Original Article

Evaluation of True Incisor Intrusion Achieved with Single Mini Implant for Correction of Deep Overbite in Adult Patients

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ABSTRACT

Aim: To determine efficacy of single mini implant placed below anterior nasal spine in achieving true incisor intrusion in deep bite adult patients.

Methods: Sample of this prospective study comprised of ten adult patients (10 female) undergoing treatment at the Department of Orthodonics, SDM college of Dental Sciences; Dharwad, India. Patients with in the age range of 20–24 years (mean 21.2 years; SD ± 8.32 years) with deep overbite of at least 4 mm were treated using mini implant as a source of anchorage. An intrusion force (60 g) was delivered by zing string which was attached to a stop crimped in the middle of the passive 018" SS utility archwire after initial alignment. Lateral cephalograms and other records were taken at the beginning of intrusion at T1 and after intrusion at T2.

Results: The amount of intrusion achieved using mini implants as a source of anchorage for intrusion was statistically and clinically significant with a mean value of 2.8 mm, when measured from centroid of maxillary incisor and palatal plane in a time interval of 3.3 months.

Conclusion: Single mini implant placed below anterior nasal spine is an efficient source of anchorage to achieve true incisor intrusion.

Keywords: Intrusion, Mini implant, Deep bite.

INTRODUCTION

Deep overbite has been considered as one of the most common malocclusion problems that is difficult to be treated and retained. Prevalence of deep overbite was found to range from 21% to 26% in normal population compared to 75% in orthodontic patients.[1] Correction of deep bite is often a main objective during orthodontic treatment because of its potentially detrimental effects on periodontal health, tempromandibular joint function, as well as esthetics.[2]

A decrease in vertical skeletal growth, axial inclinations of the upper and lower anterior teeth, vertical positions of the anterior and posterior teeth, and loss of periodontal support are among the most common factors that contribute to the development of deep bite. Methods to correct deep bite include extrusion of posterior teeth, relative intrusion of incisors and true intrusion of incisors. Extrusion of posterior teeth is one of the most common methods to correct deep bite in growing patients.[2,3] Intrusion of upper and/or lower incisors is a desirable method to correct deep bite in many adolescents and adult patients as it is more stable and does not change the vertical dimension of face. True intrusion of incisors is primarily indicated in deep bite cases with a large vertical dimension, patients with excessive incision stomion distance and a large inter labial gap. Advantages of true intrusion of anterior teeth include achievement of lip competency, reduced incisal exposure without any increase in lower anterior facial height.[4]

There are certain cases which requires absolute intrusion of incisors for correction of deep overbite such as Class II

division 2 malocclusion with supraerupted incisors,[5,6] spaced and extruded incisors frequently seen in adults following loss of periodontal attachment.[7] Even some patient's with Class II division 1 malocclusion with deep overbite often require intrusion of incisors only.[8]

Three treatment modalities were proved to effectively decrease deep overbite by intruding upper incisors: J-hooks headgear, intrusive arches and mini-screw supported intrusion system. The intrusion effect of J-hooks headgear may vary since it depends upon patient cooperation. Although, intrusive arches (utility and connecticut) are an alternative in wide spread use; undesirable side effects such as extrusion of posterior teeth and flaring of anterior teeth may compromise their efficiency. Since early 1980's, introduction of mini implants have brought a drastic change in orthodontic anchorage and biomechanics.[9] Due to their small dimensions, they can be placed in interdental areas where traditional implants cannot be inserted. Since no study has been reported so far about the efficacy of single mini implant in achieving deep bite correction, this comprehensive study was undertaken with the aim to evaluate the changes achieved with a single mini implant placed below ANS to achieve true incisor intrusion especially in adult patients.

MATERIAL AND METHODS

Sample of this prospective study comprised of ten adult patients (10 female) undergoing treatment at the Department of Orthodontics. Patients with in the age range of 20–24 years (mean age 21.25 ± 8.32 yrs) (Table 1) with deep overbite of atleast 4 mm, maxillomandibular plane > 28° and average axial inclination of incisors were treated by using mini implants (1.4 mm in diameter and 6 mm in length) placed below ANS for true intrusion of maxillary incisors. After initial alignment with preadjusted edgewise appliance (.022" × .028" MBT) (3M Unitek Gemini) utility arch design in 0.018" stainless steel (SS) with a cinch back distal to first molars was placed. Transpalatal arch was placed in the maxillary arch. Self drilling mini implant (diameter 1.4 mm, length 6 mm) (Absoanchor, Dentos South Korea) were inserted into alveolar bone between roots of central incisors at the mucogingival junction. An intrusion force was delivered by zing string which was attached to a stop crimped in the middle of the passive 018" SS utility archwire (Fig. 1). It maintained an intrusive force of 60 g on the incisors during the study.[10] The magnitude of intrusive force was measured with calibrated Dontrix guage (corex; orthocare, saltaire, UK) and checked each time at monthly interval. Mini implants were loaded immediately.

Lateral cephalograms were taken at the beginning of treatment at T1 and after intrusion at T2. All cephalograms were traced by the same investigator using 0.3 mm lead pencil. Twenty-one landmarks were located and 20 measurements (9 angular and 11 linear) were made on the cephalometric tracings (Figs 2 and 3). Incisal Centroid[11] (located at the midpoint between incisal edge and root apex) was determined on initial cephalogram of each patient and transferred to final cephalogram by individual template to evaluate treatment changes.[12] Vertical reference (VRL) line constructed perpendicular to Frankfurt (FH) plane was used to measure dental effects. The lateral cephalogram tracing taken before

Table 1

Mean ages and treatment duration of the study group

Patients (N)	*Age at T1(y)*	*Period of intrusion (months)*
10	21.25±8.32	3.3±0.67

Figure 1 A mini implant placed for anterior intrusion

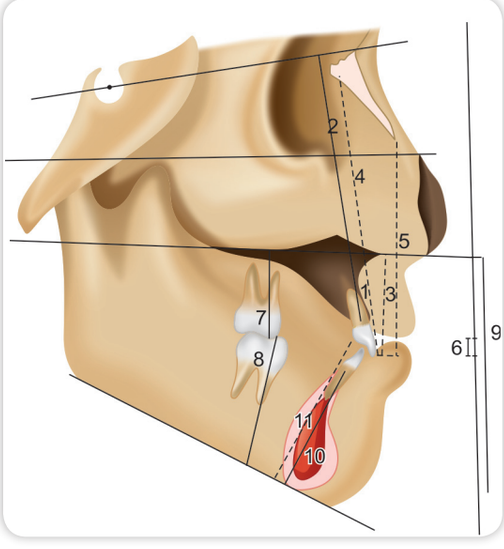

Figure 2 Mini implant placed below ANS; intrusive forces being applied using Zing string after initial alignment

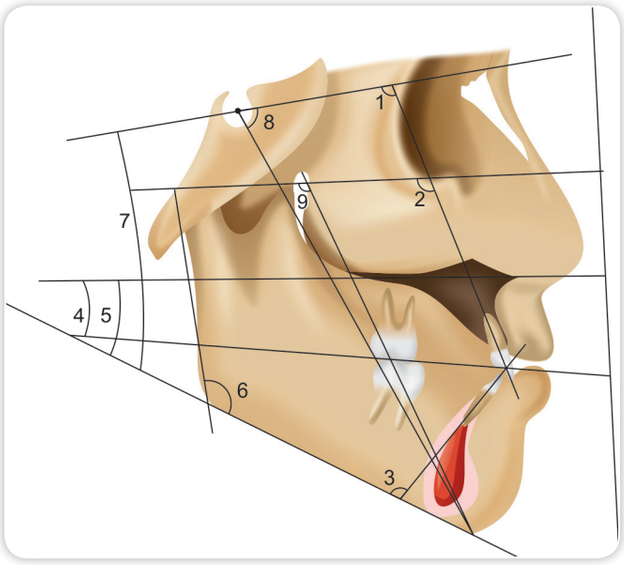

Figure 3 Linear measurements: 1, Point I1- PP (Perpendicular distance between centroid of maxillary central incisor and the palatal plane) 2, Point I1-Frankfurt plane (Perpendicular distance between centroid of maxillary central incisor and the Frankfurt plane) 3, I01- PP (Perpendicular distance between incisal edge of maxillary central incisor and the palatal plane) 4, I01-SN plane (Perpendicular distance between incisal edge of maxillary central incisor and SN plane) 5, I01-Frankfurt plane (Perpendicular distance between incisal edge of maxillary central incisor and the Frankfurt plane) 6, Stms-U1 (Distance between stomium superioris and the incisal edge of maxillary incisor projected on vertical reference plane) 7, UM6-PP (The perpendicular distance between the mesiobuccal cusp tip of the maxillary first molar and the palatal plane) 8, LM6-MP (The perpendicular distance between the mesiobuccal cusp tip of the mandibular first molar and the mandibular plane) 9, Lower Facial height (measured from anterior nasal spine to menton) 10, Point I2- MP (The perpendicular distance between centroid of mandibular incisor and mandibular plane) 11, I 02-MP (The perpendicular distance between incisal edge of mandibular incisor and mandipular plane)

and after intrusion were superimposed along the palatal plane registered at ANS[13,24] (Fig. 4). No other treatment was performed until intrusion was completed.

Periapical radiographs were obtained at T1 and T2 for each patient to determine any signs of root resorption. Statistical analysis of data were performed with statistically significant level set at $p<0.05$.

STATISTICAL ANALYSIS

The data obtained at T1 and T2 were subjected to statistical analysis. Descriptive analysis for mean differences, standard deviations and standard error were calculated between T1 and T2. The data were checked for normal distribution by using Shapiro Wills test. The student-t test was used to determine

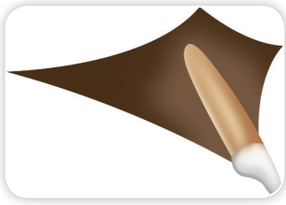

Figure 4 Angular measurements: 1, UL1–SN (Posterior inferior angle between SN and long axis of the maxillary central incisor) 2, UL1-FH (Posterior inferior angle between FH and long axis of the maxillary central incisor) 3, LI –MP (long axis of mandibular central incisor and mandibular plane) 4, PP occlusal plane (angle between palatal plane and the occlusal plane) 5, Basal plane angle (angle between palatal and mandibular planes) 6, Gonial angle (Ar –Go-Me) 7, SN-GoGn (Relates the lower border of the mandible to the anterior cranial base) 8, Y axis on SN plane (The angle formed by S-Gn and Sella–Nasion plane) 9, Y axis on FH plane (The angle between S-Gn and Frankfurt horizontal plane)

level of significance and correlation of intrusion achieved before and after treatment.

Results

Of the 10 mini-implants placed, only one loosened in the second month during treatment and was replaced immediately. Overall success rate was 99%. Significant amount of intrusion has been achieved with a mean value of 0.8 mm/month when measured from a point I_1 in relation to palatal plane and sella nasion (SN) plane. T1 and T2 values are given in Tables 2A and B. Axial inclination of maxillary incisors has increased slightly ($p<0.05$). Other variable like SN-GoGn, gonial angle, y axis on FH plane and y axis on SN plane did not show any significant changes with treatment ($p>0.05$). Cephalometric linear reading as measured by UM6-PP, L6-MP, lower facial height (ANS-Me) also showed no significant changes ($p>0.05$).

Discussion

Deep overbite is one of most common aspect of malocclusion and ironically still continues to be one of the most interguing problem faced by the orthodontists.[23] It is widely accepted that correction by extrusion of posterior teeth is both difficult and less stable in non-growing individuals. Leveling in many such adults patient's is opposed by strong muscle of mastication and would tend to increase patient lower facial height. The extruded posterior teeth would also impinge in the freeway space leaving the prognosis for this leveling technique in doubt.[24,25]

Since 1983, very few clinical study have been done to evaluate the efficacy of mini implants as a source of anchorage for intrusion of anterior teeth. Hence, this study was undertaken to fill in this important research lacunae.

Since true incisor intrusion take place with forces directed through center of resistance,[26] however such a mechanics is not possible in a clinical setup due to biologic constraints.[27] Even exact position of center of resistance of four anterior teeth is different according to different studies.[27,28] As a result some amount of flaring is inevitable with any intrusive mechanics. In the present study, only one mini implant had been placed below anterior nasal spine which led to a small amount of anterior flaring. To prevent this, archwire was cinched back distal to first molar tube. Though the change in incisor inclination was observed during the application of intrusive forces it was however not stastistically significant (0.4°).

Alqabandi[29] et al compared the effects of rectangular and continuous arch wires with a mild reverse curve of spee on the axial inclination of lower incisors during the initial stage of treatment. They reported that the change in lower incisor inclination was same in both the groups and lower incisor proclination occur in both the group unless they are cinched back. The cinch back produced in rectangular wire is going to incorporate torque into the wire which may affect the amount of net intrusion achieved for example if labial root torque is incorporated into the wire by the cinch back, the intrusive forces are going to be increased on the anterior teeth.[30] Hence, in the present study round wire was preferred over rectangular wire to evaluate the amount of true intrusion achieved.

The results of this study as compared to published case reports was different because of differences in the study design and parameters used for evaluation of incisor intrusion.

Only few case reports published have used implants for incisor intrusion. Creekmore[13] (1983) reported usage of vitallium implant placed below ANS for intrusion of upper anterior teeth. He achieved 6 mm of intrusion. Kanomi[14] mentioned the usage of mini implants for intrusion of mandibular anterior teeth by 6 mm. Ohnishi[15] achieved an incisor intrusion of 5.5 mm when measured relative to maxillary incisor tip. Kim[16] et al described a case report wherein they have achieved an incisor intrusion of 4 mm within 6 months as summarized in Table 3.

There has been a difference in amount of intrusion achieved when two mini implants were used between the roots of maxillary lateral incisors and canine on either side. Upadhyay[17] et al has reported an intrusion of 4 mm when two mini implants were used. Saxena R[20] also reported considerable amount of anterior intrusion with the usage of mini implants. Omur Polat Ozsoy[19] et al found that mean rates for intrusion was 0.4 mm/month with mini implants when compared with utility arches with an intrusion rate of 0.27 mm/month.

Semsik[21] et al also reported a true intrusion of 2.47 mm with mini implants. Various studies till now on intrusion of anterior teeth has been summarized in Table 4.

Julia[31] et al conducted a meta-analysis to quantify the amount of true incisor intrusion attained during orthodontic treatment using electronic databases-Pubmed, Medline. In process and other non-indexed citations and all EBM reviews. They concluded that in non-growing patients, the segmented arch technique can produce 1.5 mm of incisor intrusion in the maxillary arch and 1.9 mm in the mandibular arch.

Our study has revealed significant amount of intrusion with a mean value of 2.8 mm when measured from centroid rather than incisal tip. Mean time period was 3.3 ± 0.7 months.

Table 2A

Linear values

Measurement in mm	*T1*	*T2*	*P value*	*t value*	*Significance*
1. I_1- PP	21.3±2.21	18.5±2.27	0.0000***	7.792	HS
2. I_1-SN	74.1±4.17	71.7±4.05	0.0001***	7.0602	HS
3. I_{01}- PP	30.8±2.29	28±2.40	0.0000***	8.5732	HS
4. I_{01}-SN	84.7±5.03	82.4±4.52	0.0006***	5.1287	HS
5. I_{O1}-FH	52±5.01	49.6±4.85	0.0059	3.5821	NS
6. Stms-I01	6.8±2.85	4.1±2.07	0.0000	8.059	HS
7. UM6-PP	24±1.63	23.8±1.61	0.5911	0.5571	NS
8. L6-MP	32.4±3.53	32.7± 3.52	0.2789	1.1523	NS
9. Lower facial height	68±3.88	68.3±4.05	0.1934	1.4056	NS
10. I_2-MP	35.6±2.50	35.4±2.50	0.1678	1.5	NS
11. I_{02}-MP	45.6 ± 2.75	45.3 ± 2.71	0.6783	0.4286	NS

Table 2B

Angular values

Measurement in degrees	*T1*	*T2*	*P value*	*t value*	*Significance*
1. U1-SN	103.5 ± 9.80	104.3±9.49	0.0697	2.058	NS
2. U1-FH	112.7±3.62	113.1±3.81	0.5450	0.6290	NS
3. L1-MP	96±5.07	96±5.24	1.000	0	NS
4. PP-occlusal plane	11.9±2.68	11±2.86	0.1467	1.588	NS
5. Basal plane angle	28.7±3.46	28.1±3.21	0.1405	1.616	NS
6. Gonial angle	126.8±5.71	126.7± 5.10	0.9162	0.1082	NS
7. SN-GoGn	33±4.92	32.2±3.91	0.4830	0.7317	NS
8. Y axis on FH	62.1±4.74	62.2±4.96	0.8321	0.2182	NS
9. Y axis on SN	68±3.65	68.1±3.63	0.7804	0.2873	NS

Table 3

Other case reports

Author and year	*No. of mini implants placed and site of insertion*	*Amount of intrusion achieved*
Creekmore and Eklund[14] (1983)	One mini implant placed below anterior nasal spine.	6 mm intrusion of maxillary incisors
Kanomi[15] (1997)	One mini implant placed between the roots of lower central incisors.	6 mm intrusion of mandibular incisors
Ohnishi[16] (2005)	One mini implant placed between the roots of central incisors in the maxillary arch.	5.5 mm intrusion of maxillary incisors
Kim[17] (2006)	One mini implants placed between roots of central incisors in the upper arch.	4 mm intrusion of maxillary incisors
Upadhyay[18] (2008)	Two mini implants placed between roots of maxillary lateral incisors and canine.	4 mm intrusion of maxillary incisors

Table 4

Various studies on intrusion of anterior teeth

Author and year	*No. of subjects and duration of study*	*Site and number of mini implant used*	*Amount of intrusion achieved*
Deguchi[19] (2008)	8 pts; 6.6+.7 months	Two mini implant placed in the premaxilla	3.65 mm
Omur Polat[20] (2011)	13 pts; 6.61+2.95 months	Two mini implant between lateral incisor and canine	0.44 mm/month
Saxena R[21] (2010)	10 pts; 4+1.5 months	Two mini implant between lateral incisor and canine	2.9 mm+1 mm (0.9 mm/month)
Semrik and Turkkahraman[22] (2012)	15 pts; 7 months	Two mini implant between lateral incisor and canine	2.47 mm (0.34 mm/month)

Most of the studies have reported intrusion rate of 1 to 3 mm with conventional mechanics[24,32,33,34] using either incisal tip or the apex for evaluation of amount of anterior intrusion. As suggested by Burstone, incisal edge is not a reliable cephalometric landmark for assessing true incisor intrusion as it is easily affected by tipping movements of the incisors. Centroid is a superior reference for judging incisor intrusion as it is independent of incisor inclination. Hence, for this study centroid was selected for the assessment of true incisor intrusion.

Periapical radiographs of four maxillary incisors were taken at T1 and T2 which did not show any signs of blunting

or shortening of roots. Since IOPA's were taken within short period of 3–5 months sensitivity was compromised and no significant change was observed. CBCT could have been done to detect the changes but was avoided because of high radiation exposure and cost.

CONCLUSION

The amount of intrusion achieved using mini implants as a source of anchorage for intrusion was statistically and clinically significant with a mean value of 2.8 mm when measured from centroid of maxillary incisor and palatal plane in a time interval of 3.3 months. Changes in axial inclinations of maxillary incisor and extrusion of posterior teeth following intrusive mechanics were statistically and clinically insignificant.

A single mini implant placed below the ANS is an economical and efficient option for the patient when compared to two posterior mini implants for anterior intrusion. Additionally, it also provided the mechanical advantage of counteracting the tendency of incisor to tip lingually during retraction.

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REFERENCES

1. Shroff B, Lindauer SJ, Yoon WM, Burstone CJ. Simultaneous intrusion andretraction using a three piece base arch. Angle Orthod. 1997;67(6):455-62.
2. Kim TW, Kim H, Lee SJ. Correction of deep overbite and gummy smile by using a mini-implant with a segmented wire in a growing class II Division 2 patient. Am J Orthod Dentofacial Orthop. 2006;130:676-85.
3. Engel G, Cornforth G, Damerell J , Gordon J, Levy P, McAlpine J, et al. Treatment of Deep Bite. Am J Orthod. 1980;77:1-13.
4. Odman J, Lekholm U, Jemt T, Thilander B. Osseointegrated implants as orthodontic anchorage in the treatment of partially edentulous adult patients. Europ J Orthod. 1994;16:187-201.
5. Ng J, Major PW, HeoGiseon, Mir CF. True incisor intrusion attained during orthodontic treatment: A systematic review and meta–analysis. Am J Orthod Dentofac Orthop. 2006;128: 212-9.
6. Burstone CJ. The mechanics of segmental arch technique. Angle Orthod. 1966;36:99-120.
7. Dake ML, Sinclair PM. A comparison of the Ricketts and Tweed–type arch leveling techniques. Am J Orthod Dentofac Orthop. 1989;95:72-8.
8. Thuer U, Ingervall B. Pressure from the lips on the teeth and malocclusion. Am J Orthod Dentofacial Orthop. 1986;90:234-42.
9. Kyung HM, Park HS, Bae SM. Handbook for Absoanchor Orthodontic Mini implants, 2004.
10. Proffit WR. Contemporary Orthodontics. CV Mos by Company, St.Louis. 1986.
11. Johnson JS. A new approach to cephalometric analysis of the dental base relationship. Angle Orthod. 1978;48:23-31.
12. Hong RK, Hong HP, Koh HS. Effect of reverse curve mushroom archwire on lower incisors in adult patients: A prospective study. Angle Orthod. 2001;71(6):425-32.
13. Jacobson PA, Sadowsky L. Superimposition of cephalometric radiographs. Chicago: Quintessence; 1995. pp. 165-74.
14. Creekmore TD, Eklund MK. The possibility of skeletal anchorage. J Clin Orthod. 1983;17(4):266-71.
15. Kanomi R. Mini-implant for orthodontic anchorage. J Clin Orthod. 1997;31(11):763-7.
16. Ohnishi H, Yagi T, Yasuda Y, Takada K. A mini-implant for orthodontic anchorage in deep overbite case. Angle Orthod. 2005;75:444-52.
17. Kim TW, Kim H, Lee SJ. Correction of deep overbite and gummy smile by using a mini-implant with a segmented wire in a growing class II Division 2 patient. Am J Orthod Dentofacial Orthop. 2006;130:676-85.
18. Upadhyay M, Nagraj K, Yadav S, Saxena R. Mini-implants for enmasse intrusion of maxillary anterior teeth in a severe Class II division 2 malocclusion. J Orthod. 2008;35:79-8.
19. Deguchi T, Murakami T, Kuroda S, Yabuuchi T, Kamioka H, Yamamoto TT. Comparison of the intrusion effects on the maxillary incisors between implant anchorage and J hook headgear. Am J Orthod Dentofacial Orthop. 2008;133(5):654-60.
20. Polat–Ozsoy O, Arman Ozcirpici A,Veziroglu F, Cetlinsahin A. Comparison of the intrusive effects of miniscrews and utility arches. Am J Orthod Dentofacial Orthop. 2011;139:526-32.
21. Saxena R, Sethi P, Upadhyay M, Naikvijay. A clinical evaluation of mini implants as intraoral anchorage for the intrusion of maxillary anterior teeth. World J Orthod. 2010;11:346-51.
22. Semsik E, Turkkahraman H. Treatment effects of intrusion arches and mini implant system in deepbite patients. Am J Orthod Dentofacial Orthop. 2012;141:723-33.
23. Strang RHW. An analysis of the overbite problem in Malocclusion. Angle Orthod. 1934;4:65-77.
24. Weiland FJ, Bantleon HP, Droshi H. Evaluation of continous arch and segmented arch leveling techniques in adult patients–a clinical study. Am J Orthod Dentofac Orthop. 1996;110:647-52.
25. Wylie WL. Overbite and vertical facial dimensions in terms of muscle balance. Angle Orthod. 1994;14:13-7.
26. Burstone CJ. Deep overbite correction by intrusion. Am J Orthod. 1977;72(1):1-22.
27. Steenbergen EV, Burstone CJ, Andresen P, Aartman IHA. The relation between the point of force application and the flaring of the anterior segment. Angle Orthod. 2005;75:730-5.
28. Bulcke MMV, Dermaut LR, Sachdeva CL, Burstone CJ. The center of resistance of anterior teeth during intrusion using the laser reflection technique and holographic interferometry. Am J Orthod Dentofac Orthop. 1986;90:211-20.

29. Alqabandi AK, Sadowsky C, Begole E. A comparison of the effects of rectangular and round arch wires in leveling the curve of Spee. Am J Orthod Dentofacial Orthop. 1999;116: 522-9.
30. Mulligan TF. Common sense mechanics. J Clinc Orthod. 1980; 14(3):181-9.
31. Ng J, Major PW, HeoGiseon, Mir CF. True incisor intrusion attained during orthodontic treatment: A systematic review and meta analysis. Am J Orthod. 2006;128:212-9.
32. Kinzel J, Aberschek P, Mischak I, Droschl H. Study of the extent of torque, protrusion and intrusion of the incisors in the context of Class II, division 2 treatment in adults. J Orofac Orthop. 2002;63:283-99.
33. Hong RK, Hong HP, Koh HS. Effect of reverse curve mush-room archwire on lower incisors in adult patient: a prospective study. Angle Orthod. 2001;71:425-32.
34. Hans MG, Kishiyama C, Parker SH, Wolf GR, Noachtar R. Cephalometric evaluation of two treatment strategies for deep overbite correction. Angle Orthod. 1994. pp. 265-74.