ISSN: 0975-833X

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

International Journal of Current Research
Vol. 8, Issue, 08, pp.36179-36184, August, 2016

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

COMPARISON OF EFFECTS OF TWIN-BLOCK AND FORSUS ANCHORED ON ORTHODONTIC MINI-IMPLANTS ON SKELETAL, DENTO-ALVEOLAR AND SOFT TISSUE STRUCTURES

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ARTICLE INFO

Article History:
Received 07th May, 2016
Received in revised form
23rd June, 2016
Accepted 27th July, 2016
Published online 20th August, 2016

Key words:

Mini implants,
Forsus,
Twin Block.

ABSTRACT

Introduction: Class II division 1 malocclusion due to mandibular retrognathism is considered as one of the most frequently encountered problems in the orthodontic practice.
Objective: To compare dento-alveolar, skeletal and soft tissue effects of Twin Block appliance and Forsus FRD anchored on orthodontic mini-implants. Also, to evaluate whether an association of orthodontic mini-implant with Forsus FRD bring absolute skeletal correction of Class II division 1, avoiding the undesirable proclination of lower anterior teeth.
Materials and Methods: This retrospective study included 2 groups: TB and FFRDI of 7 patients each. Lateral cephalograms were traced using NemoCeph (NemoCeph, NX 2006) software at T1(Pre treatment) and T2(Post functional). The data obtained was analyzed by using descriptive statistics, Paired t-test and Independent sample t-test through SPSS for windows (v 22.0).
Results: TB was able to induce both skeletal and dento-alveolar effects while FFRDI mainly induced skeletal effects. Significant lower incisor proclination occurred with TB while there was slight or almost no change in the inclination of lower incisors with FFRDI. Maxillary molar retroclination was significant in both the groups. Maxillary molar moved distally in both the groups significantly.SNA decreased in both the groups, by 0.58° in TB and significantly reduced by 2° in FFRDI.
Conclusion: Both appliances were effective in correcting the class II division 1 malocclusion. Skeletal changes were induced by FFRDI while TB induced skeletal and dento-alveolar changes. Favourable soft tissue corrections were achieved by both the groups.

Citation: Dr. Ishi Mandrik, Dr. H. Jyothi Kiran, Dr. Shivalinga, B. M. and Dr. Abhishek Ranjan, 2016. "Comparison of effects of twin-block and Forsus anchored on orthodontic mini-implants on skeletal, Dento-alveolar and soft tissue structures", *International Journal of Current Research*, 8, (08), 36179-36184.

INTRODUCTION

Class II division 1 malocclusion due to mandibular retrognathism is considered as one of the most frequently encountered problems in the orthodontic practice. (AOztoprak *et al*., 2012; McNamara, 1981) Treatment during the period of active growth depends mainly on redirection of mandibular growth. Several removable and fixed functional appliances are used for correction of Class II malocclusions. In recent times The Twin Block (TB; Clark, 1982) appliance is one of the widely used removable functional appliances to correct class II dentoskeletal disharmony. More recently, non-compliance or fixed functional appliances are preferred by the patients and the clinicians. The Forsus Fatigue Resistant Device (FFRD) was introduced by Vogt in 2006. But treatment effects are less skeletal and more dento-alveolar with removable and fixed functional appliances. Most of the functional appliances are reported to protrude the mandibular teeth as they are directly anchored to the mandibular arch wire, which jeopardizes the stability of achieved results. Orthodontic mini-implants expanded the horizon of Class II malocclusion treatment. Few studies and case reports have suggested the use of mini-implant anchorage in conjunction with fixed functional appliances to reduce the mandibular incisor proclination that compromised the skeletal effects. (Manni *et al*., 2012; Gandedkar *et al*., 2010) The purpose of this study was to compare the skeletal, dento-alveolar and soft tissue changes obtained by Twin-block and Forsus anchored on orthodontic mini-implants in correction of Angle's Class II division 1 malocclusion.

Also, to evaluate whether an association of orthodontic mini-implant with Forsus appliance bring absolute skeletal correction of Class II division 1 malocclusions, avoiding the undesirable proclination of lower anterior teeth.

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MATERIALS AND METHODS

This is a retrospective comparative study of class II malocclusion subjects treated with Twin Block or Forsus FRD anchored on orthodontic mini-implants. A total of 14 patients' lateral cephalograms were included: 7 in the TB group and 7 in the FFRDI group selected from Department of Orthodontics and Dentofacial orthopaedics, J.S.S. Dental College and Hospital, Mysore. The inclusion criteria was Pre-treatment Angle's Class II division 1 malocclusion, pre-treatment and post-functional lateral cephalograms and overjet more than 6mm. Exclusion criteria was pre-treatment Angle's Class I, Angle's Class II division 2 or Angle's Class III malocclusion. Pre-treatment (T1) and Post-functional (T2) cephalograms of 7 patients treated with Twin-block appliance and 7 patients treated with Forsus Fatigue Resistance Device anchored on Orthodontic mini-implants (FFRDI) were categorized under two groups: TB and FFRDI. Hard and soft tissue landmarks and reference planes were identified on each lateral cephalogram and were evaluated under following 34 parameters:

Dentoalveolar Parameters	Skeletal Parameters	Soft Tissue Parameters
1.Overjet	14.SNA	23.Mx1 Proj
2.Overbite	15.SNB	24.Mx1 Inc
3.UI-NA (mm)	16.ANB	25.Md1 Proj
4.UI-NA (ang)	17.AO-BO	26.Md1 Inc
5.LI-NB (mm)	18.PFH	27.Mx1 Exp
6.LI-NB (ang)	19.AFH	28.Lower Lip Lt
7.UI-LI	20.LAFH	29.Lower 1/3 Ht
8.UI-A	21.Ramus Ht.	30.TFH
9.LI-APO	22.Body Lt.	31.Mx Ht
10.U6 Position		32.Md Ht
11.FMIA		33.Fac Ang
12.IMPA		34.Mx-Md Base
13.FMA		

Pre-treatment and post-functional cephalograms were traced using NemoCeph (NemoCeph, NX 2006) software and the above mentioned hard and soft tissue landmarks, reference planes, angular and linear measurements were recorded. The data obtained was analyzed by using descriptive statistics, Paired t-test and Independent sample t-test through SPSS for windows (v 22.0).

RESULTS

Within Group Comparisons:

In TB, there was significant decrease in Overjet, Overbite, UI-NA(ang.), LI-NB(mm), LI-NB(ang.), UI-LI, UI-A, LI-APO, U6-Pos., FMIA, ANB, AO-BO, Mandibular incisor projection to TVL, Maxillary incisor Exposure and Mx-Md base and significant increase in LI-NB(mm), LI-NB(ang), LI-APO, IMPA, SNB, AFH, LAFH, Ramus Height, Body Length, Maxillary incisor Projection to TVL, Maxillary incisor inclination., Lower Lip Length, Lower 1/3rd Height, Total Facial Height and Mandibular Height. In FFRDI, There was statistically significant decrease in Overjet, Overbite, UI-NA (mm), UI-NA(ang.), UI-A, U6-Position, FMA, SNA, ANB, AO-BO and Maxillary Incisor Exposure and statistically significant increase in SNB, AFH, LAFH, Ramus Height, Body Length, Maxillary Incisor Projection to TVL, Maxillary Inclination, Lower Lip length, Lower 1/3rd Height, Total Facial Height and Mandibular Height.

Between Group Comparisons:

Independent Sample test showed significant difference between the groups under the parameters LI-NB(mm), LI-NB(ang), UI-LI, LI-APO, FMIA, IMPA, FMA, SNA and Mandibular Projection to TVL. (Table 1, Graph 1-7)

Dento-alveolar effects:

In TB group, there was statistically significant increase in LI-NB (mm), LI-NB (ang), LI-APO and IMPA and significant decrease in UI-LI and FMIA. These changes are suggestive of significant lower incisor proclination seen in TB group. In FFRDI group, there was increase in LI-NB(mm), IMPA and LI-APO and decrease in LI-NB(ang) and UI-LI, but these changes were not statistically significant. However, statistically significant increase in FMIA by 0.68º was found in FFRDI group. These changes suggests that there was slight or almost no changes in the inclination on lower incisors in FFRDI group. Treatment with both the appliances resulted in a significant posterior movement of upper incisors and distal movement of maxillary molars.

Skeletal effects:

There was a significant reduction in SNA, ANB and AO-BO in both the groups. SNB and mandibular Body length increased significantly in both TB and FFRDI. This study demonstrated some vertical skeletal growth in both the groups with increase in PFH, AFH, LAFH and Ramus Height increased. In both groups, however, changes in AFH, LAFH and Ramus Height was significant while changes in PFH was not statistically significant.

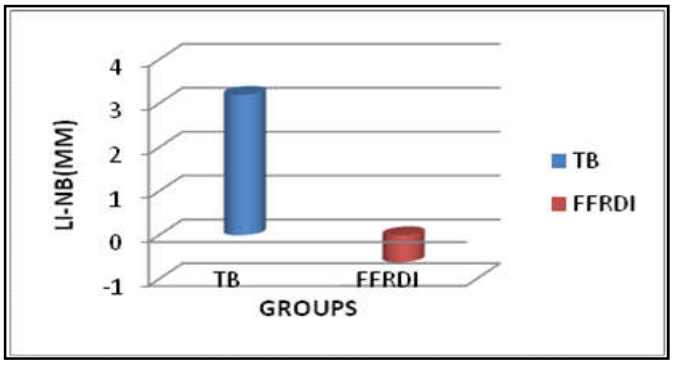
Soft tissue effects:

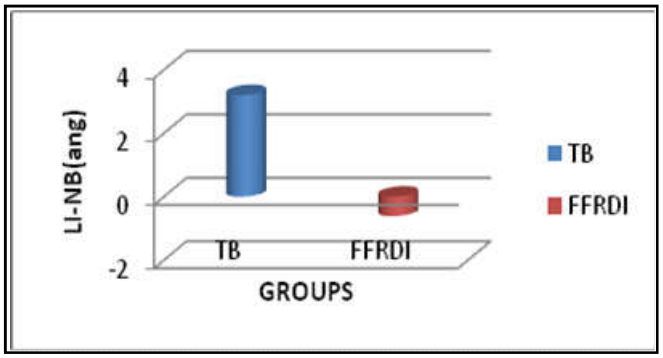
Maxillary Incisor Projection to TVL and Maxillary Incisor Inclination increased significantly in both TB and FFRDI group suggestive of backward tipping of maxillary incisors. In TB group, significant decrease was seen in Mandibular Incisor Projection to TVL while FFRDI showed no statistically significant changes. Mandibular Incisor Inclination increased by 0.61 mm in TB and decreased by 0.8º in FFRDI but these changes were not statistically significant. These findings suggest proclination of lower incisors by TB and slight or almost no significant changes in the inclination. Maxillary incisor exposure decreased in both the groups, thus, aiding in achievement of lip competency. Lower Lip Length, Lower 1/3 Height, TFH, Maxillary Height and Mandibular Height was found to increase in both the groups significantly owing to increase in vertical height due to functional appliance. Facial angle increased in both the groups but this increase was not statistically significant. This slight increase suggests decrease in facial convexity in correction of Class II div 1 malocclusion with retrognathic mandible by use of functional appliance. The distance between inferior and superior labial sulcus decreased (Mx-Md Base) in both the groups. This change was statistically significant in TB while it was not significant in FFRDI. However this increase suggests mandibular growth enhancement by both functional appliances.

Table 1. Between-group comparisons of changes between T1 and T2

						95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Lower
diffOVERJET	.455	12	.657	.5000	1.0982	-1.8929	2.8929
diffOVERBITE	-1.817	12	.094	-1.0857	.5977	-2.3879	.2165
diffUI-NA(mm)	-.330	12	.747	-.6000	1.8187	-4.5625	3.3625
diffUINA(ang.)	-1.621	12	.131	-5.2286	3.2257	-12.2567	1.7996
diffLI-NB(mm)	-5.892	12	.000	-1.84286	.31277	-2.52432	-1.16140
diffLINB(ang.)	-3.863	12	.002	-10.18571	2.63675	-15.93070	-4.44073
diffUI-LI	2.069	12	.061	3.10000	1.49841	-.16476	6.36476
diffUI-A	-1.149	12	.273	-1.0286	.8956	-2.9798	.9227
diffLI-APO	-2.624	12	.022	-1.65714	.63165	-3.03339	-.28090
diffU6-POS	.000	12	1.000	.0000	1.1288	-2.4594	2.4594
diffFMIA	4.622	12	.001	9.00000	1.94739	4.75701	13.24299
diffIMPA	-3.228	12	.007	-6.55714	2.03145	-10.98330	-2.13099
diffFMA	-2.809	12	.016	-6.52857	2.32376	-11.59161	-1.46553
diffSNA	-2.819	12	.015	-1.4143	.5016	-2.5072	-.3213
diffSNB	-2.039	12	.064	-2.14286	1.05095	-4.43267	.14696
diffANB	-1.353	12	.201	-.8000	.5911	-2.0879	.4879
diffAO-BO	1.151	12	.272	.6857	.5958	-.6124	1.9838
diffPFH	-1.268	12	.229	-6.4714	5.1028	-17.5895	4.6467
diffAFH	.353	12	.730	.4571	1.2936	-2.3614	3.2757
diffLAFH	-.189	12	.853	-.2286	1.2091	-2.8631	2.4059
diffRAMUS HT.	.104	12	.919	.1000	.9581	-1.9875	2.1875
diffBODY LT.	1.469	12	.168	1.7857	1.2157	-.8631	4.4345
diffMx. Proj.	.538	12	.600	.3429	.6374	-1.0459	1.7316
diffMx. Inc.	1.521	12	.154	3.8286	2.5171	-1.6557	9.3129
diffMd. Proj.	6.526	12	.000	3.81429	.58449	2.54078	5.08779
diffMd. Inc.	.830	12	.423	1.87143	2.25417	-3.03999	6.78285
diffMx1. Exp	-.647	12	.530	-.5000	.7732	-2.1846	1.1846
diffLow.Lip Lt.	-.291	12	.776	-.5286	1.8154	-4.4841	3.4269
diffLow.1/3 Ht.	-.918	12	.376	-.7000	.7622	-2.3606	.9606
diffTFH	.364	12	.722	.4429	1.2174	-2.2096	3.0953
diffMx. Ht.	.740	12	.474	.6000	.8109	-1.1668	2.3668
diffMd. Ht.	.090	12	.930	.0857	.9555	-1.9961	2.1675
diffFAC. ANG	-.371	12	.717	-.6286	1.6950	-4.3217	3.0646
diffMx-Md Base	.416	12	.685	.6429	1.5445	-2.7223	4.0080

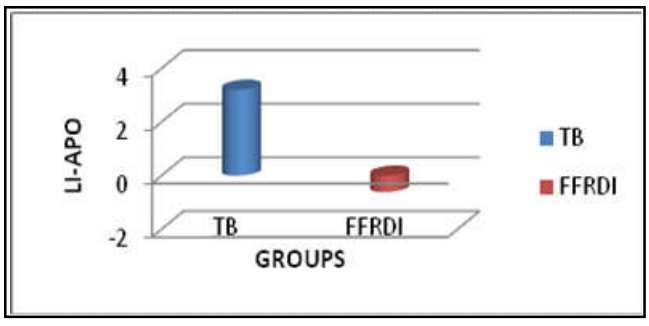
Graph 1: between-group comparisons significant difference between twin block and forsus anchored on orthdontic mini-implants under following parameters

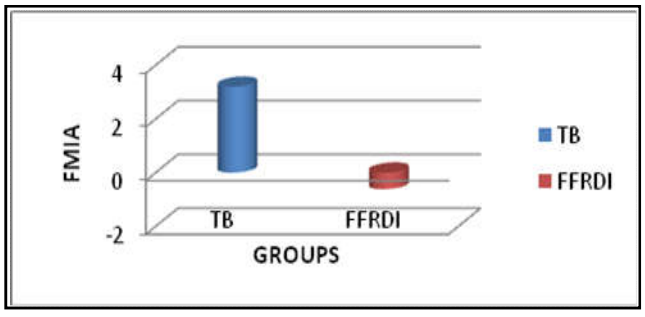




Graph 1: Comparison of Twin bock and FFRDI on L1-NB (mm)

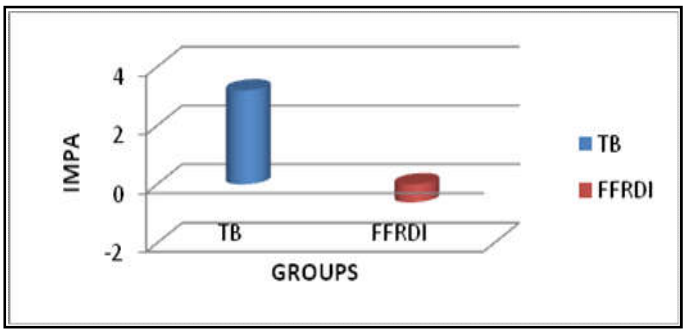
Graph 2: Comparison of Twin bock and FFRDI on L1-NB (ang)



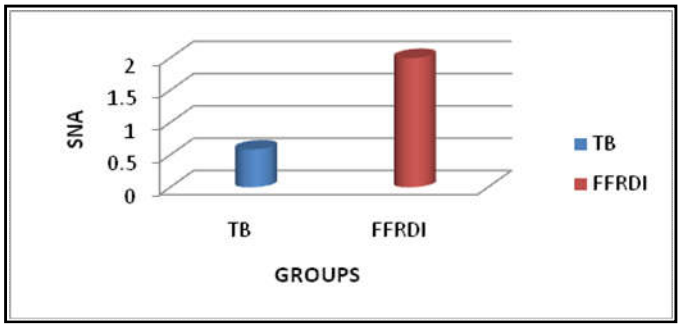


Graph 3: Comparison of Twin bock and FFRDI on LI-APO

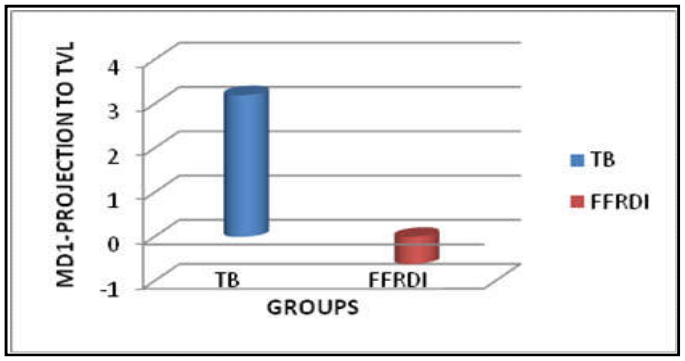
Graph 4: Comparison of Twin bock and FFRDI on FMIA



Graph 5: Comparison of Twin bock and FFRDI on IMPA



Graph 6: Comparison of Twin bock and FFRDI on SNA



Graph 7: Comparison of Twin bock and FFRDI on Md1-PROJECTION TO TV

DISCUSSION

A wide range of functional/orthopaedic appliances is available for the correction of Class II skeletal and occlusal disharmonies, a type of malocclusion with a prevalence of 12-49% in different populations, with mandibular deficiency proved to be its most dominant component of this malocclusion. (McNamara, 1981; Perillo *et al*., 2012) Among the different types of appliances, the Twin Block (TB) and the Forsus Fatigue Resistant Device are used often for the correction of Class II division 1 malocclusion. This is a retrospective cephalometric comparative study of these two commonly used appliances. Orthodontic mini-implants were used in combination with Forsus FRD appliance since most of the fixed functional appliances are reported to protrude the mandibular teeth as they are directly anchored to the mandibular arch wire, which jeopardizes the stability of achieved results. Our results highlight that both types of appliance are efficient in correction of Class II malocclusion.

The changes can be discussed under following headings:

1. Dento-alveolar effects
2. Skeletal effects
3. Soft Tissue effects

Dento-alveolar Effects

Overjet and Overbite reduction was almost similar between the two groups (independent t-test, P 0.005), which was not statistically significant. A similar finding was reported in a investigations but different authors (Lorenzo Franchi *et al*., 2011; Veronica Giuntinia *et al* 2015; Mahamad *et al*., 2012)

Mandibular incisor proclination was evident in TB group. Similar results were obtained by Antanas Sidlauskas (2005), Hanoun (2014). Mandibular incisor changes were minimal and statistically insignificant in FFRDI group. The possible explanation to this is mandibular incisors are almost upright in Forsus FRD because it is given along with fixed appliance where lower incisor inclination is corrected at levelling and alignment stage before bite-jumping with the appliance. Also it is preferred to give lingual crown torque in mandibular arch wire and anchoring the appliance on to mini implants in the mandible to prevent any further proclination. This suggests that the combination of Forsus FRD appliance with orthodontic mini-implants limited the mandibular incisor proclination. This similar finding was seen in a randomized control trial showing three-dimensional effects of the mini-implant–anchored Forsus Fatigue Resistant Device by Elkordy *et al*. (2016) Statistically significant retroclination of the maxillary incisors was evident in the both the groups. The retroclination of maxillary incisors with FFRDI is in agreement with a study by Elkordy *et al*. (2016) and with TB is in disagreement with some previous studies and is in agreement with many others studies (Sidlauskas, 2005; Sherif A. Elkordy *et al*., 2016; Sidlauskas, 2005). Maxillary molar distalization was achieved in both groups. Studies by Heinig (2001) and Karacay (2006) showed similar results.

Skeletal effects

As for the antero-posterior skeletal changes, there was a significant reduction of the SNA and ANB angles in both the groups which can be explained as "headgear effect" produced by functional appliances. A significant increase in SNB and effective mandibular length in both treatment groups was also

seen which is due a combination of enhancement of mandibular growth by functional appliance and natural mandibular growth effect. These findings confirm previous investigations (Tümer and Gültan, 1999; Franchi *et al*., 2011). As for vertical skeletal changes, Anterior facial height, LAFH and Ramus Height increased significantly in both the TB and FFRDI while posterior facial height increased but it was not statistically significant. Singh *et al*. (2010) found a similar trend toward an increase in vertical skeletal relationships in the TB sample treated during the pubertal growth spurt with respect to controls, though it did not reach statistical significance (FMA, 1.8u). Our findings regarding increase in vertical dimensions with FFRDI were in disagreement those reported by other investigators, who found that the FRD did not produce any significant change in vertical skeletal relationships. (Lorenzo Franchi *et al*., 2011) Association of orthodontic mini-implants with FFRD appliance can be a possible explanation for this skeletal effect in our study.

Soft tissue effects

Mandibular incisor projection to TVL drawn from subnasale decreased in TB while it increased in FFRDI and Mandibular Incisor Inclination angle decreased significantly in TB while its changes were insignificant with FFRDI. These findings demonstrate mandibular incisor proclination in TB and and minimal changes in the inclination of mandibular incisors in FFRDI group. Giuntini *et al* in their study showed proclination of mandibular incisors with TB and Forsus FRD appliance. While Elkordy *et al*. (2016) found out in their study that association of mini-screws with Forsus FRD appliance shows a better control on proclination of mandibular incisors. Maxillary incisor projection to TVL drawn from subnasale increased in both the groups. Maxillary incisor inclination increased in both the groups. These results may be explained by maxillary incisor retroclination caused by both functional appliances. (Manni *et al*., 2012; Lund and Sandler, 1998) In vertical dimensions, the soft tissue parameters Lower Lip Length, Lower 1/3rd Height, Total Facial Height, Maxillary height and Mandibular height increased significantly in both the groups. Singh *et al*. (2010) reported similar trend with TB while studies of other investigators (Lorenzo Franchi *et al*., 2011) was in disagreement to this finding associated with Forsus. This increase can be explained as an effect of association of orthodontic mini-implants with Forsus FRD appliance. Facial angle increased in both TB and FFRDI groups. This improvement in facial convexity with TB is in agreement with previous study by Mir *et al*. (2006) The distance between inferior and superior labial sulcus decreased (Mx-Md Base) in both TB and FFRDI. This change was statistically significant in TB while it was not significant in FFRDI. This increase suggests mandibular growth enhancement by both functional appliances. These findings confirm previous investigations (Tümer and Gültan, 1999; Franchi *et al*., 2011) that suggest a mandibular growth enhancement effect by these appliance.

Conclusion

The study concluded that TB and FFRDI are effective in the treatment of patients with class II division 1 malocclusion with retrognathic mandible as both appliances were able to induce favorable changes. The Class II correction induced by the TB was combination of dento-alveolar and skeletal effects, with a large amount of proclination of the mandibular incisors and less influence in maxilla, while incorporation of orthodontic mini-implants with FFRD decreased the mandibular dento-alveolar side effects and increased the distalizing effects of the appliance on the maxillary arch and hence, in turn, increased the skeletal effects. It can also be concluded that Mini-implants can act as absolute anchorage load-bearing units and allow the mandible to express its full growth potential without any undue adverse dental effects.

REFERENCES

Abdulfatah Hanoun, Thikriat S Al-Jewair, Sawsan Tabbaa, Mhd Amer Allaymouni, Charles B Preston. A comparison of the treatment effects of the Forsus Fatigue Resistance Device and the Twin Block appliance in patients with class II malocclusions. Clinical, Cosmetic and Investigational Dentistry 2014:6.

AOztoprak M, Nalbantgil D, Uyanlar A, Arun T. A cephalometric comparative study of Class II correction with Sabbagh Universal Spring 2 and Forsus Fatigue Resistant Device appliances. *Eur J Dent*., 2012;6:302–310.

Carlos Flores-Mir, Paul W. Major. Cephalometric Facial Soft Tissue Changes with the Twin Block Appliance in Class II division 1 Malocclusion Patients. Angle Orthodontist, Vol 76, No 5, 2006

Franchi L, Alvetro L, Giuntini V, Masucci C, Defraia E, Baccetti T. Effectiveness of comprehensive fixed appliance treatment used with the Forsus Fatigue Resistant Device in Class II patients. *Angle Orthod*., 2011;81(4):678–683.

Gandedkar N, Revankar A, Ganeshkar S. Correction of a severe skeletal Class II occlusion with a fixed functional appliance anchored on mini-implants: a patient report. *World J Orthod*., 2010;11:369–379.

Heinig N, Goz G. Clinical application and effects of the Forsus spring. A study of a new Herbst hybrid. *J Orofac Orthop*., 2001; 62:436–50.

Karacay S, Akin E, Olmez H, Gurton AU, Sagdic D. Forsus Nitinol Flat Spring and Jasper Jumper corrections of Class II division 1 malocclusions. *Angle Orthod.,* 2006; 76:666–72

Lorenzo Franchi; Lisa Alvetro; Veronica Giuntini; Caterina Masucci; Efisio Defraia; Tiziano Baccetti. Effectiveness of comprehensive fixed appliance treatment used with the Forsus Fatigue Resistant Device in Class II patients. *Angle Orthod*., 2011;81:678–683.

Lorenzo Franchi; Lisa Alvetro; Veronica Giuntini; Caterina Masucci; Efisio Defraia; Tiziano Baccetti. Effectiveness of comprehensive fixed appliance treatment used with the Forsus Fatigue Resistant Device in Class II patients. *Angle Orthod*., 2011;81:678–683.

Lund DI, Sandler PJ. The effects of Twin Blocks: a prospective controlled study. *Am J Orthod Dentofacial Orthop*., 1998;113(1):104–110.

Mahamad IK, Neela PK, Mascarenhas R, Husain A. A comparision of Twin-block and Forsus (FRD) functional appliance – a cephalometric study. *Int J Orthod Milwaukee*, 2012;23(3):49–58.

Manni A, Pasini M, Mauro C. Comparison between Herbst appliances with or without miniscrew anchorage. *Dent Res J*., 2012;9:S216–S222.

McNamara JA Jr. Components of Class II malocclusion in children 8–10 years of age. *Angle Orthod*., 1981;51:177–202.

Mir CF,Majorb MP, Majorc PW. Soft Tissue Changes with Fixed Functional Appliances in Class II division 1. *Angle Orthod*., 2006;76:712–720.

Perillo L, Padricelli G, Isola G, Femiano F, Chiodono P, Matarese G. Class II malocclusion division 1: a new classification method by cephalometric analysis. *Eur J Paediatr Dent*. 2012;13:192–196.

Sherif A. Elkordy ; Amr M. Abouelezz ; Mona M. Salah Fayed ; Khaled H. Attiab ; Ramy Abdul Rahman Ishaq ; Yehya A. Mostafab. Three-dimensional effects of the mini-implant–anchored Forsus Fatigue Resistant Device: A randomized controlled trial. *Angle Orthodontist*, Vol 00, No 0, 0000

Sidlauskas A. Clinical effectiveness of the Twin block appliance in the treatment of Class II Division 1 malocclusion. *Stomatologija*. 2005;7(1):7–10

Sidlauskas A. The effects of the Twin-block appliance treatment on the skeletal and dentolaveolar changes in Class II Division 1 malocclusion. Medicina (Kaunas). 2005;41(5):392–400.

Tümer N, Gültan AS. Comparison of the effects of monoblock and twin-block appliances on the skeletal and dentoalveolar structures. *Am J Orthod Dentofacial Orthop*., 1999;116(4):460–468.

Veronica Giuntinia; Andrea Vangelistia; Caterina Masuccia; Efisio Defraiab; James A. McNamara Jrc; Lorenzo Franchid. Treatment effects produced by the Twin-block appliance vs the Forsus Fatigue Resistant Device in growing Class II patients. *Angle Orthod*.

Veronica Giuntinia ; Andrea Vangelistia ; Caterina Masuccia; Efisio Defraiab ; James A. McNamara Jrc ; Lorenzo Franchid. Treatment effects produced by the Twin-block appliance vs the Forsus Fatigue Resistant Device in growing Class II patients. Angle Orthod. 0000;00:000–000.

Vogt W. The Forsus Fatigue Resistant Device. *J Clin Orthod*., 2006;40(6):368–377.

Singh S, Singh M, Saini A, Misra V, Sharma VP, Singh GK. Timing of myofunctional appliance therapy. *J Clin Pediatr Dent*. 2010;35:233–240

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