Case Study

Management of Proclined Anterior Teeth Using Frictionless Loop Mechanics: A Case Series

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Abstract

This case series presents the two female patient, 21 years old who presented with class 2 divison 1 maloccusion with proclination of upper and lower incisors. Both of them presented with an overjet of 5mm and 8mm respectively. The maxillary dental midline was deviated to right. The objectives were to achieve a pleasing profile, eliminate crowding, correct the inclinations of the teeth, to obtain bilateral canine and molar class 1 relationship, an adequate overbite and overjet, correct midline and a good balance and occlusal function. Treatment consisted of extraction of the maxillary and mandibular bicuspids and fixed orthodontic therapy. The usage of T loop for the alignment of highly placed canine and KSIR loop for the retraction of the anterior segment have been described in the case series.

Key-words: T loop, ksir loop, class 2 div 1, deepbite,

Key Messages: KSIR loop and T loops can be efficiently used in the retraction of anterior teeth in the class 2 div 1 malocclusion.

Introduction

Space closure is one of the most challenging processes in Orthodontics. The ability to close spaces, especially those resulting from tooth extraction, is an essential skill required during orthodontic treatment. Orthodontic tooth movement during space closure is brought about by two types of mechanics. The first type, sectional or segmental arch mechanics involves closing loops incorporated in either a full or sectional arch wire and the teeth move through activation of the wire loop. The second type, sliding mechanics involves sliding the arch wire through bracket slot or tubes or moving the bracket along the arch wire. One of the main differentiating features between these two mechanics is friction. Sectional mechanics as they involve no friction are also called as Friction-free or Frictionless mechanics. On the contrary as friction plays a significant role in sliding mechanics, they are called friction mechanics. One of the major advantages of frictionless mechanics is that a known force system is delivered to teeth because there is no dissipation of force by friction. So, this way it is possible to determine forces that are being delivered to the tooth segments on the basis of the geometry and material properties of the spring alone. [1,2]

Case History: Case Presentation 1

A 22 years old, female patient reported to the department of orthodontics and dentofacial orthopedics with the chief complain of forwardly

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placed teeth in the upper front region of the jaw. On general examination, she presented with the ectomorphic body type, normal gait and posture. Extraoral examination reveals brachcephalicheadshape, leptoproscopic face and straight profile, potentially competent lips with incisor exposure of 4mm seen at rest. Intraoral examination reveals Angles class1 molar relation on both sides and class 1 canine relation on left side and highly placed canine on right side (figure 1).

Figure 1: Pretreatment extraoral and intraoral photographs of case 1

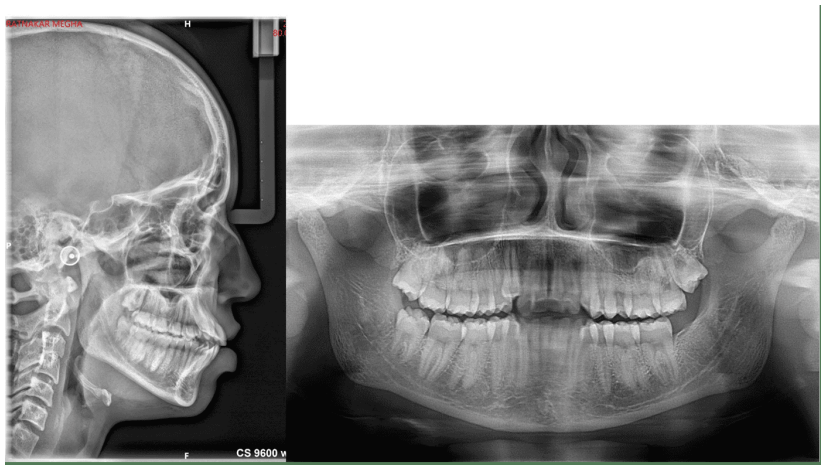


Figure 2: Pretreatment Lateral Cephalogram and OPG of the case 1

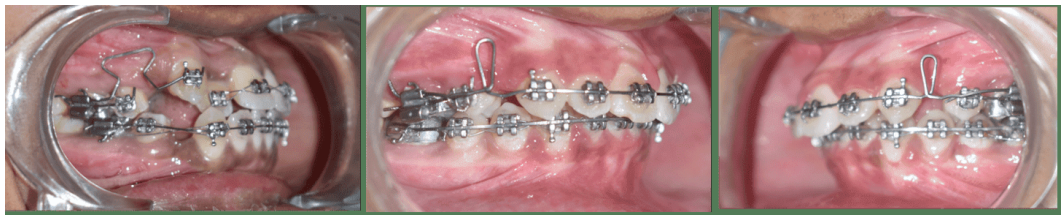
Diagnosis

Pretreatment radiographs are depicted in figure 2. Cephalometric analysis indicated a skeletal class 1 with hypodivergent growth pattern. On Boltons analysis, maxillary overall excess was found. On discrepancy analysis, space requirement in maxillary and mandibular arches is 16mm and 10mm respectively.

Treatment Progress

Extraction line of treatment was chosen with the extraction of first premolars in both the arches. Fixed

mechanotherapy using 0.22" MBT prescription pre adjusted appliance (Gemini, 3M Unitek, Monrovia, CA, USA). 0.017x0.025 segmental T loop was given for alignment of the canine (13) onto the occlusal palne (figure3). Initial levelling and aligning using nickel titanium archwires (Orthoforce G4, Nickel Titanium, G & H, Franklin, IN,USA)was carried out using 0.016 inch round, 0.017 x 0.025 inch the wires were stepped up to 0.017 x 0.025 inch stainless steel. Retraction was performed on 0.19x 0.025 inch stainless steel arch wires using elastomeric chain (3M Unitek, Monrovia, CA, USA) (figure 3). Finishing was achieved on 0.016 inch round stainless steel arch wires (AJ Wilcock, Hay Mills, Birmingham, England).



(a) (b) (c)

Figure 3: T loop(a) and KSIR loop(b & c) in case 1 and case 2 respectively

Treatment Outcome

The post treatment extraoral photographs show good profile changes (figure 4). The intraoral photos show Class I molar and canine relationship with good intercuspation (figure 4). The prefinishing radiographs depicted in figure 5. The post treatment cephalometric readings showed normalised incisor inclinations, reduced ANB, Wits, NA-Pog, A to B perpendicular on FH. sagittal readings indicating reduction in convexity (table 1).

Figure 4: Post treatment extraoral and intraoral photogarphs of case 1.

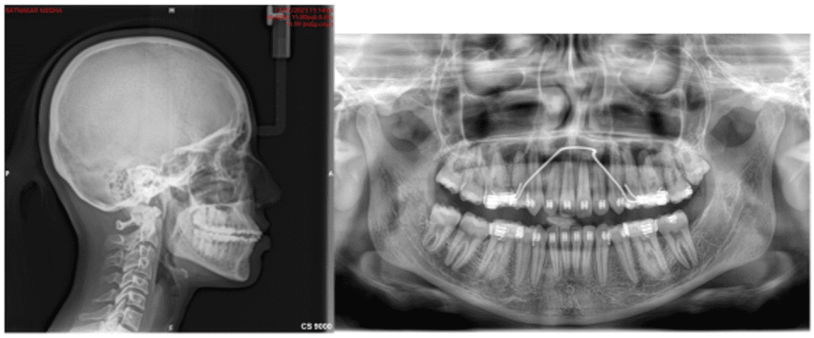


Figure 5: Prefinishing Lateral Cephalogram and OPG of Case 1

Follow up

Post 1 year follow up radiographs and clinical examination shows good stability of the orthodontic corrections (figure 6).

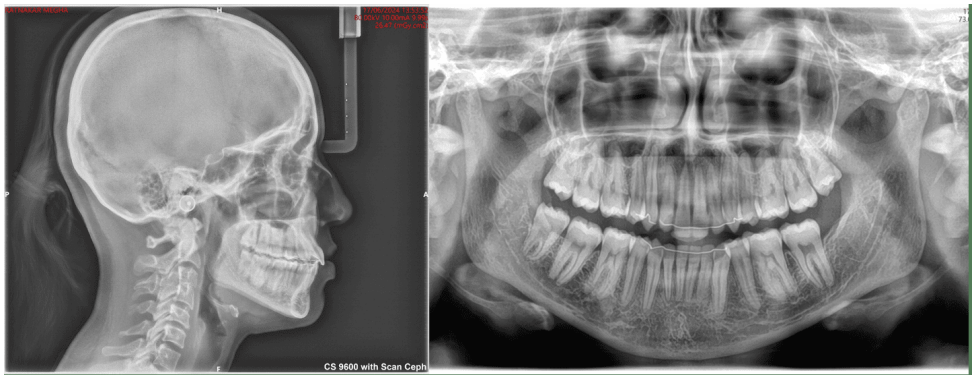


Figure 6: 1 year post treatment Lateral Cephalogram and OPG of Case 1

Table1. Caphalometric parameters of case1

Cephalometric parameters	Norm values	Pre treatment	Post treatment
SNA	82 ±2	79	79
SNB	80 ±2	81	81
ANB	2	2	2
SN-MP	32	32	29
U1-NA	22/4	45, 10mm	34,13mm
L1-NB	25/4	32, 6mm	22,4mm
Interincisal angle	135	103	132
IMPA	90± 5	103	92

Case 2: A 22 years old, female patient reported to the department of orthodontics and dentofacial orthopedics with the chief complain of forwardly placed teeth in the upper front region of the jaw. On general examination, she presented with the ectomorphic body type,normal gait and posture. Extraoral examination reveals brachycephalic headtype,leptoproscopic face and straight profile, potentially competent lips with incisor exposure of 4mm seen at rest. Intraoral examination reveals Angles class II molar relation on right side and endoon relation on left side and class II canine on both sides (figure 7) with 10mm of overjet and 5mm of overbite.

Figure 7: Pre treatment extraoral and intraoral photographs of case 2.

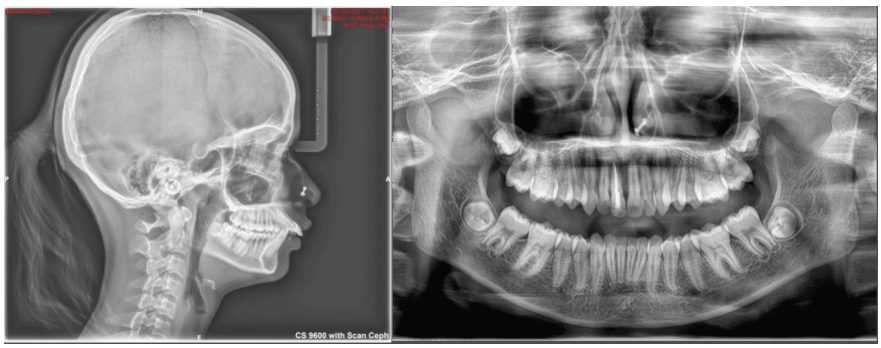


Figure 8: Pretreatment Lateral Cephaolgram and OPG.

Diagnosis

Pretreatment radiographs are depicted in figure 8. Cephalometric analysis indicated a moderate skeletal class II with matching soft tissues and a hypodivergent growth pattern. Maxilla normal in size with 5mm of dorsal placement, and mandible decreased in size by 3.5mm and normally placed. On Boltons analysis, maxillary overall excess was found. On discrepancy analysis, space requirement in maxillary and mandibular arches was 14mm and 8mm respectively.

Treatment Progress

Extraction line of treatment was chosen with the extraction of only maxillary first premolars in both the arches. Fixed mechanotherapy using 0.22" MBT prescription pre adjusted appliance (Gemini, 3M Unitek, Monrovia, CA, USA). After initial levelling and aligning using nickel titanium archwires (Orthoforce G4, Nickel Titanium, G & H, Franklin, IN,USA) 0.016 inch round, 0.017 x 0.025 inch the wires were stepped up to 0.017 x 0.025 inch stainless steel. Retraction was performed on 0.017x 0.025 inch TMA, KSIR loop (figure 3). Finishing was achieved on 0.016 inch round stainless steel arch wires (AJ Wilcock, Hay Mills, Birmingham, England).

Treatment Outcome

The post treatment extraoral photographs show good profile changes (figure 9). The intraoral photos show Class I molar and canine relationship with good intercuspation (figure 9) with reduction in overjet and overbite. The pre finishing radiographs depicted in Figure 10. The post treatment cephalometric readings showed normalised incisor inclinations, reduced ANB, Wits, NA-Pog, A to B perpendicular on FH. Sagittal readings indicating reduction in convexity (table 2).

Figure 9: Post treatment photographs of Case 2

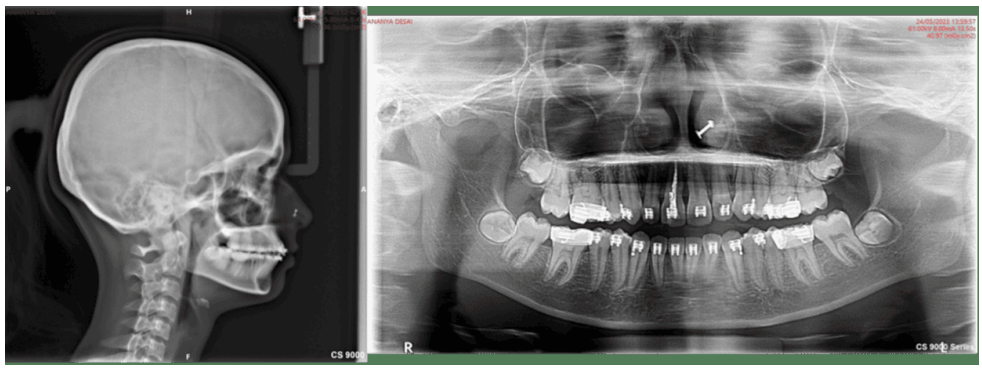


Figure 10: Prefinishing lateral Cephaolgram and OPG

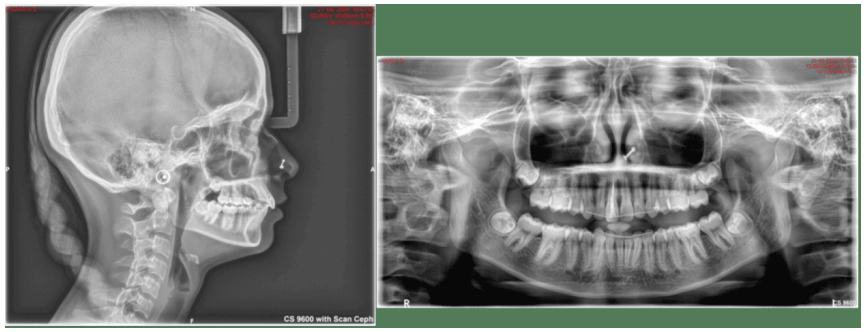


Figure 11: 1year Post treatment Lateral Cephalogram and OPG of case 2

Table 2. Cephalometric parameters of Case 2.

Cephalometric parameters	Norm values	Pre treatment	Post treatment
SNA	82 ±2	86	81
SNB	80 ±2	82	80
ANB	2	4	1
SN-MP	32	18	26
U1-NA	22/4	43, 11mm	35,7mm
L1-NB	25/4	31, 4mm	30,5mm
Interincisal angle	135	101	113
IMPA	90± 5	112	105

Discussion

Malocclusions can be treated in several ways according to the characteristics associated with the problem, such as the anteroposterior discrepancy, age and complications of each patient.[3]

In both the cases, the patient was treated with frictionless mechanics. The extractions only of first premolars in case 2 was planned because no significant discrepancies existed, or severe crowding of the mandibular arch which coincides with what was proposed by Strang and Bishara in 1995.[4,5].

It was necessary to place transpalatal bar to support the retraction of the anterior segment, however, despite we obtained acceptable results, loss of posterior anchorage was present and it limited the full retraction of the anterior segment and the consequent mesialization of the first upper molars even while maintaining treatment with the transpalatalbars. The latter would have justified the use of labial miniimplants to achieve all necessary retraction and avoid mesialization of the posterior segment, given that there are studies that support the advantages of the use of these devices as maximum anchorage.[6] One of the main facial considerations in this patient when we decided to perform extractions of the upper premolars was to maintain the profile and the position of the upper lip. At the end of the treatment changes were minimal in the position of the upper lip after removal of the upper premolars and the retraction of the upper incisors.

Another factor that helped maintain the profile was the position of the upper incisors, which had minimal changes in their labio-palatal inclination. These results are consistent with those reported by the studies of Bokas and Scott [7,8] There are yet to be available retention data of medium or long term

stability in this case, however, we must be prepared to contain a possible relapse due perhaps to the proclination of the upper teeth and the retroclination of the lower anterior teeth, which would increase the overjet as reported by Fidler in 1995.[9] To avoid this problem, it is suggested that according to the technique employed to perform fibrotomies of the teeth involved in the treatment.[10-12]

Follow-up

Case 1 and 2 were given removable beggs wrap around retainers and fixed lingual bonded retainers in both the arches, and followed up after 1year of the post treatment. One year follow up radiographs depicted in Figure 11. At the one-year post-treatment assessment, patient had broken bonded fixed retainer in the upper arch between 12 and 13 with the spacing evident on the radiographs. Both patients had stable occlusion, overjet and overbite, a pleasant facial profile, with no clinically significant recurrence. Radiographic evaluation revealed stable incisor inclinations and acceptable root parallelism without evidence of root resorption. The treatment results were maintained satisfactorily during the follow-up period.

Conclusion

Frictionless loop mechanics using T-loops and KSIR loops offers an effective and biologically sound approach for anterior retraction in Class II Division 1 malocclusion. In the current case series, segmented mechanics produced controlled space closure, normalization of incisor inclinations, reduction of overjet and overbite, improvement in facial profile, and establishment of stable canine and molar relationships. The lack of friction during activation allowed delivery of predictable force systems, which improved the quality of tooth movement and overall treatment outcomes.

Clinical Implications

When compared to traditional sliding mechanics, T-loops and KSIR loops allow for greater control over the strength and direction of forces. They help in maintaining anchorage, prevent uncontrolled tilting, and control torque loss of anterior teeth during retraction. Patients with severe proclination, deep bites, and extraction-based treatment approaches where exact space closure is necessary benefit most from these mechanics.

Limitations: The follow-up period was limited, and long-term post-retention stability could not be assessed.

Source of Funding: No

Conflicts of Interest: NO

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