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ANCHORAGE REVISITED: CONVENTIONAL VERSUS IMPLANT

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ABSTRACT This study was undertaken to evaluate and compare the anchorage value of mini-implants against a unit of II premolar, I and II molar as anchor unit. 20 cases were treated with PEA appliance, wherein anchorage planning for 10 cases was using mini implants and for 10 cases using a consolidated unit of II pre molar, I and II molar, reinforced with Transpalatal Arch at I molar. Orthodontic study models were used in both the groups to observe pre and post anterior retraction changes. Post-treatment changes within and between groups were analyzed by Independent sample t test and Paired sample t test. The implant supported cases show negligible mesial molar movement as compare to consolidated unit of II pre molar, I and II molar cases. The results have been tabulated and discussed. It was concluded that, although implants are the absolute anchorage devices, ancorage loss in the unit of consolidated II pre-molar, I and II molar was not statistically significant.

KEYWORDS : Anchorage, Mini Implant, Bimaxillary protrusion

INTRODUCTION

The biology of the unique connection of teeth to bone through periodontal ligament is the key to what allows them to move and be moved. Periodontal ligament forms a very dynamic system and is constantly remodeling in response to normal forces of occlusion, also forming the basis to orthodontics. Orthodontic tooth movement is thereby, possible by careful manipulation of force that is used to guide the teeth into a new, improved position and better equilibrium. Thus, the goals of function, stability and esthetics are achieved in orthodontic treatment. To improve a good control over tooth movement and to resist any undesirable tooth movement, a perfectly devised anchorage system becomes inevitable. Multiple strategies have been developed to enhance anchorage. One of the most important events in modern history of orthodontic anchorage devices is the appearance of mini implants. The challenge to Newton's 3rd law (every action provokes reaction) can be achieved by means of skeletal anchorage, but the use of zygomatic ligatures, mini plates, etc., hasn't been so wide due to technical difficulties. With mini implants, absolute anchorage has been made available to all the orthodontists thanks to its simple method and to its satisfactory cost-benefit relation.[1-3] Advantages of this system include ease of insertion and removal of the screws, immediate early loading, low cost, and adequate anchorage support for orthodontic tooth movement. Clinical reports demonstrate the viability of using mini implants for skeletal anchorage to support a variety of orthodontic tooth movements.[4-6]

A number of previous workers have documented that premolars are the most commonly extracted teeth for orthodontic purposes.[7-9] Conveniently located between the anterior and posterior segments, premolar extractions would seem to allow for the most straightforward relief of crowding or the correction of an unacceptable interincisor relationship.[10] So, this study was designed to evaluate and compare the anchorage value of mini-implants against a unit of IInd pre molar, Ist molar and IInd molar as anchor unit in the retraction of six anterior teeth after Ist premolar extraction.

MATERIALS & METHODS

20 patients with skeletal class I, bimaxillary protrusion, average growth pattern malocclusion and high anchorage demand, requiring orthodontic treatment were selected. Pre-adjusted edgewise appliance, MBT 0.022" (3M unitek – Gemini) prescription, was used to treat the patients. After leveling and aligning was completed with NiTi arch wires and stabilized with stainless steel (SS) arch wires, cases were treated with enmass retraction of anterior teeth. In 10 cases, anchorage requirement was met by placement of mini implant (skeletal anchorage) in between second premolar and first molar in the buccal vestibular region, whereas in other 10 cases, anchorage planning for anterior retraction was done with consolidation of IInd premolar, Ist molar and IInd molar as anchor unit with a reinforcement using transpalatal arch.

The mini implants were placed under topical anaesthesia in the buccal cortical bone on the attached gingiva [11] between the second premolar and the first molar in the maxillary arch.[12] Published studies describe the site of insertion as midroot or at/beyond the root apex.[2,4] Implants used were, 8 mm in length and 1.5 mm in diameter. tapering, a button head, selfdrilling type. The button type of head prevents any impingement of elastomeric rings or ligature wires onto the soft tissue mucosa during retraction. They were made of titanium, manufactured by S.K. Surgicals of Pune, India. For the implant positioning, radiographic evaluation of the region between the second premolars and the first molars in the maxillary arch was done with the help of specially made gauge (jig) and IOPA. With the gauge in place, implant was slowly threaded in the gingiva from the jig-hole assessing the direction of implant and the buccal root prominences. Implant was driven until only the button head was visible in the vestibule and the implants were immediately loaded.

Retraction was carried out on 0.019 X 0.025 SS arch wires in both the mini implant and the non implant cases using a 6mm closed coil NITI springs delivering a force of about 250 – 300 gms. Arch wires were removed and the study models, photographs and lateral cephalograms were obtained, after six months, or after obtaining required retraction of the anterior segment, whichever happened earlier. Study models were used for the measurement of the anchorage loss if any by virtue of mesial movement of the molar in relation to the specified reference.

On each maxillary cast, a line through anterior raphe point and posterior raphe point was used to construct a median reference line. The median end of the distinct third rugae, which is considered most stable by Almeida M et al.[13], Bailey TJ et al.[14] and Hoggan BR & Sadowsky C [15], was marked. Then, the points needed for the measurements were marked on the mesial occlusal pit of the first permanent molars. The orthodontic study models were then scanned using a HP Scanner and a 1:1 reproduction of the occlusal surface of the plaster models was obtained. The image was then transferred to the software (Adobe photo deluxe, home edition 3.1), where the measurements were carried out.[16] Bringing the scale to 0 at the marked rugae to the occlusal pit was considered as A at the end of the study period, the same measurements were carried out which is B. The anchorage loss was assessed by subtracting A from B, which gave the amount of anchorage loss. The readings from the left and right side were calculated for an average to obtain the anchorage loss in that case.

Table 1: Anchorage loss in implant group in mm

S.no	Pre-treatment			Post-treatment			Difference
	Right	Left	Average	Right	Left	Average	
1	8	8.5	8.25	7.5	8	7.75	0.5
2	9.5	9	9.25	9	8.5	9.25	0.0
3	9	9	9	8	8.5	8.25	0.75
4	8	8	8	7.5	7.5	7.5	0.5
5	8.5	8	8.25	8.5	8	8.25	0.0
6	8	8.5	8.25	7.5	8	7.75	0.5
7	8	8	8	7.5	8	7.75	0.25
8	9	8.5	8.75	9	8	8.5	0.25
9	10	10	10	10	9.5	9.75	0.25
10	9.5	9	9.25	9	9	9	0.25
Mean	8.75	8.65	8.7	8.35	8.3	8.37	0.32
SD	0.75	0.62	0.66	0.88	0.59	0.75	0.24

Table 2: Anchorage loss in controi group in mm

S.no	Pre-treatment			Post-treatment			Difference
	Right	Left	Avg	Right	Left	Avg	
1	8.5	8	8.25	8	7	7.5	0.75
2	9	8.5	8.75	8	8	8	0.75
3	8	8.5	8.25	7	8	7.5	0.75
4	9	9	9	8	8	8	1.0
5	8.5	8	8.25	8	7	7.5	0.75
6	10.5	10	10.25	10	9	9.5	0.75
7	9.5	9	9.25	8.5	7.5	8	1.25
8	9	8	8.5	8	7	7.5	1.0
9	10	9.5	9.75	9	9	9	0.75
10	9	9	9	8.5	7.5	8	1.0
Mean	9.10	8.75	8.92	8.3	7.80	8.05	0.87
SD	0.74	0.68	0.68	0.79	0.75	0.68	0.18

Table 3: Comparison of anchor loss between Implant and Control groups using Paired Sample t test and Independent sample t test

Group	Pre	Post	Anchorage loss (pre-post)		Implant vs control**
			Mean ± SD	p value*	
Implant	8.70±0.66	8.37 ± 0.75	0.32 ± 0.24	0.002 (HSS)	0.001 (HSS)
Control	8.92±0.68	8.05 ± 0.68	0.87 ± 0.18	0.001 (HSS)	

DISCUSSION

The conventional way for retraction of anteriors includes II premolar and I molar as anchor unit. Anchorage preservation is the biggest challenge and despite the number of retraction biomechanical strategies, absolute or minimal anchorage loss schemes are not feasible in conventional way of retraction. Studies have been done including only I molars and II premolars as anchorage unit. Such a conventional pattern is useful in group B type of anchorage systems where molar mesial migration is necessary for space closure. In critical anchorage requirement such anchorage system fails to give absolute anchorage. So, we included II molars, and a trans-palatal arch in I molars to reinforce the anchorage.

The results show the mean anchor loss in implant group was 0.32mm with SD of 0.24mm which is practically and statistically non-significant(p value 0.002). Although implants are considered as absolute anchorage devices, still minimal amount of mesial migration was observed, which must be the result of physiologic mesial migration tendency of posterior teeth in six months duration. If we would have attached the implants to molar (indirect anchorage system) then probably no anchor loss would have been seen. The mean anchor loss in non-implant group was found to be 0.87mm with SD of 0.18mm which is statistically non-significant(p value 0.001).

The comparison between implant group and non-implant group reveals that, very minimal anchor loss was observed in implant group as compared to the non-implant group,implying that implants are the better source of anchorage system than the consolidated unit of II premolar, I molar and II molar. These results, when co-related with previous study done by Shrinivas et al [16] in 2012, show similar observation with implant group. They observed 0.65 mm anchor loss in implant group and 2.7 mm in conventional group. The conventional group consisted only I molar as anchor unit whereas in this study the non-implant group consisted of an additional II premolar and II molar. The addition of 2 more teeth in anchor unit reduced the amount of anchor loss. This also explains that more the root surface area involved in anchor unit more is the resistance and less is the anchor loss. The consolidated unit, though increased the resistance to migrate mesially, could not provide absolute anchorage system, but still it can be used in cases where implants are not indicated.

High anchorage requirement cases need perfect anchor unit to give excellent results. For example, camouflage for skeletal problems with borderline conditions is part and parcel of treatment planning, which needs perfect anchorage. In dentoalveolar Class II malocclusions, where absolute anchorage is required to maintain cusp to fossa relationship, implants can be used and an end-on relationship cases can be treated with a consolidated unit of II premolar, I molar and II molar. Same situations can be dealt in class III malocclusions.

Studies done by Saelens NA et al.[17] observed a 4.4 mm of mesial molar movement in upper first premolar extraction cases, Ong HB et al.[18] observed a mean anchorage loss at 3.7 mm and Geron et al.[19] found the mesial molar movement in the same upper first premolar extraction cases to be 3.9 mm. These values were far greater than 1.72mm as found in this study against the conventional treatment modality with the difference that, this degree of anchor loss was observed throughout treatment time.

Implants are easily available in market in various sizes, shapes, materials, and economic ranges, right choice is necessary for stability and to avoid the side effects. Titanium mini screws are to be used with minimum diameter of 1mm minimum for better stability. Other factors associated with stability are health of the peri-implant tissue, and cortical bone morphology. Reported success rate of TADs ranges from 80.5% to 95.2%. [20-23] However, there was no significant association between the success rate and the following variables: screw length, kind of placement surgery, immediate loading, location of implantation, age, gender, crowding of teeth, antero-posterior jaw base relationship, controlled periodontitis and TMJ symptoms.[24] Increased insertion depth increases retention, though shorter implants should be sufficient in most orthodontic force systems if placed at 90° to the cortical plate. Placement at 90° to the cortical plate is the most retentive insertion angle. The present study did not attempt to evaluate the stability of the implant.

CONCLUSION

Mini Implants are the absolute anchorage devices when compared with the consolidated unit of II premolar, I molar and II molar in retraction mechanics. Though consolidated unit of II premolar, I molar and II molar forms a good anchor unit, the mini implants were found to be the absolute form of anchorage. It was also found that when minimal anchorage loss is acceptable then instead of implants II molar inclusion in conventional anchorage system definitely reinforces the anchorage.

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