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CASE REPORT

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Distalization of the entire maxillary arch with mini-implants in the posterior palatal alveolus- A case report

Distalização de todo o arco maxilar com mini-implantes na região alveolar posterior palatina - Relato de caso

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ABSTRACT

A 22 year old male patient reported to the hospital with a chief complaint of forwardly placed teeth. On examination patient had Angle's Class I malocclusion and proclination of the anterior teeth. There were signs of frictional keratosis on the buccal mucosa. Treatment plan was to extract the third molars alone and distalize the entire maxillary arch with palatal mini-implants. 0.022 MBT brackets were bonded on the buccal aspect. 0.019" x 0.025" stainless steel wire was placed sequentially. Mini-implants were placed on the posterior alveolus on the palatal surface of maxilla. Retractive force was applied from an attachment bonded on the palatal aspect of the maxillary canine. Patient was reviewed periodically. Comparison of pre-treatment and post-treatment results revealed that the entire maxillary arch intruded and translated distally with a counter-clockwise rotation of the mandible with reduction in LAFH. There was a mild reduction in inter-canine with marginal expansion in the premolar and molar region. An improvement in facial profile was noted with no sign of root resorption. Thus, the posterior alveolus may be considered as a new and appropriate site for placement of mini-implant to bring about distal movement of the entire maxillary dentition.

KEYWORDS

Orthodontic anchorage procedures; Bone screw; Palate.

RESUMO

Um Paciente do sexo masculino, 22 anos, foi encaminhado ao hospital com queixa principal de dentes posicionados para a frente. Ao exame clínico o paciente apresentava má oclusão de Classe I de Angle e inclinação vestibular dos dentes anteriores. Havia sinais de queratose friccional na mucosa bucal. O plano de tratamento foi extrair os terceiros molares e distalizar todo o arco maxilar com mini-implantes por palatino. Bráquetes MBT 0,022 foram colados por vestibular. Fio de aço inoxidável 0,019 "x 0,025" foi colocado seqüencialmente. Mini-implantes foram instalados na região alveolar posterior da superfície palatina da maxila. A força de retração foi aplicada a partir de acessórios colados nas faces palatinas dos caninos superiores. O paciente foi reavaliado periodicamente. Os resultados da comparação pré-tratamento e pós-tratamento revelaram que todo o arco maxilar intruiu e transladou distalmente com rotação da mandíbula no sentido anti-horário com redução da AFAI. Houve uma ligeira redução na distância intercanina com expansão marginal nas regiões de pré-molar e molar. Foi percebida melhora no perfil facial sem sinal de reabsorção radicular. Assim, a região alveolar posterior pode ser considerada como um novo e apropriado local para instalação de mini-implante para promover movimento distal de toda a dentição maxilar.

PALAVRAS-CHAVE

Procedimentos de ancoragem ortodôntica; Parafuso ósseo; Palato.

INTRODUCTION

Although there are several ways to treat patient with mild arch length tooth size discrepancy, group distalization, otherwise called total arch distalization using mini implant may be considered as a better treatment option compared to proximal stripping and second premolar extraction since there is no loss of tooth material. Group distalization may be performed with buccal [1-3] or palatal mini-implants [4-6]. Some clinicians are skeptical with the use of buccal mini-implants for group distalization as they are placed in areas with limited inter-radicular bone width and may cause loosening and dis-lodgement due to root proximity. Palatal mini-implants may be considered in such situations due to better biologic and anatomic conditions resulting in a greater success rate. The safe sites for placement of mini-implant in the palate are the area around the mid-palatal suture, anterior alveolus especially the canine region and posterior palatal alveolus [7-11].

Although there are several techniques that employ palatal mini-implants, many of these require extensive laboratory procedure which may be time-consuming, requires extended chair side time for placement, may involve distal movement of the maxillary first permanent molars alone and may be accompanied with increased patient discomfort [12-17]. Modified C palatal plate [5,6] and modified palatal anchorage palate [4] are the only palatal anchorage systems that bring about group distalization. To overcome the difficulties encountered with the above systems, we contemplated on a retraction mechanics that would be simple and effective and bring about distal movement of the entire maxillary dentition.

The area between the second premolar and first permanent molar in the posterior alveolus on the palatal side of the maxilla has sufficient cortical bone thickness, bone depth and inter-radicular bone width [8,9] and is suitable for mini-implant placement. A retractive force applied bilaterally from an attachment bonded to the lingual surface of the permanent maxillary canine to the mini-implant would probably bring above distalization of the entire maxillary dentition.

The bio-mechanical principle involves placement of the retractive force through the centre of resistance (Cres) of the maxillary dentition. The Cres of the entire maxillary dentition lies above the apex of the premolars [18]. If the length of the attachment is at the same height as the mini implant, application of a distalizing force will results translation of teeth if it passes through the Cres (Figure 1). If it passes above or below the Cres canting of the occlusal plane may occur.

This article describes the treatment of a young male patient with convex profile, Angle's Class I molar relation with bimaxillary proclination treated with third molar extraction and group distalization/ total arch distalization using mini-implants on the palatal aspect.

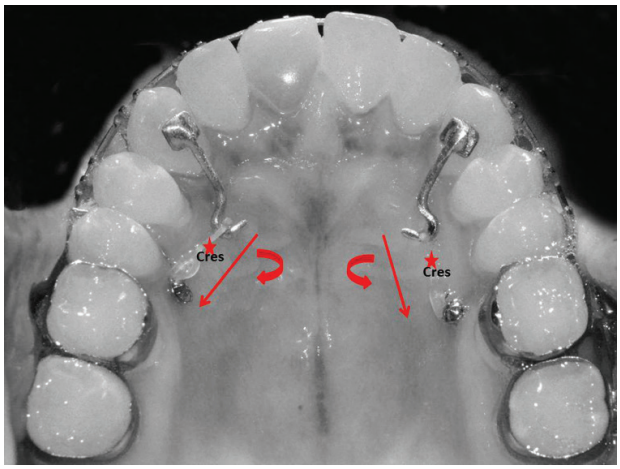

Figure 1 - Biomechanical principles involved when distal movement of the entire maxillary arch is performed from an attachment on the canine to a mini-implant placed between the second premolar and first permanent molar at the posterior alveolus of the palate.

CASE REPORT

DIAGNOSIS AND ETIOLOGY

A young male patient aged 22 years reported to the hospital with a chief complaint of forwardly placed teeth. Extraoral examination (Figure 2a-2c) revealed convex profile, average growth pattern, acute nasolabial angle, shallow mentolabial sulcus, deficient chin and mildly increased lower facial height. Intraoral examination (Figure 2d-2j) revealed an Angle's Class I molar relation with mild spacing of the upper anterior teeth and proclination of the upper and lower anterior teeth. Patient had an overjet and overbite of 3mm and 1mm respectively. Patient had a temporary crown in the upper right central incisor. There were signs of frictional keratosis on the buccal mucosa due to buccal tipping of the maxillary third molar.

Analysis of pre-treatment lateral cephalogram (Table 1, Figure 3) showed skeletal Class II malocclusion (ANB = 5°, Wits appraisal = 4mm) with a prognathic maxilla (SNA = 85°), orthognathic mandible (SNB = 80°), average growth pattern (GoGn to Sn = 31°, FMA = 25°), moderate proclination of upper anterior teeth (U1

to NA (Linear) = 7mm, U1 to NA (angular) = 33°, U1 to palatal plane = 56°), severe proclination of the lower anterior teeth (L1 to NB (Linear) = 12mm, L1 to NB (angular) = 41°, IMPA = 113°) and protrusive lips (Upper lip to S line = 2mm, Lower lip to S line =10mm).

Table 1 - showing comparison of pre-treatment and post-treatment cephalometric measurements

Parameter		Norm	Pre-treatment	Post-treatment	Change
Skeletal					
SNA (°)		82	85	85	0
SNB (°)		80	80	80	0
ANB (°)		2	5	5	0
Wits (°)		0	4	4	0
Go-Gn to Sn (°)		32	31	29	2
FMA (°)		25	25	23	2
Go-Gn to palatal plane (°)		25	23	23	0
Angle of inclination (°)		85	89	89	0
Dental					
U1 to NA (Linear) (mm)		4	7	4	3
U1 to NA (angular) (°)		22	33	28	5
L1 to NB (Linear) (mm)		4	12	10	2
L1 to NB (angular) (°)		25	41	39	2
Inter-incisal angle (°)		130	102	116	-14
U1 to palatal plane (°)		70±5	56	60	-4
U6 to palatal plane (°)			92	92	0
U4 to palatal plane (°)			100	97	3
IMPA (°)		90-96	113	111	0
U6 to pterygoid vertical (mm)	Crown tip (Distal surface)		22	17	5
	Furcation		27	22	5
	Distal root tip		24	18	6
U4 to pterygoid vertical (mm)	Crown tip (Distal surface)		41	35	5
	Root tip		41	37	4
U1 to pterygoid vertical (mm)	Incisal tip		65	55	10
	Root tip		50	44	6
$U6_{Cres}$ to palatal plane (mm)			15	13	2
$U4_{Cres}$ to palatal plane (mm)			14	12	2
$U1_{Cres}$ to palatal plane (mm)			12	9	3
Soft tissue					
Nasolabial angle (°)		90-110, 102±8	97	103	-6
Mento-labial sulcus (mm)		-4±2	6	5	1
Upper lip to S line (mm)		0	2	2	0
Lower lip to S line (mm)		0	10	10	0
Root resorption					
Transverse change					
Inter-canine width(mm)			35	32	3
Inter-premolar width(mm)			35	37.5	-2.5
Inter-molar width(mm)			46.5	47	-0.5

The pretreatment panoramic radiograph (Figure 4) revealed presence of third molars in all four quadrants with mild spacing in the upper anterior teeth. Although the patient had a temporary crown in the upper right central incisor there was no evidence of root canal treatment. Vitality tests revealed a vital pulp in the upper right central incisor.

Model analysis showed a mild arch length tooth size discrepancy of 3mm and 10mm in the upper and lower arch respectively.

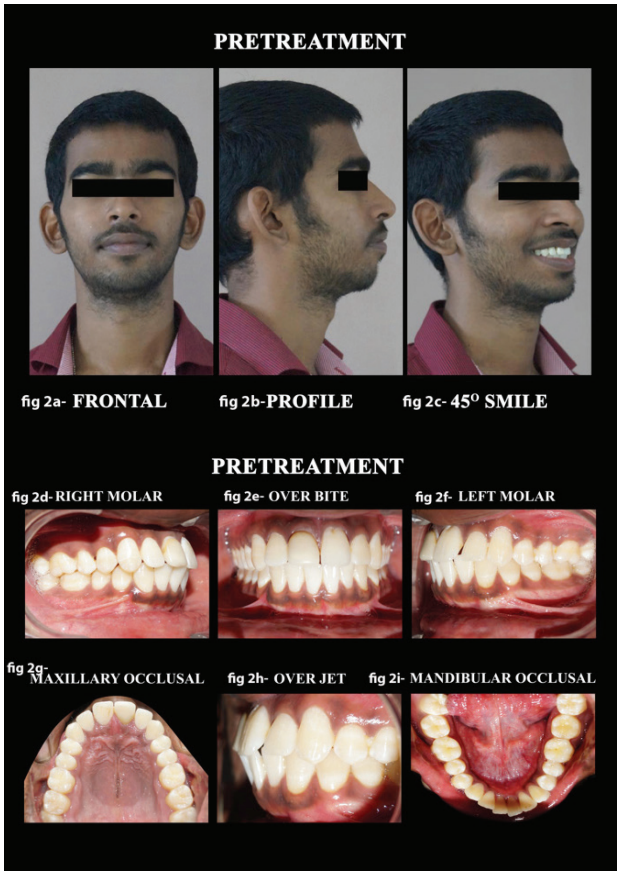

Figure 2 - a-c: Pre-treatment extraoral photographs. d–i: Pre-treatment intraoral photographs.

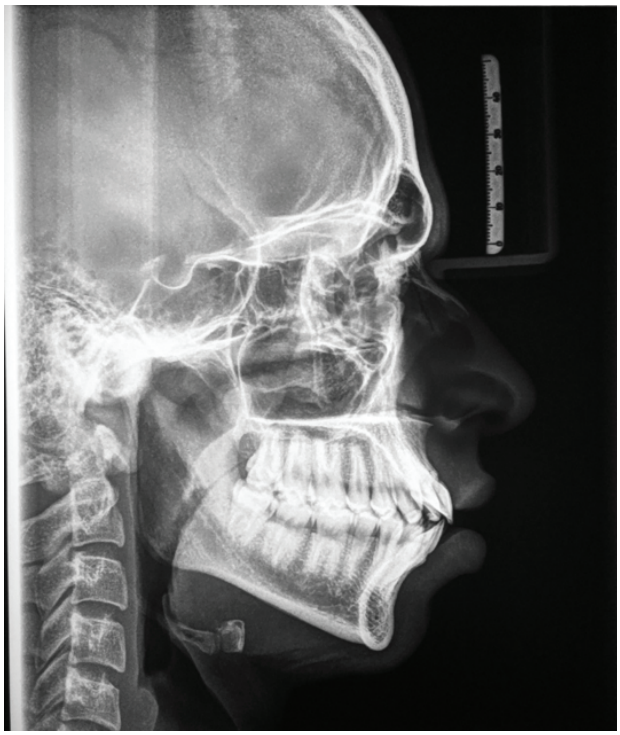

Figure 3 - Pre-treatment lateral cephalogram.

Figure 4 - Pre-treatment panoramic radiograph.

TREATMENT OBJECTIVES

Treatment objectives were to camouflage skeletal Class II malocclusion as patient was not willing for orthognathic surgery. The objectives were to improve facial profile, obtain optimal inclination of upper and lower anterior teeth. The other objectives were to close upper anterior spacing, achieve normal overjet and overbite, maintain Angle's Class I molar relation, reduce proclination in the upper and lower arch and achieve good esthetics and soft tissue profile.

TREATMENT ALTERNATIVES

As the patient had a skeletal Class II malocclusion orthognathic surgery would have resulted in a significant change in facial appearance. Since the patient was not willing for orthognathic surgery the next option would be extraction of the premolars in all four quadrants to correct axial inclination. However, the patient was worried about the premolar extraction spaces and therefore hesitant towards extraction of premolars. Proximal stripping may be performed to gain space, but this may sometimes result in proximal caries or improper contacts due to ledge formation.

Hence, group distalization was contemplated to correct the axial inclination of the maxillary anterior teeth, close the anterior spaces, maintain Class I molar relation with improvement in soft tissue profile. For effective group distalization, third molars were extracted in all four quadrants. The patient had frictional keratosis due to the buccally tipped third molars and therefore indicated for extraction. Now, group distalization in the maxillary arch can be done with mini-implants in the buccal or palatal aspect or with extra-radicular implants. The buccal placement of mini-implants in the maxilla was not considered in this patient due to the minimal inter-radicular width between the maxillary second premolar and the first permanent molar. Extra-radicular implants were not contemplated as the location of the sinus lining appeared to be close to the roots of the maxillary molars on the radiograph. Therefore, group distalization was performed with palatal mini-implants in the upper arch and buccal mini-implants in the lower arch.

TREATMENT PROGRESS

Prior to the initiation of orthodontic treatment, the patient was referred to the oral surgeon for extraction of third molars. 0.022" MBT brackets were bonded on the buccal aspect. Buccal tubes were bonded on the second molars on either side in the upper and lower arch. Leveling and aligning was done. The entire

maxillary arch was consolidated as one segment with a 0.019" x 0.25" stainless steel wire.

Topical anaesthesia was applied on the palatal aspect in the region of mini-implant placement. 1mm of local anaesthesia was injected. After 5minutes, 1.2mm x 8mm indigenous mini-implants were placed palatally in the posterior alveolus between the second premolar and permanent first molar bilaterally. Primary stability is achieved.

An attachment with a long hook was bonded on the palatal aspect of both the maxillary canines at the cingulum. Bonding the attachments more occlusally may produce interference from the mandibular canine. 200 grams of force was placed by means of elastomeric chain from the mini-implants to the palatal attachment (Figure 5). In the mandibular arch 0.018" x 0.025" stainless steel wire was placed. Attachments are soldered between the lateral incisor and canine. Mini-implants are placed bilaterally on the buccal aspect between the mandibular second premolar and permanent first molar. Retractive force was placed in the lower arch from an attachment placed between the mandibular lateral incisor and canine to the mini-implant bilaterally. The mini-implant on the lower left quadrant became loose during the course of retraction and had to be removed and replaced. Mid-treatment panoramic radiograph shows the palatal mini-implants in place in the upper arch (Figure 6).

The patient was reviewed periodically until axial inclination was corrected. Finishing, detailing and settling were done. The appliance was debonded, intraoral and extraoral photographs (Figure 7) and post-treatment lateral cephalogram (Figure 8), panoramic radiograph (Figure 9) and dental casts were taken. Modified Essix retainer was given in the upper arch (Figure 10a) and lingual bonded retainer was given in the lower arch (Figure 10b). Sagittal and vertical change was measured on the lateral cephalogram and transverse change was measured on the casts. The linear distance from the cervical region, the root apex and furcation (only for the molar) to the pterygoid vertical were measured for the maxillary first permanent molar, first premolar and incisor to determine whether translation or tipping of the tooth occurred. Treatment duration was two years three months.

Figure 5 - Intraoral photograph showing placement of distalizing force from the mini implants placed on the palatal aspect between the maxillary second premolar and permanent first molar and an attachment bonded to the palatal aspect of the maxillary canine.

TREATMENT RESULTS

Pre-treatment and post-treatment cephalograms were compared to evaluate treatment change (Table 1). There was no change in the maxillary and mandibular skeletal base. The entire maxillary arch intruded with a counter-clockwise rotation of the mandible with reduction in lower anterior facial height. Retraction of the maxillary and mandibular anterior teeth was noted. There was distal tipping of the maxillary first premolar and first permanent molar. Dental cast analysis revealed that there was a mild reduction in inter-canine width with marginal expansion in the premolar and molar region (Table 1). The first permanent molar, second premolar and incisor were evaluated for bodily movement. All the teeth showed translation with movement of the crown and root relative to the pterygoid vertical. An improvement in facial profile was noted. There was mild constriction of the arch in the canine region and mild expansion in the

premolar and molar region (Table 1). Post-treatment panoramic radiograph did not reveal any evidence of root resorption.

Superimposition of pre-treatment and post-treatment cephalogram showed distalization of the maxillary and mandibular molars, retraction and intrusion of both the maxillary incisors and permanent first molars with improvement in soft tissue profile (Figure 11).

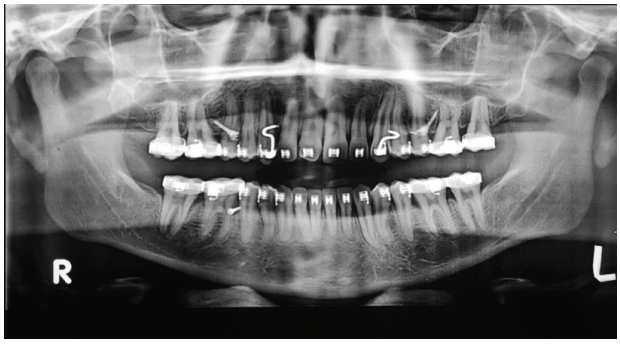

Figure 6 - Mid-treatment panoramic radiograph showing the mini-implants in place.

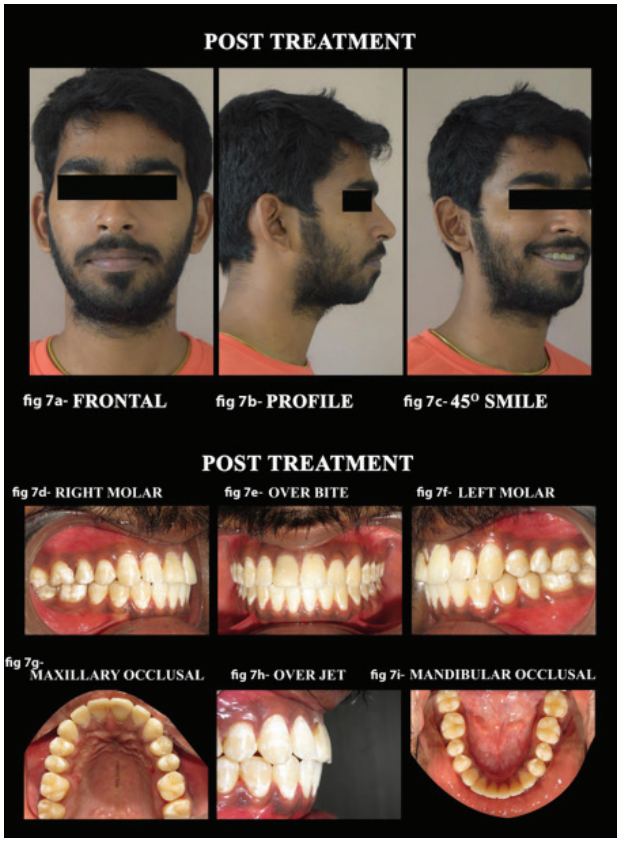

Figure 7 - a-c: Post-treatment extraoral photographs. d-i: Post-treatment intraoral photographs.

Figure 8 - Post-treatment cephalogram.

Figure 9 - Post-treatment panoramic radiograph.

Figure 10 - a: Modified Essix retainer in the upper arch. b: Fixed lingual bonded retainer in the lower arch.

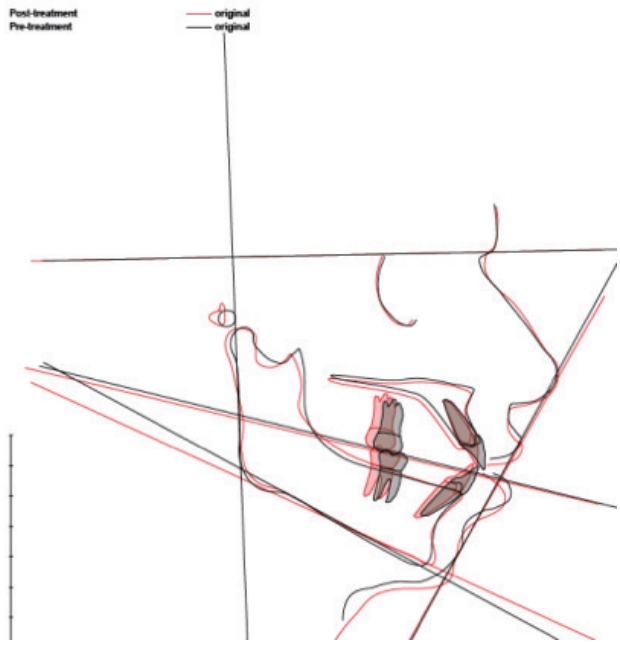

Figure 11 - Superimposition of pre-treatment (Black) and post-treatment cephalogram (Red).

DISCUSSION

The patient had a convex profile with mild/moderate arch length tooth size discrepancy in the upper and lower arch. The aim was to correct the malocclusion but avoid extraction of healthy and functional teeth such as the premolars as opposed to impacted or buccally placed third molars that would require extraction at a later stage.

Group distalization may be done with buccal or palatal mini-implants as anchorage. However, buccal mini-implants may loosen due to root proximity resulting in failure and subsequent replacement. To overcome this problem mini-implant may be placed on the palatal aspect where there was thick keratinized mucosa, sufficient cortical bone thickness, inter-radicular bone width and thickness. Existing literature shows that the modified 'C' palatal plate and modified palatal anchorage plate was the only appliance that brought about group distalization [5,6]. However, these appliances are bulky requires elaborate lab work and increased patient discomfort.

A distal force from an attachment bonded to the lingual aspect of the maxillary canine may help in eliminating cumbersome laboratory procedures. Therefore, alternate sites for mini-implant placement were evaluated. The posterior alveolus between the second premolar and maxillary first permanent molar on the palatal aspect was considered safe and had sufficient inter-radicular width and good cortical thickness [8].

The mini-implant thus placed on the palatal aspect was stable at the end of treatment and did not show any signs of failure. The treatment outcome was similar to the other existing studies [4,5] using palatal mini-implant which showed distalization and intrusion of the maxillary first molar, improvement in nasolabial angle and upper lip retraction. Although the overbite in the present case was only 1mm at the start of treatment, intrusion of the maxillary dentition did not result in an open bite probably because of the counter-clockwise rotation of the

mandible. Interestingly, an earlier study [6], showed extrusion and uprighting of the maxillary incisors which was contrary to the current case which showed intrusion of the incisors. Thus, the method employed here may be contemplated in cases requiring intrusion in both the anterior and posterior region. Also, reduction in ANB angle was noted in previous studies but was not seen in the current case probably because of the simultaneous retraction in the upper and lower arch with concomitant remodeling of bone.

Most studies [12-14,19,20] existing in literature involve procedures that use palatal mini-implants to bring about distalization of the maxillary first permanent molar followed by retraction of the remaining anterior teeth. The magnitude of molar distalization in these studies [12-14] were slightly less ranging from 3.45mm to 4.7mm compared to the treatment change of 5mm in the present case. However, the zygoma gear [19] and the zygomatic plate [20] produced molar distalization greater than 5mm. The modified palatal anchorage plate which resulted in distalization of the entire arch produced molar distalization varying from 3.06mm [4] to 4.22mm [5,6]. Group distalization with buccal mini-implants [1,3,] produced only minimal amount of maxillary first permanent molar movement varying from 1.4mm to 1.7mm.

The mechanics of retraction varied from those of other studies [1-3,4-6]. The maxillary arch and mandibular arch were individually consolidated as one unit with the placement of 0.019”X0.025” stainless steel wire in the brackets bonded on the buccal aspect. Placement of a retractive force as described in this study caused the entire maxillary arch to move distally. It was not necessary to change the position of the mini-implant during the course of retraction as it was placed on the palatal aspect were the inter-radicular space between the second premolar and first permanent was wide.

Occlusal interference on the canine attachment from the lower canine could be a limitation in severe deep bite cases. Care should be taken to prevent trauma to the greater palatine vessels as this might cause bleeding with hindrance to mini implants placement. Sometimes short inter-bracket distance may require repeated activation.

CONCLUSION

The posterior alveolus of the palate is a good alternative site for implant placement to bring about distal movement of the entire maxillary arch. The biomechanics involved appears to produce good treatment results with less risk of mini-implant failure and lesser need for repeated procedures.

REFERENCES

1. Park HS, Lee SK, Kwon OW. Group distal movement of teeth using microscrew implant anchorage. Angle Orthod. 2005 Jul;75(4):602-9.
2. Yamada K, Kuroda S, Deguchi T, Takano-Yamamoto T, Yamashiro T. Distal movement of maxillary molars using miniscrew anchorage in the buccal interradicular region. Angle Orthod. 2009 Jan;79(1):78-84. doi: 10.2319/020408-68.1.
3. Bechtold TE, Kim JW, Choi TH, Park YC, Lee KJ. Distalization pattern of the maxillary arch depending on the number of orthodontic miniscrews. Angle Orthod. 2013 Mar;83(2):266-73. doi: 10.2319/032212-123.1. Epub 2012 Sep 12.
4. Sa'aed NL, Park CO, Bayome M, Park JH, Kim Y, Kook YA. Skeletal and dental effects of molar distalization using a modified palatal anchorage plate in adolescents. . Angle Orthod. 2015 Jul;85(4):657-64. doi: 10.2319/060114-392.1. Epub 2014 Sep 5
5. Lee SK, Abbas NH, Bayome M, Baik UB, Kook YA, Hong M, Park JH. A comparison of treatment effects of total arch distalization using modified C-palatal plate vs buccal miniscrews. Angle Orthod. 2018 Jan;88(1):45-51. doi: 10.2319/061917-406.1. Epub 2017 Oct 6.
6. Park CO, Sa'aed NL, Bayome M, Park JH, Kook YA, Park YS, Han SH. Comparison of treatment effects between the modified C-palatal plate and cervical pull headgear for total arch distalization in adults. Korean J Orthod. 2017 Nov;47(6):375-383. doi: 10.4041/kjod.2017.47.6.375. Epub 2017 Sep 29.
7. Lee JS. Applications of orthodontic mini implants. Quintessence Publishing Company. 2007. p 54. ISBN: 9780867154658.
8. Baumgaertel S. Quantitative investigation of palatal bone depth and cortical bone thickness for mini-implant placement in adults. Am J Orthod Dentofacial Orthop. 2009 Jul;136(1):104-8. doi: 10.1016/j.ajodo.2008.11.020.
9. Baumgaertel S. Cortical bone thickness and bone depth of the posterior palatal alveolar process for mini-implant insertion in adults. Am J Orthod Dentofacial Orthop. 2011 Dec;140(6):806-11. doi: 10.1016/j.ajodo.2011.05.020.
10. Winsauer H, Vlachojannis C, Bumann A, Vlachojannis J, Chrubasik S. Paramedian vertical palatal bone height for mini-implant insertion: a systematic review. Eur J Orthod. 2014 Oct;36(5):541-9. doi: 10.1093/ejo/cjs068. Epub 2012 Dec 4.
11. Park J, Cho HJ., Three-dimensional evaluation of interradicular spaces and cortical bone thickness for the placement and initial stability of microimplants in adults. Am J Orthod Dentofacial Orthop. 2009 Sep;136(3):314.e1-12; discussion 314-5. doi: 10.1016/j.ajodo.2009.01.023.

12. Cambiano AO, Janson G, Fuziy A, Garib DG, Lorenzoni DC. Changes consequent to maxillary molar distalization with the bone-anchored pendulum appliance. J Orthod Sci. 2017 Oct-Dec;6(4):141-146. doi: 10.4103/jos.JOS_66_17.

13. Cozzani M, Pasini M, Zallio F, Ritucci R, Mutinelli S, Mazzotta L, et al. Comparison of Maxillary Molar Distalization with an Implant-Supported Distal Jet and a Traditional Tooth-Supported Distal Jet Appliance. Int J Dent. 2014;2014:937059. doi: 10.1155/2014/937059. Epub 2014 Jun 11.

14. Suzuki EY, Suzuki B. Maxillary molar distalization with the indirect Palatal miniscrew for Anchorage and Distalization Appliance (iPANDA). Orthodontics (Chic.). 2013;14(1):e228-41. doi: 10.11607/ortho.982.

15. Maino BG, Gianelly AA, Bednar J, Mura P, Maino G. MGBM system: new protocol for Class II non extraction treatment without cooperation. Prog Orthod. 2007;8(1):130-43.

16. Pseiner BC, Wunderlich A, Freudenthaler JW. Upper molar distalization with skeletally anchored TopJet appliance. J Orofac Orthop. 2014 Jan;75(1):42-50. doi: 10.1007/s00056-013-0189-1. Epub 2014 Jan 19.

17. Gurgel Jde A, Pinzan-Vercelino CR, Bramante FS, Rivera AP. Distalization of maxillary molars using a lever arm and mini-implant. Orthodontics (Chic.). 2013;14(1):e140-9. doi: 10.11607/ortho.604.

18. Nanda R. Textbook on Biomechanics in clinical Orthodontics. Saunders, 1996. p 125. ISBN: 9780721627847.

19. Kaya B, Sar C, Arman-Özçirpici A, Polat-Özsoy O. Palatal implant versus zygoma plate anchorage for distalization of maxillary posterior teeth. Eur J Orthod. 2013 Aug;35(4):507-14. doi: 10.1093/ejo/cjs059. Epub 2012 Sep 11.

20. Kilkis D, Celikoglu M, Nur M, Bayram M, Candirli C. Effects of zygoma-gear appliance for unilateral maxillary molar distalization: A prospective clinical study. Am J Orthod Dentofacial Orthop. 2016 Dec;150(6):989-996. doi: 10.1016/j.ajodo.2016.05.010.

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