Management of Skeletal Class II with Dental Class I - A Case Report

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Abstract
Background: This article aims to present a unique case of skeletal class II with dental class I relationship treated using ceramic bracket on stainless steel wire and observe if it caused any kind of compromise in the treatment quality or timing while opting for the best fit modality.
Result: There are various steps that can be considered while treating patients with ceramic brackets in order to minimize friction. Nonetheless in our experience it did not much compromise neither the treatment quality or timing of completion.
Conclusion: A good understanding of how friction may impact the clinical development of the orthodontic therapy, the variables that increase friction and how they can be better controlled is very important to the orthodontist who wishes to improve his or her clinical skill and consistently provide better services to the patients.
Key words: Skeletal class II, Dental class I, TADs, Ceramic brackets

Introduction

Skeletal Class II malocclusion is commonly observed clinical entity which is easily recognized by **dental** health professionals. Furthermore, occasionally practitioners come across cases which present with skeletal class II exhibiting a dental class I relationship. Treating such cases requires understanding the unique relationship between the two, along with choosing the most effective treatment modality which best brings out the changes sought for. Next the clinicians are faced with the challenge of completing the treatment effectively and efficiently, with 'friction' being main culprit for increasing treatment duration when treating on ceramic brackets.

One of the primary focuses of the search for ideal conditions for orthodontic tooth movement (OTM) is the reduction of friction at the bracket-wire-ligature interface in certain stages of treatment. The material of the bracket and the wire also changes the friction generated between them. A study previously done compared the frictional force generated by wires in ceramic brackets with that produced in stainless steel brackets and noted that ceramic brackets, especially in combination with steel ligatures, were associated with larger frictional force. For these reasons, manufacturers have come up with new designs of ceramic brackets which claim to offer excellent optical properties and promise additional esthetic appeal without significant functional compromises. This article aims to present a unique case of skeletal class II with dental class I relationship treated using ceramic bracket on stainless steel wire and observe if it caused any kind of compromise in the treatment quality or timing while opting for the best fit modality.

Diagnosis

Extra oral clinical examination of the patient revealed a dolicocephalic, leptoprosopic and a posterior divergent profile with no gross facial asymmetry. (Figure 1) On assessing the vertical proportions, it was revealed that the lower proportion was slightly greater than the remaining equal proportions in addition to a shallow mentolabial sulcus. Skeletal and dental examination revealed a class II skeletal base with Angle's Class 1 molar and canine relationship along with proclined upper incisors which contributed to an acute nasolabial angle. Further intraoral examination revealed all permanent dentition with complete eruption of teeth along with decreased overjet and overbite. He was also noticed to have an Ellis class 1 fracture in reference to 21. Occlusal view featured U shaped maxillary and mandibular arch. The lower midline was found to be shifted 1 mm towards right side with respect to the upper midline. The smile assessment revealed 4 mm incisal display at rest (potentially competent/ pseudo incompetent lips) and full display on smiling with no gingival exposure. The oral hygiene status was average. Temporomandibular joint (TMJ) assessment revealed no history of pain or clicking on maximum opening and closure. The right and left excursive movements were normal with maximum mouth opening of 60 mm.

	CEPHALOMETRIC DATA		
	NORM	PRE-TREATMENT	POST TREATMENT
SNA	82°	83°	83 °
SNB	80°	77°	77°
ANB	2°	6°	6°
MPA	32°	35°	36°
1/NA	22°	41°	25°
1-NA	4.0 mm	7 mm	2 mm
1/NB	25°	36°	24°
1-NB	4.0 mm	11 mm	6 mm
IMPA	90°	104°	90°
1/1	131°	97°	126°
Beta angle	27-35	25	25
Yen angle	117-123	112	112
W angle	51-56	50	50

Table:- 1 Pre & Post Cephalometric Reading

OPG and cephalometric analysis

Panaromic radiographic examination revealed optimum bone support for orthodontic mechanotherapy (Fig1). Impacted third molars were visible in all the quadrants except for the third quandrant. TMJ space revealed normal size, shape and position of the condylar heads.

On cephalometric assessment the pretreatment ANB angle was found to be 6°, MPA was 35°, Beta angle was 25°, Yen angle was 112° along with W angle being 50° pointing towards a Class II skeletal base and a hyperdivergent growth pattern (Table 1). As clinical examination already revealed proclined upper and lower incisors hence the 1/NA, 1/NB and IMPA angulations were found to be increased i.e. 41°, 36° and 104° respectively.

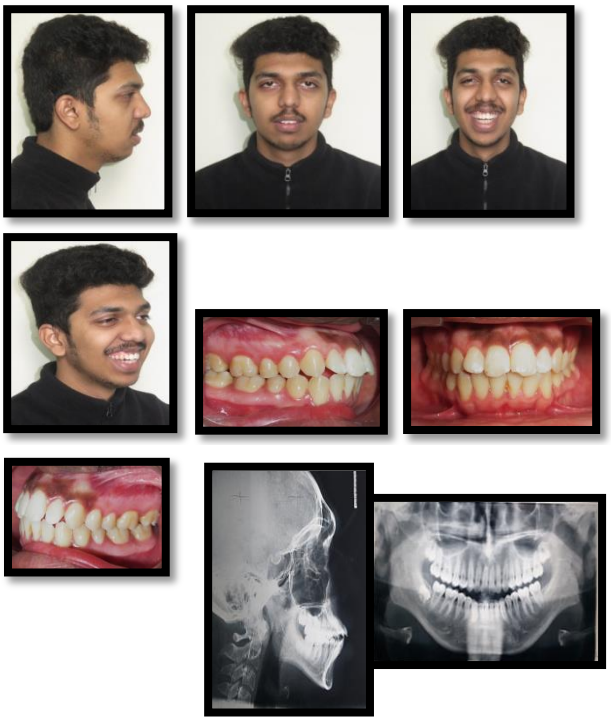

Figure 1. Pre-Treatment Records

Model analysis

Ashley Howe's analysis gave a calculated value of 39.38% for PMBAW (premolar basal arch width) i.e. laying within the borderline case range. Bolton's analysis revealed a maxillary anterior tooth material excess of 1.05 mm while overall maxillary tooth material excess was 1.35 mm.

Treatment objectives and plan

Treatment objectives were to

1) camouflage class II skeletal relationship,

2) correct dental relationships i.e. reduced overbite, proclined incisors and tooth material excess in upper arch

3) correct the convex profile to attain a more esthetically pleasing soft-tissue profile.

We arrived to the conclusion that following a fixed mechanotherapy along with extraction would benefit the case most in correcting the dental problems, followed by genioplasty to deal with the retrusive chin and convex profile. The patient being too concerned with esthetics, was suggested to undergo treatment on ceramic brackets.

Treatment Progress and Results

Full fixed preadjusted Edgewise appliance **3M Unitek Gemini Clear Ceramic Brackets MBT - 0.022" slot** prescription was placed to level and align both arches. Patient was referred for extraction of upper and lower first premolars before commencing leveling and aligning. Leveling aligning was commenced on 0.014" NiTi (3M Unitek Nitinol Super elastic wire) following banding of upper first molar. The following visit, the lower arch was also banded and bonded along with placement of 0.014" Niti likewise. (Figure 2) Gradually, both arch wires were replaced by a thicker gauge wire in each visit till we reached 0.019" X 0.025" SS in a period of six months. The next visit two TADs i.e. temporary anchorage device (S.K Surgical mini implant) were carefully positioned at the mucogingival junction between the first molar and second premolar. An 8mm power arm was placed to facilitate bodily retraction of anterior teeth in upper arch through a closed coil niti spring. While in the lower arch, direct class 1 force was applied from molar to anterior segment via continuous E chain on to a crimpable hook placed between the lateral incisor and canine tooth bilaterally. Monthly activation and replacement of E chain in the lower arch was done.

Figure 2. Mid-Treatment Records

As soon as the space was closed in both the arches owing to the retraction of the upper anteriors, the patient was advised an OPG which revealed the need for 13,22 and 23 root uprighting. Therefore the concerning brackets were replaced and repositioned by fresh metal brackets following placement of 0.012" Niti arch wire. The following appointment the arch wire was replaced by 0.014" Niti. The patient was instructed to begin wearing settling elastics in short class II fashion on right side while in the triangular fashion on left side.

After 22 months of active treatment class I molar relation was maintained, upper and lower incisors were retracted and retroclined along with their alignment. The patient's soft profile appeared more esthetically pleasing). Following this debonding was done and post treatment records were taken. The ellis fracture was treated with careful and precise enameloplasty. The cephalometric

measures produced by treatment are displayed in Table 1. The patient was very much satisfied and pleased with his treatment and his soft tissue profile. Fixed retainers were placed in both the arches.

Figure 3. Post -Treatment Records

Result

The post treatment cephalometric analysis reveals no changes in ANB, Beta angle, Yen angle and W angle i.e. 6°, 25°, 112° and 50° respectively as we followed a treatment approach involving only masking the skeletal discrepancy and not correcting it (Table 1). Extraction of premolars provided sufficient space for retraction along with retroclination of upper and lower anteriors which improved the 1/ NA to 25°, IMPA to 90°and 1/NB to 24°. Patient was very much satisfied with his profile and therefore declined surgical treatment. The OPG post debonding revealed fully erupted third molars with respect to the first and second quadrant. We advised the patient to under extraction of all third molars in order to avoid their supra eruption.

Discussion

Two types of friction is seen during orthodontic tooth movement. First one being 'Static force' is the smallest force needed to initiate a movement between two solid bodies that were static in relation to each other. Second is the Kinetic friction and is the force that resists against the sliding movement of a solid object against another at a constant speed. Static force is always greater than kinetic force since it is harder to change a body from its inertial situation than to maintain it moving.[1,2]

Kojima e Fukui evaluated this influence of friction on orthodontic tooth movement using the finite element method and reported that approximately 60% of the orthodontic force applied to a tooth is lost as static force. Thus, the biological tissue response to the mechanical stimulus takes place only if the force is strong enough to overcome static force. Therefore, higher levels of friction during sliding mechanics require the application of higher orthodontic forces and may compromise the amount of movement obtained as well as complicate anchorage control.[1]

A study performed by Vaughan *et al.* involved reviewing several variables that can directly or indirectly contribute to the frictional force levels between the bracket and the wire such as within Archwire, Bracket, Ligation and Biological factors.[3]

As due to esthetic concern of patient, ceramic brackets were used, which according to various studies suggest higher friction on SS wire. To overcome such increased friction of ceramic brackets, some manufacturers have incorporated a SS slot into the ceramic bracket. However, no significant difference was found between the SS brackets and the ceramic bracket with a SS slot.[4]

Another reduced friction declaration popularized the Damon Clear Braces (self-ligating). They claim that their design involves utilization of a high technology arch-wire which does not require ties to attach it to the brackets, therefore potentially speeding up treatment by 20% compared to the use of a standard brace.

In contrary, various studies study performed for example by Pandis *et al.* in 2007 and Scott et al. in 2008 mentioned there was no difference in frictional forces or in tooth movement between self-ligating (Damon 2) and conventional brackets.[1,5]

In the mentioned case, we performed retraction on the SS wire with the size of 0.019×0.025 inch^2 because it is the recommended wire for sliding and space closure. When considering the wire size, majority of studies have concluded that frictional forces were greater in ceramic brackets in comparison to metallic ones in most wire sizes. However, it seems that with increasing the wire size and therefore decreasing the clearance, the difference between low-friction system and high-friction system would decrease.[1,6]

In a systematic review, Ehsani *et al.* concluded that until 2009, there had been only a little information to show that self-ligating brackets produce less friction than the conventional ones in the presence of rectangular wire with tipping and torque and in an arch with a severe malocclusion.[1,7]

We as such did not feel the need of adding additional or excessive force during space closure as we found it to be efficient in our case. When talking about retraction, TADs were felt to be the best option as this was a critical \maximum anchorage case. Tads also have an additional advantage of much higher patient compliance in comparison to frictionless mechanics which would also have been another good option. Though our treatmnent modality made minimal changes in the skeletal relationship, it did help in reducing the convexity of the face as well as provide competent lips. This helped camouflage the class II skeletal base. (Figure 4)

Figure 4. Superimposition

Ceramic brackets were developed to improve esthetics during orthodontic treatment. In clinical use, however, they have problems including brittleness leading to bracket or tie-wing failure, iatrogenic enamel damage during debonding, enamel wear of opposing teeth, and high frictional resistance to sliding mechanics. [8]

Conclusion

Therefore, a good understanding of how friction may impact the clinical development of the orthodontic therapy, the variables that increase friction and how they can be better controlled is very important to the orthodontist who wishes to improve his or her clinical skill and consistently provide better services to the patients.

There are various steps that can be considered while treating patients with ceramic brackets in order to minimize friction. Nonetheless in our experience it did not much compromise neither the treatment quality or timing of completion.

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