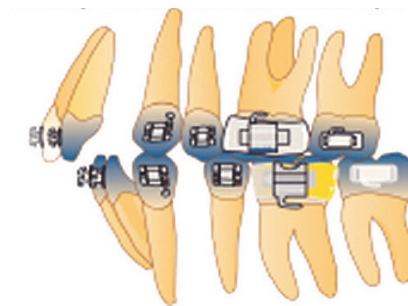


Figure 2: Occlusal result when the mandibular canine occupies one-third of the extraction space, and the maxillary canine has fully retracted

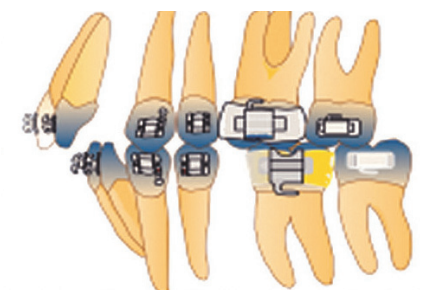


Figure 3: Occlusal result when the mandibular first premolar and canine occupy one-third of the extraction space, and the maxillary canine has fully retracted

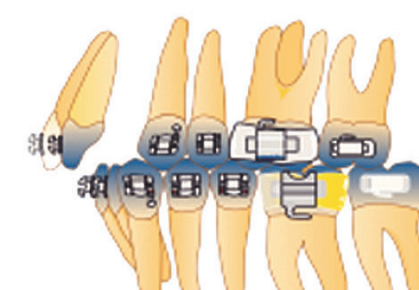


Figure 4: Occlusal result when extracting only the maxillary first premolars. The overjet and overbite can now be corrected



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established himself as the one of the most formidable and successful along with Raymond Begg^{3,4}.

Angle's non-extraction system had so disappointed Tweed that he retreated many of his patients by extracting maxillary and mandibular premolars, and subsequently developed his own diagnostic and treatment planning procedure, i.e., the Tweed Triangle⁵⁻⁸.

Janson,⁹⁻¹⁴ et al., began to challenge the efficacy and efficiency of Tweed's extraction technique for Class II malocclusions by showing that the removal of four premolars resulted in longer treatments with less satisfying results than when clinicians chose to remove only two maxillary premolars. Bryk¹⁵ had earlier illustrated why the removal of four premolars in Class II malocclusions created a particularly difficult environment for the successful resolution of these orthodontic problems (Figures 1-4).

When clinicians choose to remove mandibular premolars in the correction of a Class II malocclusion, they need to

realize that only one-third of the extraction space need occupation by the retraction of the mandibular canines to make the achievement of Class I canines unusually difficult (Figure 2). At this point, only forceful Class II interarch mechanics, e.g., Class II elastics, will arrange the canines in a Class I relationship. But such mechanics will also displace the mandibular arch more forward, which negates any effort to upright the incisors to $90^\circ \pm 3^\circ$ relative to the mandibular plane. Growing patients can, of course, benefit from the use of cervical retractors, but this has the disadvantage of retracting not only the entire maxilla but also the upper lip^{16,17}.

When limited-growing or non-cooperative Class II patients reach this impasse, few remedies remain for the clinician to employ, and many will resort to so-called noncompliant devices such as Saif Springs¹⁸, Forsus¹⁹, MPAs^{20,21}, Eureka Springs^{22,23}, etc. Unfortunately, at this point, patients have been in treatment for 1 year or more, and many are suffering from orthodontic fatigue, which makes



Figure 5: Adult Class II malocclusion



Figure 6: Occlusal result of maxillary first and mandibular second pre-molar extractions



Figure 7: Mature adolescent patient with a Class II malocclusion

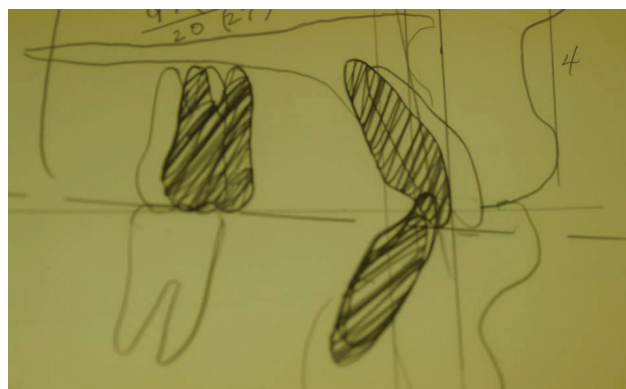


Figure 8: VTO illustrating needed movement of the incisors

their cooperation with even noncompliant appliances questionable.

Some clinicians have sought to avoid this dilemma by removing maxillary first premolars and mandibular second premolars; but, again, if the mandibular first premolar and canine occupy just one-third of the extraction space, the same end-on canine will result (Figure 3). For this strategy to work, almost all of the extraction space will need occupation by the molar.

Bryk and Janson have suggested the extraction of only maxillary first premolars as a remedy for this type of malocclusion, which will result in Class I canines and Class II molars (Figure 4). This strategy offers a predictable Class II correction of overjet, overbite, and canine position.

Therapeutic reports

Critics may counter that the above illustrations are just that and don't reflect clinical realities, but clinicians need only view a few of their Class II patients they have treated with maxillary and mandibular premolar extractions to see

the truth of these remarks. The following patient is only one of the many I could, unfortunately, provide, but it is typical of the predictable failure that results with the removal of maxillary first and mandibular second premolars in Class II adult, poorly-growing patients or noncompliant patients (Figure 5). This patient displays a Class II malocclusion complicated by maxillary and mandibular arch length discrepancies (6 mm respectively), which causes clinicians to believe that the extraction of maxillary and mandibular premolars remains the only option. Figure 6 shows the result of that decision.

The patient now has four fewer teeth, end-on canines, and a slight overjet with under-torqued maxillary incisors. Outside of better alignment and a midline correction, it would be hard to qualify this patient as having even a marginal treatment result.

Certainly, it is not one acceptable to the American Board of Orthodontics. By the time the patient needed to use forceful Class II elastics, she was worn out and was only mildly compliant.

This tempts the clinician to claim that the poor outcome was the result of marginal patient cooperation, but is that a satisfactory answer? Might not the questionable consequence be due to the original treatment plan? In this case, I am certain it was.

A better treatment would have resulted from the removal of the maxillary first premolars and interproximal enamel reduction (IER), aka Air Rotor Stripping²⁵ of 6 mm in the mandibular arch. Some might object to that much polishing of enamel, but it is much more conservative than removing 15 mm of tooth structure through extractions, and multiple studies have shown minimum harmful effects^{24-27, 28-32} from interproximal enamel reduction; and it would have offered much better occlusion and a quicker, less traumatic conclusion.

The following patient offers a clinical illustration of this type of strategy (Figures 7-11). The patient displayed a bilateral Class II malocclusion characterized by maxillary and mandibular arch length discrepancies, a large overjet, and moderate overbite, a

	Max	Man
Arch Length Discrepancy	-3	-4
Arch Development		
Relocation Incisor	-7	
Mesial Molar Movement	-5	
Distal Molar Movement		
Curve of Spee		
Interproximal Reduction		4
Extractions	15	
Total Net	0	0

Figure 9: Modified Steiner box for calculating space needs of this patient

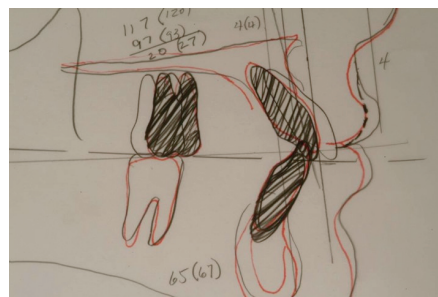


Figure 10: VTO superimposed on the actual treatment result

midline deviation, and a slightly protrusive soft tissue profile. The Visualized Treatment Objective (VTO) developed in Figure 8 was based on a consensus derived from the Alvarez³², Holdaway^{16,17} and Creekmore³³ treatment planning strategies. All of these analyses had agreement regarding the protrusiveness of the maxillary incisors and the need of the mandibular incisors for intrusion but to remain in place otherwise. The Tweed, Steiner, and Ricketts treatment planning strategies would have repositioned the mandibular incisors lingually, which would have required the removal of mandibular premolars also. The modified Steiner box in Figure 9 illustrates the calculations that determined the need to remove maxillary first premolars only, while leaving the mandibular arch non-extraction and using interproximal enamel reduction of 4 mm to resolve the mandibular arch length discrepancy. Figure 11 displays the results of the strategy of removing only maxillary first premolars and using IER to provide space to resolve the mandibular arch length discrepancy. Figure 10 shows how the final cephalometric result coincided with the original VTO.

The VTO with cross-hatched replicas of the teeth coincide quite nicely with the actual treatment result outlined in red. This treatment finished in less than 2 years without the need of Class II elastics or mechanics and only a slight amount of time with Class III elastics to bring the maxillary molars forward to close the remaining extraction spaces.

Discussion

The removal of maxillary and mandibular premolars in Class II malocclusions has become such a routine procedure that it remains almost unchallenged. However, by simply arranging a schematic to illustrate how difficult positioning the maxillary canine in a Class I relationship after such



Figure 11: Completed therapy for Class II patient

a decision, clinicians can understand the difficulty they routinely encounter with this strategy. In Class II malocclusions, the maxillary canines start with a decided deficit by their mesial position vis-à-vis the mandibular canines, and the slightest movement distally of the mandibular canines increases the difficulty in achieving Class I canine occlusion.

When patients do not or cannot experience substantial mandibular growth to overcome this inherent deficit, or benefit from a retractor that moves the entire maxilla and/or maxillary dentition distally, the only remedy left is to apply powerful Class II mechanics, which will displace the mandibular dentition forward. Such tactics, of course, result in what has become known in orthodontic parlance as “round tripping,” and this introduces more treatment time along with the uncertainty of Class II mechanics side effects, which often negate their positive contributions. Also, the additional time required to correct the end-on canines resulting from the removal

of mandibular premolars causes patients to have a vulnerability to root resorption^{34,35} decalcification³⁶, caries³⁷, and periodontal problems³⁸.

Unfortunately, when clinicians need to apply Class II mechanics for these types of patients, it is after several months of therapy that has resulted in end-on canines. By then, patients can see good alignment and other corrections in their malocclusions, and they often display serious treatment tiredness, and a reluctance to cooperate in the application of forceful Class II mechanics. It is exactly this common scenario that has resulted in the development and popularity of the so-called noncompliant appliances, and clinicians eagerly seek and use them — even with their substantial extra cost.

Orthodontic clinicians would do well to develop alternative approaches to the treatment of Class II malocclusions that require space to correct their protrusiveness and/or arch length discrepancies they often display. Rather than removing

mandibular premolars when an arch length discrepancy exist in Class II malocclusions, clinicians should consider some alternative strategies such as:

- removal of only the maxillary premolars combined with IER of the mandibular teeth;
- correction of the Class II malocclusion before removing maxillary and mandibular premolars;
- removal of the maxillary second molars and retract the entire maxillary arch with IER of the mandibular teeth;
- consider removing a mandibular incisor if occlusograms confirm it.

When the mandibular arch length discrepancy is so large that extractions must be done, then clinicians can remove the maxillary first and mandibular second premolars and elect one of the following:

- use aggressive Class II interarch mechanics, e.g., Herbst, MPA, Eureka, Forsus, Jasper Jumper, MARA etc;
- carefully monitor the mandibular extraction space, and do not exceed one-third of it with canine retraction;
- consider removing maxillary first molars in addition to the first premolars;
- use Temporary Anchorage Devices, aka TADs, to retract the maxillary arch.

Conclusion

When orthodontic clinicians design a Class II malocclusion strategy that involves the removal of maxillary and mandibular premolars, they will inevitably face a particular problem in achieving Class I occlusion if the mandibular canines occupy more than one-third of the extraction space. To avoid such a conundrum, they

would be well advised to remove only the maxillary premolars and conclude the therapy with the maxillary canines in a Class I relationship and the molars in a Class II relationship. At the least, they should approach such therapies with full knowledge of the problems they will face, should they elect to remove maxillary and mandibular premolars.

One final caveat regarding the diagnosis and treatment planning of Class II patients: avoid treatment planning regimens that emphasize restrictive positions for the mandibular incisors to the exclusion and neglect of the maxillary incisors, which have the ultimate responsibility for lip support. **OP**

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