ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 9, Issue, 05, pp.49869-49877, May, 2017

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

COMPARATIVE EVALUATION OF TREATMENT DURATION AND CHANGES USING CORTICOTOMY ASSISTED SELF LIGATING TECHNIQUE AND CONVENTIONAL MBT TECHNIQUE

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ARTICLE INFO

Article History:
Received 22nd February, 2017
Received in revised form
25th March, 2017
Accepted 08th April, 2017
Published online 19th May, 2017

Key words:

Corticomy,
Self ligation,
Regional acceleratory phenomenon,
Acceleration of tooth movement,
Closed coil spring.

ABSTRACT

Background and Objectives: Corticotomy assisted orthodontics is a tissue engineering procedure which causes rapid tooth movement at a ratio of 3-4 times greater than conventional orthodontic movement. Self-ligating techniques shortens treatment time due to reduced friction between the brackets and archwire. The use of closed coil springs to deliver constant retraction force also encourages faster space closure. A combination of corticotomy with Self Ligating Technique along with NiTi Closed Coil springs would further reduce treatment duration. The objective of this study was to assess and compare the treatment time taken and treatment changes in one Group of patients treated with Corticotomy and Self Ligating Brackets and with another Group of patients treated with conventional orthodontics. Both the groups followed the MBT (Mclaughlin Bennet Trevesi) prescription.

Material and Method: Five patients each in Group A were treated with corticotomy assisted SLT (Self Ligating Technique) with retraction force from NiTi closed coil springs and five patients of Group B were treated with conventional MBT technique. The patients of both the groups were indicated for first four premolars extraction therapy with Angles Class I molar relationship. For the patients of Group A, a full thickness flap was elevated on the buccal and lingual aspect of the upper and lower arches. Vertical and horizontal cuts were made on the cortical bones with 701 surgical bur with diameter of 2mm upto a depth were medullary bone appeared (indicated by appearance of bleeding spot). Bone grafts were placed on the bone surface, flaps were sutured back in position. The initial aligning wires were placed immediately after surgery and the patients were recalled every 2 weeks whereas the patients treated with conventional orthodontics technique (Group B) were recalled every 6 weeks interval. The time taken for both the groups to complete the treatment was noted and the treatment results (Skeletal, Dental and soft tissue changes) in both the goups were assessed using pre and post treatment cephalograms with the Steiners analysis and the treatment efficiency was compared.

Result: Data was coded and entered in an MS Excel format and analysed using appropriate statistical software. The quantitative data was measured using mean, standard deviation and independent t-test. The average number of days for treatment completion for Group A was 310.8000 and for Group B patients was 497.4000 which was statistically significant (p value was $0.013 < 0.05$) thus the treatment for the patients of Group A was 62% faster than the patients of group B. When the treatment changes of both the groups were compared, we could conclude that the change in skeletal, dental and soft tissue profile after treatment for the patients of Group A was more than patients of group B, although such a mild difference was statistically insignificant for all the parameters.

Interpretation and Conclusion:
These results concludes that
1. The treatment time taken for Group A patients was 62% faster than the Group B patients.
2. The treatment results, the skeletal, dental and soft tissue parameters did not show any statiscally significant difference indicating that both the methods had similar treatment results.
3. Group A showed more consistent treatment change skeletally and Group B patients showed more consistent treatment change dentally along with improvement in the soft tissue profile.

Citation: Dr. Rosaline Tina Paul, Dr. Ligil, A. R. and Biswas, P. P. 2017. "Comparative evaluation of treatment duration and changes using Corticotomy assisted self Ligating technique and conventional MBT technique", *International Journal of Current Research*, 9, (05), 49869-49877.

INTRODUCTION

The main objectives in orthodontic treatment are to achieve better occlusion, improved oral function and harmonized facial appearance. However, prolonged treatment time is definitely a clinical problem. 1 Figuring out this challenge will dramatically improve the quality of orthodontic care.

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Orthodontic tooth movement is a mechanically induced bone remodeling process wherein bone formation takes place on the tension side and bone resorption on the compression side of the tooth. The normal tooth movement usually expected is 1mm in 1 month interval. Burstone in 1962 classified the tooth movement into 3 phases namely, the initial phase, lag phase (slowest period) and the post lag phase. Therefore it is evident that we could accelerate the tooth movement if the second phase which is the slowest phase due to hyalinization of the bone could be avoided or minimized. (Vinod and Zeev, 2006)

The tooth movement can be accelerated by either employing certain adjunctive orthodontic procedures or by using advanced mechanotherapy. The various adjunctive orthodontic procedures are physical, chemical and surgical methods. (Shailesh *et al*., 2014) Physical stimulation can be induced by using electric (Loius, 1974; Zeev *et al*., 1980), magnetic (Thomas and Peter, 1987; Sten and Sven, 1991; Tengu *et al*., 2000; Minako *et al*., 2008), mechanical vibrations (Fred, 1970; Makoto *et al*., 2008; Jose and Dawei, 2010) and laser irradiation. (Pourzarandian *et al*., 2005; Angela *et al*., 2009; Yoshida *et al*., 2009; Mariana *et al*., 2013; Massoud *et al*., 2012) The above methods increase tooth movement speed by 0.3 to 1 times according to various reviews while some literature states that about 70% reduction of time occurs. The last category is the surgical method, which includes, corticision, corticotomy and distraction osteogenesis. (Shailesh *et al*., 2014) Corticotomy is defined as a surgical procedure where only the outer cortical bone is cut, perforated or modified while the medullary bone is left intact. The surgical alteration of the form of alveolar bone is an acceleration of the natural process of bone bending within a healing wound. The Regional Accelerated Phenomenon (RAP) is a local response of tissues to noxious stimuli by which tissue regenerates faster than normal in a localised regeneration / remodeling process. This is an intensified bone response characterized by increased osteoclastic and osteoblastic activity, and increased levels of local and systemic inflammation markers in areas around cuts that extend to the marrow. (Thomas *et al*., 2008)

The other method of accelerating tooth movement is by adopting advanced mechanotherapy, ie. by using a bracket system that offers lesser friction which facilitates better alignment correction and sliding mechanics. For this purpose Self Ligating Brackets (SLB) were ideal. Along with this a force delivery system which could provide an optimum and continuous force would enhance the tooth movement during the retraction phase of treatment. A NiTi closed coil spring has the ability to deliver a more constant force during the deactivation period. (Kyu *et al*., 2009) Other advanced methods to accelerate tooth movement are the use of Temporary Anchorage Devices which aids to generate heavy forces without compromising with the anchor molar tooth (Deepak *et al*., 2011) and the use of sophisticated archwires (eg. B-Titanium, Austenitic NiTi) with increased superelastic properties to facilitate better tooth movement. (Manu *et al*., 2009) SLBs have an in-built metal face, which can be opened and closed by moving the slides or clips. These brackets exhibits low friction between the bracket and the archwire. It also provides secure and robust ligation which helps in maintaining good oral hygiene and patient finds it more comfortable. The most important property is that it facilitates better sliding mechanics which ultimately hastens treatment time. Studies have shown that such frictional resistance to archwires was reduced by 70% and 50% in active and passive self- ligating brackets respectively. (William *et al*., 2001)

The combined effects of advanced mechanotherapy (SLB) with less friction along with constant retraction force delivery system using NiTi closed coil spring and the use of an adjunctive orthodontic procedure to augment tooth movement should definitely further reduce treatment duration. Thus this study would help us to assess the treatment time and treatment changes, in one of the fast fixed appliance orthodontic technique that exists.

MATERIALS AND METHODS

The study design was interventional. A sample of ten patients were selected, the sample size was calculated using Winpepi software (COMPARE2.EXE- Version 3.11) to get a power of 90% and a significance level of 5%.57 The sampling method used was convenience sampling which is a statistical method of drawing representative data by selecting people because of the ease of their volunteering and the speed with which data can be gathered. After fulfilling the selection criterias of the study, the selected patients were divided into two groups, Group A and Group B. In Group A, five patients were included that were treated with corticotomy procedure combined with Self ligating brackets – SmartClipTM SL3 (3M Unitek, USA, Figure:1). In Group B, five patients were treated with conventional brackets (Leone s.p.a.Orthodontics and Implantology, Italy Figure:2) having 0.022" slot, without surgical intervention. Both the groups had MBT prescription. This was done to assess the total amount of treatment time taken by both the methods and thereby assess which technique achieved less treatment time.

The inclusion criterias for case selection are:-

1. Patients between the age group of 15 to 30 years were included in this study. This age criteria was selected since patients below 15 years of age are usually under growth modification therapy and patients above 30 years of age have dense bone for whom bone remodeling would be at a slow rate which in turn would cause variation in the treatment results.
2. The criteria of malocclusion was standardized to all patients of Group A and Group B. The patients of both the groups had Angles Class I molar relation with either spacing, crowding or even bimaxillary protrusion so that the difference in time taken to complete the treatment would be more reliable.
3. Patients requiring extraction of the 1st bicuspids.
4. Skeletal cases with mild maxillary prognathism were included.

The exclusion criterias were:-

1. Mutilated cases were avoided in the study since the fixed mechanotherapy varies in such conditions.
2. Periodontally compromised patients with active periodontal disease were not included in this study.
3. Medically compromised patients and patients under medications were excluded from the study.

The study commenced after obtaining a certificate of approval from the Institutional Ethics Committee (Royal Dental College, Palakkad) which met on 19.12.2012. The selected patients were asked to sign the consent form which explained the use of local anaesthesia, the surgical corticotomy procedure (for group A patients) including the use of bone grafts and extraction of the bicuspids followed by fixed appliance therapy using Self Ligating Brackets. Standard records like models, lateral cephalogram and Orthopantomogram were taken. The cephalostat used was GXDP-700TM Digital Panoramic X-ray System (Gendex Dental System).

The pretreatment cephalogram was plotted using the Dolphin software (v)11 and the measurements were recorded and compared with the post treatment lateral cephalogram. The

date of starting the procedure was noted and the duration of the study was calculated till the orthodontic procedure was completed.

The Fixed Mechanotherapy procedure

Self ligating brackets–SmartClipTM SL3 (3M Unitek, USA) (Figure :1) with MBT prescription having 0.022" slot were strapped up 1 week prior to the surgical procedure for the five patients of group A. For five patients of group B, strap up was done using conventional brackets (Leone s.p.a.Orthodontics and Implantology, Italy) having 0.022" slot, (Figure :2). Both the groups had conventional MBT prescription.

Figure 1. Brackets used for GroupA

Figure 2. Brackets used for Group B

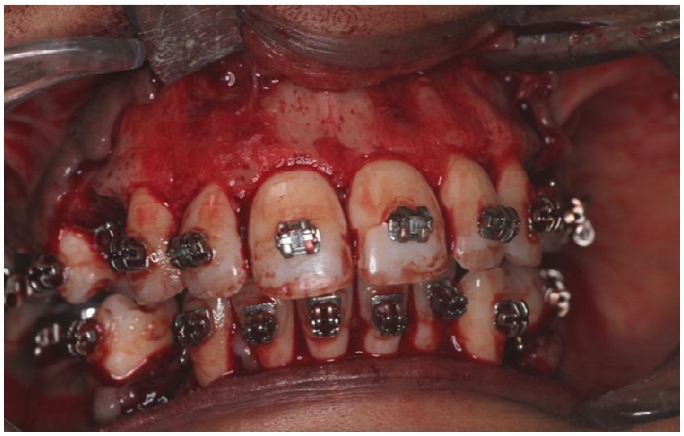

Figure 3. Elevation of a full thickness mucoperiosteal flap on the labial aspects of the upper arch

Figure 4. Elevation of a full thickness mucoperiosteal flap on the palatal aspects of the upper arch

Figure 5. Elevation of a full thickness mucoperiosteal flap on the labial aspects of the mandibular arch

Figure 6. Elevation of a full thickness mucoperiosteal flap on the lingual aspects of the mandibular arch

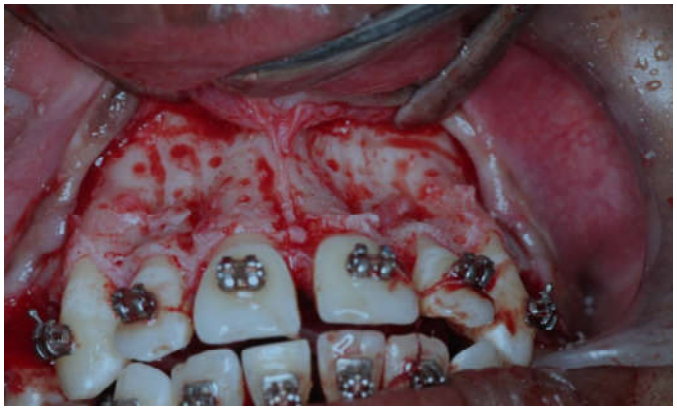

Figure 7. Vertical and horizontal cuts on the cortical bone along with surface decortication bur holes on the labial aspect of the maxillary arch

Figure 8. Vertical and horizontal cuts on the cortical bone along with surface decortication bur holes on the palatal aspect of the maxillary arch

Figure 9. Vertical and horizontal cuts on the cortical bone along with surface decortication bur holes on the labial aspect of the mandibular arch

Figure 10. Vertical and horizontal cuts on the cortical bone along with surface decortication bur holes on the lingual aspect of the mandibular arch

The surgical procedure

After taking the test dose, anaesthesia with Lignox 2% (Indoco remedies Ltd) containing Lignocaine Hydrochloride and Adrenaline Bitartrate injection I.P. having a 1 : 80,000 dilution was given to the patients of Group A during the surgery. In the upper arch bilateral Infraorbital nerve block for buccal anasethesia along with Greater Palatine nerve block and Nasopalatine nerve block on the palatal aspect was given. In the mandibular arch bilateral Inferior alveolar nerve block, Lingual nerve block and Buccal nerve block was given. After assuring sound anaesthetic effect a crevicular incision was placed using a BP Blade No. 12 on the buccal and lingual aspect extending from the canine of one side to the canine of the other side on both the maxillary and mandibular arches. A distal extension on the first Premolar extraction region was given for convenience of placement of the vertical cut distal to the canine tooth. Next a full thickness mucoperiosteal flap was raised on the buccal and lingual aspects of both arches using a periosteal elevator. The flaps were elevated such that good vision is obtained upto the apex of the tooth from the canine of one side to the canine of the contralateral side (Figure:3,4,5,6) Seven vertical cuts were made interdentally between the roots of the tooth 1mm short of the alveolar margin extending upto the level of apex of the roots of the tooth. The vertical cuts were placed one on the distal aspect of the canine on the right side, between the canine and lateral incisor, between the lateral incisor and central incisor and between the two central incisors. These similar cuts were placed on the contralateral side also. Such cuts were made on both the maxillary and mandibular arches. This was followed by horizontal cuts which were made on the cortical bones subapically (Figure:7,8,9,10). The cortical cuts were made with HP-701 tungsten carbide surgical bur (Meissinger-Germany) having a diameter of 2mm or a round bur HP-4(SS White) depending on the thickness of the cortical plate. The remaining cortical bone was scored with bur holes which was placed on the rest of the exposed cortical bone as shown in (Fig:7,8,9,10).

Figure 11. Placement of bone graft on the cortical bone on the labial aspect of the upper arch

With the help of a slow speed micro-motor (NSK) using a straight head handpiece (NSK) cuts were made using the surgical burs HP-701 and HP-4. When the cuts were placed copious saline irrigation was done. With the help of a suction unit the irrigated saline and blood from the cortical cuts were evacuated. The thick cortical bone was cut using HP-701 bur and the thin bone was cut using HP-4. The depth of the cut was made upto a point were bleeding just appeared indicating the entry to the medullary bone. Care was taken such that no buccolingual communication between the decortications is executed and absolutely no luxation of teeth or bone is attempted. After the cuts were made on the exposed cortical bone on upper and lower arches, bone graft was mixed with saline and placed all over the area of decortications and cuts. The allograft consists of 2 vials, each containing 0.25g sterile Demineralised Freeze Dried Bone Matrix Xenograft, Type I collagen granules (OsseograftTM DMBM, manufactured by Advanced Biotech Products (P) Ltd) which was mixed with 2 or 3 drops of saline such that a workable consistency is achieved. The mixed graft material is carried to the area of decortications using a spatula. Similarly the bone grafts were

evenly smeared on the buccal and lingual cortical areas of the upper and lower arches. The flaps were sutured to their original position using a 3-0 Ethicon (Mersilk, NW5003) a non resorbable braided silk surgical suture. Interrupted sutures were placed interdentally in the upper and lower anterior teeth such the flaps were repositioned to their original position without any tension on the flaps. Soon after surgery orthodontic treatment was initiated by engaging the initial aligning wires. All surgical procedures were carried out under standard aseptic conditions.

The patient was prescribed

1. Antibiotic regimen for 10 days.
2. Tramadol Hydrochloride tablet 50 mg BD for five days.
3. Chlorexidine mouth wash 0.12% diluted in water after every meal.
4. Soft bristle brushes to prevent injury to the gums.

The standard post operative surgical instruction given to the patient were:-

1. The patient was instructed not to take any other medication apart from what was prescribed.
2. Patients were informed about post operative swelling.
3. To place the head elevated while sleeping.
4. Ice –packing on the circum-surgical field, alternating left and right side every 20 minutes for the first 24 hours.

The patients of group A were recalled for orthodontic activation every two weeks whereas the patients of group B were recalled every six weeks interval. This was done because no hyalinization takes place due to high degree of metabolic turbulation, whereas in conventional orthodontics the orthodontic activation should be done after the hyalinization of the bone is resolved by the body's response.

The sequence of wires used were (Table 1) selected according to the standard MBT mechanics

Table 1. The sequence of wires used for both the groups

S No	Treatment	Group A	Group B
1	Initial leveling and aligning stage	0.014" NiTi	0.014" NiTi
		0.016" NiTi	0.016"NiTi
		0.018" NiTi	0.018" NiTi
		0.016"x0.022" NiTi	0.016"x0.022" NiTi
		0.017"x0.025" NiTi	0.017"x0.025" NiTi
2	Space closure	0.019"x0.025" SS	0.019"x0.025" SS
3	Finishing and detailing	0.019"x0.025"braided NiTi	0.014" SS

The retraction wire used in both the groups were 0.019" x0.025" posted arch stainless steel wires. The retraction phase was instituted for the patients of Group A using a 12mm or 9mm NiTi closed coil spring (3M Unitek, USA) which could generate a force of 311g on each side. The retraction force was measured using a Dontrix gauge. For the patients of Group B active tie backs with modules and ligature wires were given to generate a force of 100-150g per side as mentioned by the MBT philosophy. The final stage of finishing and detailing for the Group A patients was done using 0.019"x0.025" braided NiTi (3M Unitek, USA) which aided better settling followed by 3/16 settling elastics which could generate a force of 112 gm of force. For the patients in Group B this phase was carried out using 0.014 inch Stainless Steel archwires along with serpentine ligations and Spaghetti elastics to help in settling. The treatment results were assessed for both the groups separately. The treatment time was calculated from the day of application of the initial aligning wire upto the day when the brackets were debonded. Comparison of both the groups using pre and post treatment cephalograms which were plotted using the Dolphin software (Dolphin Imaging v11.7) and the skeletal and dental measurements with the Steiners Analysis was done

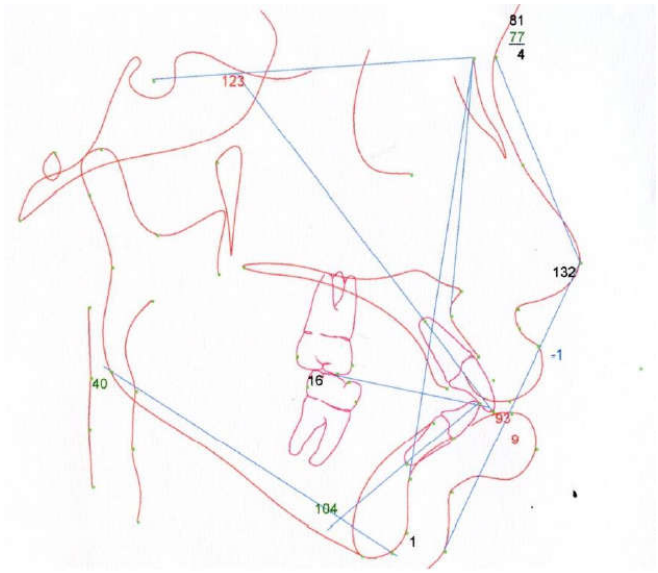

Figure 12. Dolphin tracing

Table 2. Dolphin tracing reading

Measurement	Mean	Patient
SNA	82^0+/-2^0	80.9^0
SNB	80^0+/-2^0	77.3^0
ANB	2^0	3.6^0
Occlusal plane	14^0	15.7^0
Mandibular plane	32^0	40.3^0
Upper incisor to NA(linear)	4mm	11 mm
Upper incisor to NA(angle)	22^0	42.4^0
Lower incisor to NB(linear)	4mm	12.6 mm
Lower incisor to NB(angle)	25^0	41.2^0
Interincisal	131^0	92.9^0
S Line upper lip	On S line	5mm ahead of S line
Lower lip	On S line	9mm ahead of S line

The treatment duration and the significance of the new appliance treatment was estimated by using the unpaired t-Test with the formula

$$t = \frac{\bar{x} - \mu}{\frac{s}{\sqrt{n-1}}} \sim t_{n-1}$$

where
μ = population mean
x= sample mean
s = sample standard deviation
n = sample size.

The coefficient of variation was also calculated to assess the treatment that had more consistent results by using the formula Coefficient of Variation Cv = Standard Deviation / Mean. The group with least Coefficient of Variation Cv score was considered the method with more consistent treatment change.

RESULTS

The data was coded and entered in a MS Excel format and analysed using appropriate statistical software.

Results based on time taken for both the Groups A and B to complete active treatment

The average number of days for active orthodontic treatment completion for group A was 310.8 and 497.4 for group B patients which was statistically significant (p value was 0.013 < 0.05). Thus the treatment for the patients of group A was 62 faster than the patients of group B.

Results based on the treatment changes that occur in both the groups

Skeletal Parameters

SNA changes

The mean change in SNA for group A after treatment was 0.46 and for group B patients was 0.42 from pretreatment values. When the treatment changes of both the groups were compared, it was statistically insignificant (p value was 0.907 > 0.05). Thus, it is concluded that, the change in SNA after treatment for the patients of group A was more than for group B patients, although such a mild difference was statistically insignificant.

SNB changes

The mean change in SNB for group A patients after treatment was 0.300 and for group B patients was 0.120 from pretreatment values. When the treatment changes of both the groups were compared, it was statistically insignificant (p value was 0.796> 0.05). Thus, it is concluded that the change in SNB after treatment for the patients of group A was more than for group B patients, although such a mild difference was statistically insignificant.

ANB changes

The mean change in ANB for group A patients after treatment was 0.080 and 0.340 for group B patients**.** When the treatment changes of both the groups were compared, it was statistically insignificant (p value was 0.599 > 0.05). It could be concluded that, although the change in ANB after treatment for the patients of group B was more than for group A patients, it was statistically insignificant.

Occlusal plane changes

The mean change in occlusal plane for group A patients was 0.560 and 0.860 for group B patients**.** When the treatment changes of both the groups were compared, it was statistically insignificant (p value was 0.889 > 0.05). Thus, it is concluded that, although the change in occlusal plane after treatment for the patients of group B was more than for patients of group A, such a mild difference was statistically insignificant.

Mandibular plane plane changes

The mean change in mandibular plane for group A after treatment was 1.520 and 0.040 for group B patients. When the treatment changes of both the groups were compared, it was statistically insignificant (p value was 0.329 > 0.05). Thus, it is concluded that, although the change in mandibular plane after treatment for the patients of group A was more than for patients of group B, such a mild difference was statistically insignificant.

Dental changes

Upper incisors to NA (Linear)

The mean change in upper incisors to NA (linear) for group A was 6.340 and 6.000 for group B patients. When the treatment changes of both the groups were compared, it was statistically insignificant (p value was 0.981 > 0.05). Thus, it is concluded that, although the change in upper incisors to NA (linear) after treatment for the patients of group A was more than for patients of group B, such a mild difference was statistically insignificant. For the patients of group A mild overretraction was seen and for the patients of group B the retraction achieved was near normal.

Upper incisors to NA (Angular)

The mean change in upper incisors to NA (Angular) for group A was 14.220 and 10.220 for group B patients. When the treatment changes of both the groups were compared, it was statistically insignificant (p value was 0.463 > 0.05). Thus, it is concluded that, although the change in upper incisors to NA (Angular) after treatment for the patients of group A was more than for patients of group B, such a mild difference was statistically insignificant. For the patients of group A mild loss of torque was seen and for the patients of group B the incisor inclination achieved was near normal.

Lower incisors to NB (Linear)

The mean change in lower incisors to NB (linear) for group A was 5.340 and 4.500 for group B patients**.** When the treatment changes of both the groups were compared, it was statistically insignificant (p value was 0.439 > 0.05). Thus, it is concluded that, although the change in lower incisors to NB (linear) after treatment for the patients of group A was more than for patients of group B, such a mild difference was statistically insignificant.

Graph 9: Change in lower incisors to NB (linear) for group A and group B

Change in lower incisors to NB (Angular) for Group A and Group B

The mean change in lower incisors to NB (Angular) for group A was 15.540 and for group B patients was 10.380 from pretreatment values. When the treatment changes of both the groups were compared, it was statistically insignificant (p value was 0.194> 0.05). Thus it is concluded that, although the change in lower incisors to NB (Angular) after treatment for the patients of group A was more than for patients of group B, such a mild difference was statistically insignificant.

Interincisal angle

The mean change in the interincisal angle for group A after treatment was -29.860 and for group B patients was -20.880**.** When the treatment changes of both the groups were compared, it was statistically insignificant (p value was 0.176 > 0.05)**.** Thus, it is conclude that, although the change in the interincisal angle after treatment for the patients of group A was more than seen for patients of group B, such a mild difference was statistically insignificant.

S Line to Upper Lip

The mean change in the S Line to Upper lip for group A was 2.20 and 2.00 for group B patients**.** When the treatment changes of both the groups were compared, it was statistically insignificant (p value was 0.822 > 0.05). Thus it is concluded that, the change in the S Line to upper lip after treatment for the patients of group A was more than seen for patients of group B, such a mild difference was statistically insignificant.

S Line to Lower Lip

The mean change in the S Line to lower lip for group A was 4.00 and 2.40 for group B patients. When the treatment changes of both the groups were compared, it was statistically insignificant (p value was 0.176 > 0.05). Thus it is concluded that, the change in the S Line to lower lip after treatment for the patients of group A was more than patients of group B, such a mild difference was statistically insignificant.

Results to evaluate the consistency in treatment

Skeletal Parameters

Table 3. Coefficient of variation for skeletal parameters

Measurement	SNA	SNB	ANB	Occlusal plane	Mandibular plane
Group A – C.V.	2.72	3.27	22.04	22.04	5.88
Group B – C.V.	3.18	4.68	30.69	30.69	7.57

Considering the skeletal parameters, the patients of group A shows lessercoefficient of variations than the patients of group B. This indicates that treatment by this method had more consistent treatment change skeletally.

Dental Parameters

Table 4. Coefficient of variation for dental parameters

Measurement	Upper incisor to NA(linear)	Upper incisor to NA(angle)	Lower incisor to NB (linear)	Lower incisor to NB (angle)	Interincisal
Group A – C.V.	108.78	36.51	38.65	15.21	6.51
Group B – C.V.	35.89	19.08	12.61	15.58	3.91

Considering the dental parameters, except for the lower incisor inclination the patients of group B showed lesser coefficient of variation than the patients of group A. This indicates that the desired incisor position and inclination is attained more better by following the conventional technique than the surgical intervention technique.

Soft tissue Parameters

Table 5. Coefficient of variation of soft tissue parameters

Measurement	Upper lip to S-line	Lower lip to S-line
Group A – C.V.	116.07	51.29
Group B – C.V.	29.99	10.54

Considering the soft tissue profile, the patients of group B showed lesser coefficient of variation than the patients of group A. This indicates that the treatment by non-surgical method resulted in a more consistent pattern of profile improvement than the surgical intervention technique.

DISCUSSION

Fergusson treated bimaxillary protrusion cases and noted that the retraction phase was completed within 1 ½ months time (William *et al*., 2001). Chung reported the completion of retraction in Class I bimaxillary protrusion cases in 3 ½ months. (Kyu *et al*., 2009) Ramachandra reported a patient with flaring of the maxillary and mandibular incisors which took eight months for completion after the surgery. (Ramachandra *et al*., 2013) Mohammad Tizini, reported a 21-year-old female patient with severe maxillary incisor protrusion, where en masse retraction of the anterior teeth was completed within 4.5 months of treatment. (Mohammed and Ghosn Ibrahim, 2013) In Germac's case report, the total orthodontic treatment time for en masse retraction of bimaxillary protrusion patient took 16 months for completion. (Derya *et al*., 2006) Wilcko treated a patient with class I molar relation and combined it with PAOO and completed his active orthodontic treatment within 6 months. (Thomas *et al*., 2008) Lino stated that by this method the treatment time was reduced by 1/3 -1/4 of routine extraction or non extraction time. The rate of tooth movement was related to the metabolism of bone and bone density. Tooth movements in juveniles is faster than in adults at the initial phase because mediator levels in juveniles are more responsive than those in adults in early tooth movement. He completed his treatment on bimaxillary protrusion patients within 1 year. (Shoichiro *et al*., 2006) Subraya treated patients with bimaxillary protrusion, and completed the retraction within 17.4 months time. (Subraya *et al*., 2012) Ashish, completed en masse retraction of anteriors within 6.5 months. (Ashish *et al*., 2011) Arif treated a 29 year old patient with bimaxillary protrusion with PAOO procedure and achieved completion of treatment within 7 months. (Arif, 2012) With the application of light continuous force using NITI closed coil springs (Deepak *et al*., 2011) and a sophesticated appliance like the SLB[21] which exhibited less friction along with the Regional Accelerated Phenomenon induced we were able to complete our 5 Class I bimaxillary protrusion cases on an average of 10.3 months. This was 62% faster than the patients of group B for whom we took an average of 16.58 months to complete the treatment.

Kole did decortications cuts on the cortical bone and believed that the rapidity of tooth movement was due to the bony block tooth movement. Suya described the medullary bone as the handle that moved the bony block. Wilkco described the mechanism of rapid tooth movement was due to the RAP which was potentially a tissue healing phenomenon. Germac, showed that single sided approach was sufficient to stimulate rapid tooth movement completed en masse retraction within 16

months of treatment. (Derya *et al*., 2006) Fergusson stated that transient osteopenia combined with high metabolic turbulation caused rapid tooth movement. Collins and Sinclair also feel that the increased bone turnover due to cortical activation was the reason for the accelerated tooth movement. (William *et al*., 2001) Sebaun and co-workers stated that selective alveolar decortications caused an overwhelming stimulus leading to a catabolic and anabolic process which peaked at 3 weeks. Sanjideh stated in his experiment on foxhound that the greatest tooth movement occurred during the aligning and leveling phase approximately 6 months after which a second corticotomy could help in prolonging the RAP. (Payam *et al*., 2010) In our study the shortened treatment duration for the study group patients could be attributed to the RAP which was induced by the decortication procedure and catalysed both by the passive SLB and retraction with closed coil springs which yielded a constant force. The cancellous portion of the alveolar bone transforms into a more pliable, transient, reversible, demineralized state called osteopenia. With demineralization, bone matrix transportation occurs and the remaining collagenous soft tissue matrix of the bone is transported with the root in the direction of tooth movement. According to Wilcko this demineralization is followed by the anabolic process, which is a formation response wherein new bone is deposited and the osteoid matrix gets remineralized which ultimately aids in augmentation of alveolar bone following orthodontic treatment. (Thomas *et al*., 2008)

Conclusion

This study was carried out to evaluate the speed and treatment changes that occurred in two groups of patients who were treated orthodontically. Considering the treatment time, the patients of GroupA was 62% faster than the patients of group B. Considering the treatment results, the skeletal, dental and soft tissue parameters did not show any statistically significant difference, indicating that both the methods had similar treatment results. The patients of Group A showed more consistent changes skeletally than the patients of Group B. Although the dental and soft tissue profile improvement changes were more in the Group A patients, the patients of Group B showed a more consistent treatment change, which was more near normal.

Summary

1. The treatment time taken for Group A patients was 62% faster than the Group B patients.
2. The treatment results, the skeletal, dental and soft tissue parameters did not show any statistically significant difference indicating that both the methods had similar treatment results.
3. Group A showed more consistent treatment change skeletally and Group B patients showed more consistent treatment change dentally along with improvement in the soft tissue profile

REFERENCES

Angela D, Paola C, Monica M. 2009. An in-vitro study of human osteoblasts to Low-Level Laser irradiation. *J Oral Laser Applications*, 9:21-28.

Arif AY. 2012. Accelerated orthodontics with alveolar decortications and augmentation: A case report. Orthodontics (Chic), 13:146-155.

Ashish J, Tarun D, Rashi C, 2011. One-stage Surgical Alveolar Augmentation (PAOO) For Rapid Orthodontic Movement. A Case Report. *Indian Journal of Dental Sciences*. October 4(3):18-21.

Deepak KA, Anup R, Abhishek A, Preeti B, Ankur G, Kapur DN. 2011. Comparative study of orthodontic coil springs. *The Journal of Indian Orthodontic Society*, 45(4):160-168.

Derya G, Bahadir G, Illken K, Ayhan E. 2006. Lower incisor retraction with a modified corticotomy. *Angle Orthod*., 76(5):882-89.

Fred MG. 1970. Bone bending , a feature of orthodontic tooth movement. *Am J Orthod Dentofacial Orthop.,* 62:41.384-393.

Hu L, Ujjwal P, Yan W, Lina L, Yang Z, Wenli L. 2013. Interventions for accelerating orthodontic tooth movement. A systematic review. *Angle Orthod*., 83:164-171.

Jose AB, Dawei L. 2010. Moving teeth faster, better and painless. Is it possible? *Dental Press J Orthod*., Nov-Dec; 15(16):14-17.

Kyu RC, Seong HK, and Baek SL. 2009. Speedy surgical-orthodontic treatment with temporary anchorage devices as an alternative to orthognathic surgery. *Am J Orthod Dentofacial Orthop*., 135:787-98.

Kyu RC, Seong HK, and Baek SL. 2009. Speedy surgical-orthodontic treatment with temporary anchorage devices as an alternative to orthognathic surgery. *Am J Orthod Dentofacial Orthop*., 135:787-98.

Loius AN. 1974. Implications of Bioelectric Growth Control in Orthodontics and Dentistry. *Am J Orthod Dentofacial*., 45 :34-42.

Makoto N, Mirei C, Toshiro O, Masaaki S, Yoshiyuki S, Kaoru I *et al*. 2008. Periodontal tissue activation by vibration: Intermittent stimulation by resonance vibration accelerates experimental tooth movement in rats. *Am J Orthod Dentofacial Orthop*., 133:572-83.

Manu K, Sukumaran K, and Kurian MA. 2009. Comparative evaluation of frictional forces in active and passive self – ligating brackets with various archwire alloys. *Am J Orthod Dentofacial Orthod*., 136:675-82.

Mariana M, Ana MB, Monica TSA. 2013. Evaluation of two low-level laser application in patients submitted to orthodontic treatment. *Dental Press J Orthod*., Jan-Feb;18(1):33el-9.

Massoud S, Fernaz Y, Nazila A. 2012. The innovated Laser assisted flapless corticotomy to enhance orthodontic tooth movement. *J Laser Med Sci*., 3(1): 20-25.

Minako S, Yoshitake Y, Nobuyoshi I, Shunsuke N and Akihiko N. 2008. The effect of static magnetic field on orthodontic tooth movement. *Journal of Orthodontics*, 32:249-254.

Mohammed T, Ghosn Ibrahim. 2013. Retraction of the upper maxillary incisors with corticotomy-facilitated orthodontics and mini-implants. *Saudi Journal of Dental Research*, 1-6.

Payam AS, Emile PR, Phillip MC, Lynne AO, Peter HB. 2010. Tooth movements in foxhounds after one or two alveolar corticotomies. *Europeon Journal of Orthodontics*, 32:106-113.

Pourzarandian A, Watanabe H, Ruwanpura SMPM, Aoki A, Noguchi K, Ishikawa I. 2005. Er: YAG laser irradiation increases prostaglandin E2 production via the induction of cyclooxygenase-2 mRNA in human gingival fibroblasts. *J Periodont Res*., 40;182-186.

Ramachandra P, Karthikeyan MK, Saravanan R, Kannan KS, Arun MR. 2013. Anterior maxillary intrusion and retraction with Corticotomy- Facilitated Orthodontic Treatment and

Burstone Three Piece Intrusive Arch. *Journal of Clinical and Diagnostic Research*, 1-3.

Shailesh S, Krishna USN, Vivek B, Arjun N. 2014. Accelerated orthodontics-A Review. *International Journal of Scientific Study*, February, Vol 1:Issue 5.

Shoichiro L, Sumio S, Shouichi M. 2006. An adult bimaxillary protrusion treated with corticotomy-facilitated orthodontics and titanium miniplates. *Angle Orthod*., 76(6)1074-82.

Sten LA, and Sven L. 1991. A morphometric study of bone surfaces and skin reactions after stimulation with static magnetic fields in rats. *Am J Orthod Dentofacial Orthop*., 99:44-48.

Subraya GB, Vishal S, Mahalinga KB. 2012. PAOO technique for the bimaxillary protrusion:perio-ortho interrelationship. *Journal of Indian Society of periodontology,* 16(4):584-7.

Tengu BS, Joseph B K, Harbrow D, Taverne AAR and Symons AL. 2000. Effect of a static magnetic field on orthodontic tooth movement in the rat. *European Journal of Orthodontics*, 22:475-487.

Thomas MS. and Peter MS. 1987. Effect of pulsed electromagnetic field on orthodontic tooth movement. Am *J Orthod Dentofacial Orthop*., 91:91-104.

Thomas MW, William MW, and Nabil FB. 2008. An evidence based analysis of Periodontally accelerated orthodontic and osteogenic techniques: A synthesis of scientific perspectives. *Semin Orthod*., 14:305-316.

Vinod K and Zeev D. 2006. Cellular, molecular, and tissue-level reactions to orthodontic force. *Am J Orthod Dentofacial Orthop*., 129:469e. 1- 460e.32.

William MW, Thomas MW, Bouquot JE, Donald JF. 2001. Rapid Orthodontics with alveolar reshaping: Two case reports of Decrowding. *Int J Periodontics Restorative Dent*, 21:9-19.

Yoshida T, Yamaguchi M, Utsunomiya T, Kato M, Arai Y, Kaneda T, Yamamoto H, Kasai K. 2009. Low –energy laser irradiation accelerates the velocity of tooth movement via stimulation of the alveolar bone remodeling. *Orthod Craniofac Res*., 12:289-298.

Zeev D, Matthew DF, Ghulamit S, Joseph LS, Paul CM, and Edward K. 1980. Electric current, bone remodeling, and orthodontic tooth movement. *Am J Orthod Dentofacial Orthop*., 77: 14-32.

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