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To evaluate the use of modified power arm [Discopender 468] for efficient anterior teeth retraction - A clinical study

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Abstract: *Introduction:* Many new bracket prescriptions and Techniques have been developed and modified as treatment mechanics progress to create force system that can work efficiently and shorten the orthodontic treatment period. Aim of this study was to evaluate the use of modified power arm [Discopender 468] for efficient anterior Teeth retraction, to determine anchorage loss and upper incisor changes after space closure. *Material & Method:* Ten patients of class II division1were selected to need maxillary first premolars was extracted and the retraction of anterior teeth was carried out segmentally by using discopender468 which applies variable force with respect to height of power arm. To prevent anchor loss during anterior retraction we have placed the mini implant screw mesial to 1st molar bilaterally in maxillary arch. Pre and post lateral cephalograms were taken to determine the anchorage loss and upper incisor changes. *Result and Conclusion:* Anterior retraction carried out by a new design of discopender 468 and minim plant brings out controlled bodily tooth movement and also has variable force vectors, which is one of the variable method to use for retraction in Straight Wire Appliance in day to day orthodontic practices and also has advantage over conventional retraction mechanics.

Keywords: Modified Power Arm [discopender468], Sliding Hook, Miniscrew Implant.

Introduction

The demand for speedy and efficient orthodontic treatment has been increasing in recent years. Control of anterior tooth movement is essential for the orthodontists to execute an individualized treatment plan. The use of power arms attached to the arch wire enables one to readily achieve controlled movement of anterior teeth. That is, the force system for the desired type of tooth movement such as lingual crown tipping, lingual root tipping, or bodily movement can be easily carried out by attaching various heights of power arm to the arch wire [1].

Many studies have been done which shows that placement of power arm to the arch wire between lateral incisor and canine enables orthodontists to maintain better control of anterior teeth movement [2-4]. Noriaki yashida has introduced and presented a new power arm [Discopender 468, [5]. marketed by Biomaterial Korea by which it help us to engage elastic at various levels and various force vector can be applied as per our mechanical requirement. Getting inspired from his study we have designed a mechanics and used this new type of power arm (discopender 468). Also many manufacturers like Dentos, AO, and Rocky mountain have brought many modified power arms in the market. Hence the study has been under taken to evaluate the efficacy of modified power arm [Discopender 468] for controlled anterior tooth retraction.

Aims and objectives of study:

1. To determine rate of retraction.
2. To determine the anchor loss after space closure.
3. To determine upper anterior torque after space closure.

Material and Methods

Ten orthodontic patients were taken from the Department of orthodontics and Dentofacial Orthopaedics. The patients were of Class II division I malocclusion, requiring upper first premolar extraction as a part of orthodontic treatment.

Procedure: Ten selected patients were bonded with pre-adjusted edgewise appliance system (0.022 slot MBT prescription). Initial levelling and aligning was achieved with round and rectangular HANT arch wires with segmental approach. Maxillary arch was divided into three parts, one anterior segment & two posterior segments. After alignment a preformed 0.019 x 0.025 inch S.S segmental wire was ligated to six maxillary anterior teeth (UR3-UL3) &Posterior segment with 0.019 x 0.025 inch S.S wire. To prevent anchorloss during anterior `retraction we have place the mini implant screw (absoanchor/sk surgical) between second premolar and first molar bilaterally and a cantilever is prepared with 0.017x0.025 TMA wire and placed in the auxiliary tube and passively adapted to the implant for a maximum anchorage control Fig.1,2,3.

Fig-1: Biomechanics used in the study for efficient and controlled anterior teeth retraction

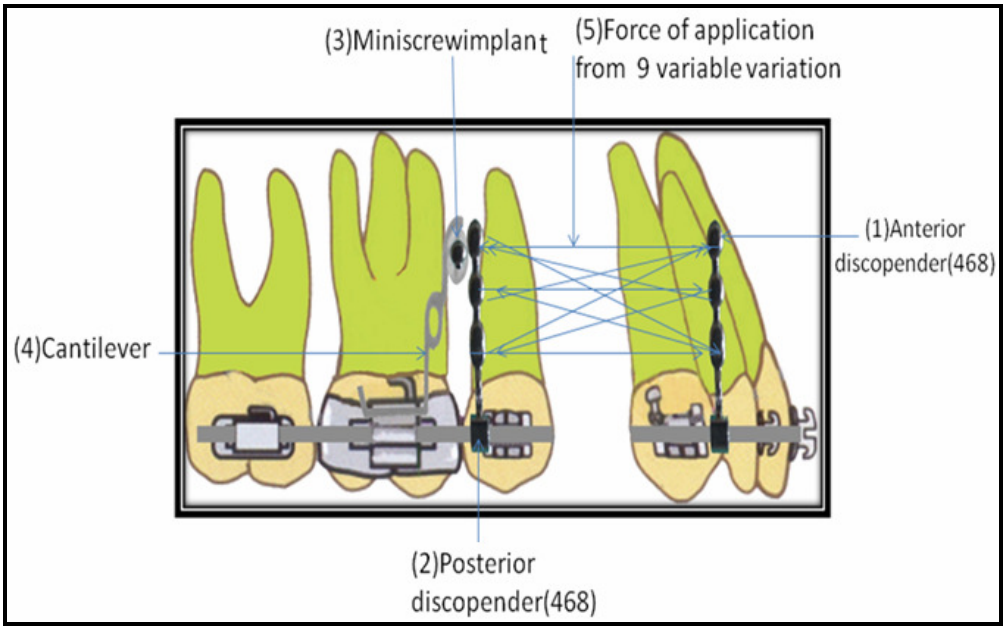


Fig-2: Biomechanics for retraction mechanics

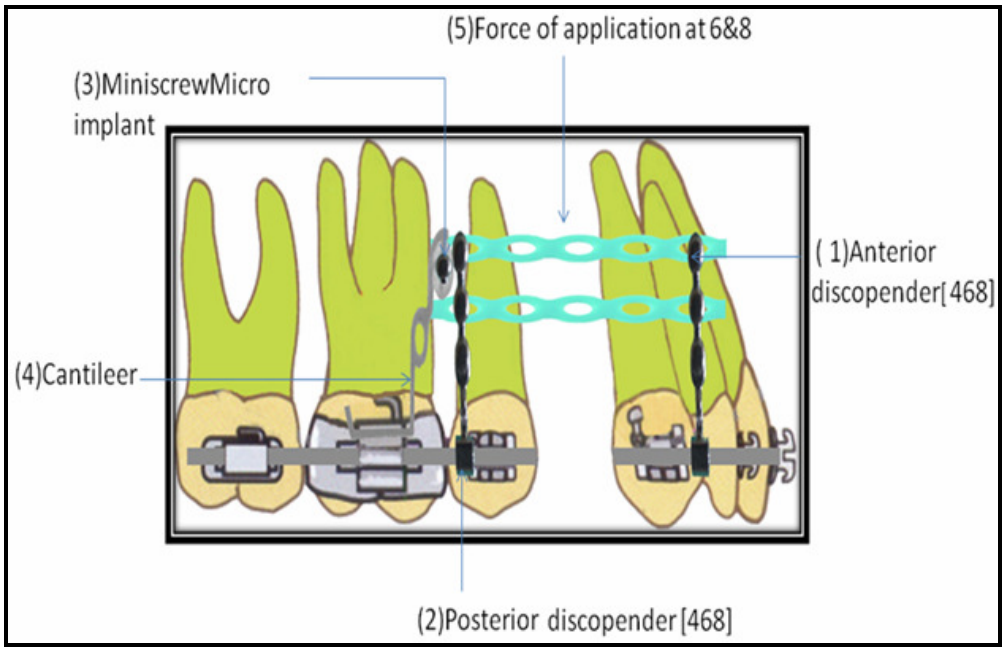
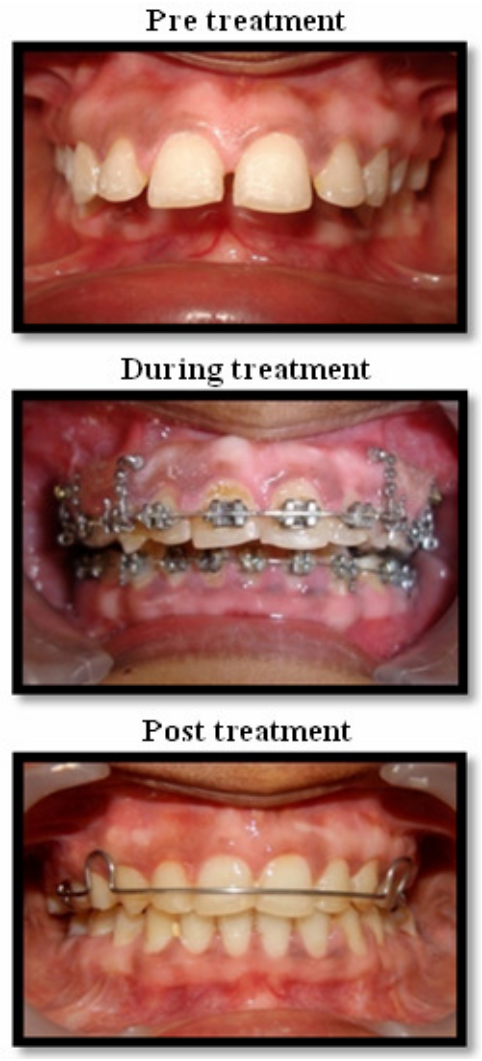


Fig-3: Intraoral Photograph



Then the modified power arm [Discopender 468] was placed mesial to canine that is between canine and lateral and one between mesial to molar that is between premolar and molar bilaterally on each side and a horizontal retraction force of 150gms was applied bilaterally for anterior retraction prestreatched e-chains were engaged between two modified power arms (anterior and posterior near the CRes for bodily movement that is between 6mm and 8mm hook) at 6mm and 8mm hooks to achieve the bodily movement. Sometimes various force vectors were used to get the desired results. Fig-2, 3.

Determination of rate of retraction: The rate of retraction was defined as the distance travelled, divided by the time required to complete space closure. This was recorded in millimeters per interval. An interval was defined as a 4week period. The widths of the extraction spaces were measured, and space closure and time of retraction were recorded. Measurements of the rate of retraction were recorded with a Vernier caliper.

Determination of Anchor loss after space closure: Pre and Post space closure lateral cephalometric radiographs were taken for all patients and the change in the position were superimposed and Anchorage loss was measured by marking Ptm vertical and measuring the distance from Ptm vertical to distal surface of first molar.

Determination of upper anterior changes after space closure: Pre and post space closure lateral cephalometric radiographs were taken for all the patients to evaluate torque change in upper incisors.

The following parameters were analyzed:

- Upper 1 to SN plane

Results

Ten orthodontic patients were selected. These patients were treated with 0.018 slot MBT prescription brackets and needed anterior teeth retraction with extraction of first premolar with maximum anchorage as a part of orthodontic treatment. In the present study we have evaluated the rate of retraction, anchor loss and upper incisor torque after space closure .The results were as follows:

Rate of retraction: Mean treatment duration of maxillary anterior En mass retraction was recorded at 6 months. Rate of retraction was calculated by measuring the post extraction space intra orally and dividing with the amount of time taken to close the space. Space was recorded every month till six months.

Kruskal Wallis Test shows: H = 0.168 (P=0.682).

The rate of retract ion of maxillary arch was not significant statistically Tab 1.

Comparing the retraction between right and left side of maxillary arch shows statistically not significant Tab 2.

Table-1: Mean Rate of Retraction values							
	M1	**M2**	**M3**	**M4**	**M5**	**M6**	
Left (SD)	1.14 (0.206)	1.17 (0.156)	1.13 (0.163)	1.13 (0.133)	1.15 (0.143)	1.15 (0.150)	**H=0.168 P=0.682**
Right (SD)	1.93 (0.168)	1.46 (0.140)	1.28 (0.099)	1.07 (0.128)	1.01 (0.064)	0.13 (0.389)	
Remarks							**Non Significant**
H and P value calculated by Kruskal Wallis Test							

Table-2: Comparing rate of retraction between left and right side						
	Mean	**SD**	**SEM**	**P Value**	**T value**	**Results**
Left	1.1433	0.0163	0.0067	0.4516	0.7869	NS
Right	1.1340	0.0230	0.10103			

Determination of Anchor Loss: Pre-treatment cphalograms and post space closure cephalograms were obtained and tracings were done. Vertical line was dropped from Ptm. And distance from distal of upper first molar was calculated. Difference in values of pre and post treatment cephalograms was the amount of anchor loss. In patients, the mean pre-treatment value is 20.1 mm while the mean post treatment value is 20.6mm which is suggestive of mesialmovement of molar is by -0.5mm, with 't' value of 1.861 and 'p' value is 0.0957 which shows that it is not significant Tab 3, 4.

Table-3: Pre treatment and Post space closure in patients in Ptm vertical to distal of U6	
Ptm vertical to distal of U6	**Mean**
Pre-tratment	20.1
Post-space closures	20.6

Table-4: Statistical Analysis of Pre and Post treatment of ten patient in Ptm vertical to distal of U6						
	Mean	**S.D.**	**S.E.**	**T**	**p**	**Remarks**
Pre-tratment	20.1	2.998	1.060	1.861	0.0957	NS
Post-space closures	20.6	2.914	1.027			

Upper incisor change:

1. *U1 to SN:* In patients the mean pre-treatment value is 116.8° while the mean post treatment value is 103.7° which is suggestive of incisor changes of 13.8°, with 't' value of 12.625and 'p' value is, <0.0001 which shows that it is highly significant Tab 5,6.

Table-5: Pretreatment and Postspace closure in patients in U1 to SN	
U1 TO SN	**Mean**
Pre-tratment	116.8
Post-space closures	103.7

Table-6: Statistical Analysis of Pre and Post treatment of ten patients in U1 to SN						
	Mean	**S.D.**	**S.E.**	**t**	**p**	**Remarks**
Pre-tratment	116.8	5.350	1.692	12.625	0.0001	HS
Post-space closures	103.7	3.234	1.023			

2. *U1 to ANS-PNS:* In patients the mean pre-treatment value is 125.4° while the mean post treatment value is 110.6° which is suggestive of incisor changes of 11.2°, with 't' value of 14.8 and 'p' value is <0.0001 which shows that it is highly significant Tab 7, 8.

Table-7: Pretreatment and Postspace closure patients in U1 to ANS- PNS

U1 to ANS-PNS	Mean
Pre-tratment	125.4
Post-space closures	110.6

Table-8: Statistical Analysis of Pre and Post treatment of ten patients in U1 to ANS-PNS

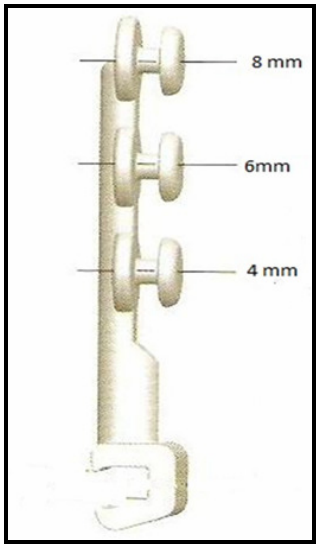
	Mean	S.D.	S.E.	t	p	Remarks
Pre-tratment	125.4	7.291	2.444	10.595	0.0001	HS
Post-space closures	110.6	3.563	1.136			

Discussion

Space closure in orthodontics, particularly those from tooth extractions, still represents a challenge to the professional in this area. It occurs mainly due to the increase in treatment time, patient discomfort, as well as the pursuit of excellence on the finishing stage. In the present study, we have used discopender (468) fig.4 which has got force of application point at 4,6,8 mm fig 5 and have applied the force of 150gms each side at 6 and 8mm and have got the desired bodily movement fig.2. To create a force system that can work efficiently and shorten the orthodontic treatment period.

Fig-4: Discopender 468

Fig-5: Discopender 468 (modified power arm)



The advantages of Discopender:

1. No friction, that allows speedy space closure
2. Controllable Tooth Movement can be easily performed using power arms with three consecutive hooks.
3. Capability to monitor orthodontic tooth movement
4. Force vector can be selected from 9 variation.

Retraction mechanics: There are various methods of determining the rate of retraction given by different authors Hayashi, Robert J. Herman, Hyo Sang Park, Lawrence P. Lotzof and Howard A. Lawrence P. Lotzof and Howard A. in their study, defined the rate of retraction as the distance travelled, divided by

the time required to complete space closure. This was recorded in millimeters per interval. An interval was defined as a 3-week period. The widths of the extraction spaces were measured, and space closure and time of retraction were recorded. Measurements were performed by direct-technique from stone casts obtained before and at the completion of retraction for each canine. Measurements of the rate of retraction were recorded with a Vernier caliper. The distance between the distal canine to the mesial second premolar to be recorded bilaterally with a Vernier caliper directly in the patient‘s mouth right after extraction and every month until the retraction is completed and rate of retraction is calculated by distance divided by time [6].

Hassan Noroozi in his study measured the distance between the canine cusp and the buccal cusp tip of the second premolar before and after retraction to measure the amount of retraction [7]. Treatment mechanics for space closure have mostly changed from closing loop mechanics to sliding mechanics, With the closing loop mechanics, activated loop forces would only work at the bracket level, whereas in sliding mechanics, retraction forces can be transferred to any height level on a power arm to move the tooth in a preprogrammed direction. Retraction force levels below and above the center of resistance will produce controlled crown-lingual tipping movement and controlled crown-labial movement, respectively. Meanwhile, bodily translation movement (lingual movement) will occur when the retraction force level is at the same level as the center of resistance [8].

Tariqu ansari evaluated the effectiveness of the power arm in bringing about bodily movement and also determine the idieal length of the power arm .concluded the attachment of the power arm at the cervicle third brought about maximum bodily movement, fallowed by middle and incisal third variation in length of power arm at different sites of attachment did not bring any change in the out come. Thus the point of attachment is critical in bringing about bodily movement. It is believed that different heights of retraction force on the power arm (lengths of power arm) could affect the degree and course of anterior tooth movement during retraction with sliding mechanics. Generally, the degree of rotation of the target tooth varied according to the different heights of retraction force on the power arm [9] In the present study, we have used discopender (468) which has got force of application point at 4,6,8 mm and have applied the force of 150gms each side at 6 and 8mm and have got the desired bodily movement.

Anchor loss: There are various methods of determining the anchorage loss given by different authors like Brent R. Hoggan, Storey and Smith, Aronsen, Lawrence P. Lotzof and Howard. Fine Anchorage loss is a reciprocal reaction that could obstruct the success of orthodontic treatment by complicating the anteroposterior correction of the malocclusion and possibly detracting from facial esthetics. Silvia Geron studied the factorial response which is responsible for the anchorage loss. For the measurement of anchorage loss heused two methods one is radiographic method in which he uses lateral cephalogram of pre and post treatment difference of the distal contact point of maxillary first molar to a line perpendicular to occlusal plane through sella [10]. Wook Heo did the comparison of the anchorage loss in En Masse retraction and two step retraction of maxillary anterior teeth in adult class I women patient. He also gave the different methods to calculate the anchorage loss by plotting ptm vertical and measuring the distance from 1st molar. There will be 1mm of anchorage loss in the upper molar [11].

In the present study, we took lateral cephalographs of prespace closure treatment and after space closure. Superimposition of cephalographs was done. And the horizontal distance from the pterygoid vertical to the distal surface of the first molar is measured to calculate the anchorage loss. In the study the mean pre-treatment value is 20.1 mm while the mean post treatment value is 20.6mm which is suggestive of mesial movement of molar is by -0.5mm, with 't' value of 1.861 and 'p' value is 0.0957 which shows that it is not significant Tab 3,4.

Upper Incisor changes: In the present study we have determined the incisor change with $p<0.0001$ which shows highly significant both clinically and statistically Tab 6.

Conclusion

In the present study, we have evaluated the rate of retraction, the anchorage loss and upper incisor torque after space closure. Hence after using the new design of discopender for retraction we concluded that this is one of the best method to use for retraction with bodily controlled tooth movement can be easily performed using power arms with three consecutive hooks and its 9 variable factors.

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