



A THREE-DIMENSIONAL EVALUATION OF THE EFFECTS OF DIFFERENT INCISOR INTRUSION MECHANICS TO THE PERMANENT MAXILLARY FIRST MOLAR TEETH BY USING CONE BEAM COMPUTED TOMOGRAPHY (CBCT)

Farklı Kesici İntrüzyon Mekaniklerinin Daimi Üst Birinci Molar Dişlere Etkilerinin Üç Boyutlu Olarak Değerlendirilmesi

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ABSTRACT

Objective: The present study aims to evaluate the impacts of the upper incisor teeth intrusion in deepbite patients by two different techniques to the permanent maxillary first molar tooth using the three-dimensional cephalometric analysis in the individuals.

Materials and Methods: The population of this study consists of 34 patients with >4 mm overbite and a ≥ 2 mm gummy smile during post-pubertal period. Patients who underwent intrusion of upper incisor teeth were randomized to receive Connecticut intrusion arch (CTA) or miniscrew anchorage intrusion system (MAIS) to compare the impacts on permanent maxillary first molar teeth. Cone Beam Computed Tomography (CBCT) data obtained before (T1) and after (T2) intrusion were evaluated through three-dimensional (3D) cephalometric analysis. Intragroup assessment of treatment-related variables were performed via “t-test in dependent samples” and intergroup comparisons were assessed by “t-test in independent samples”.

Results: In patients who underwent intrusion of upper incisors, permanent maxillary first molar teeth became deviated distally (1.48 mm/7.63 degree) only in CTA group, a statistically significant difference was found between two groups ($p < 0.05$). The distance between resistance centers of maxillary first molar teeth was only increased in CTA group (0.31 mm), which also statistically differed from MAIS group.

Conclusion: CTA and MAIS techniques resulted in similar intrusive effects overall at the end of the treatment. While MAIS is recommended when anchorage from posterior region is not desired in patients with deep overbite, we believe that CTA may serve a suitable treatment alternative where miniscrew technique could not be performed.

Keywords: Deep overbite, intrusion, miniscrew, three-dimensional cephalometric analysis

ÖZ

Amaç: Bu çalışmanın amacı, derin örtülü kapanışa sahip bireylerde üst kesici dişlerin farklı tekniklerle intrüzyonunun daimi üst 1. Molar diş etkilerinin 3 boyutlu sefalometrik analiz ile karşılaştırılmasıdır.

Materyal ve Metot: Araştırmamıza, postpubertal dönemde, overbite'ı >4mm. ve dişeti gülümsemesi ≥ 2 mm. olan toplam 34 hasta dahil edilmiştir. Hastalar rastgele bir şekilde Connecticut intrüzyon arki (CTA) ile minivida ankrajlı intrüzyon sistemi (MAIS) gruplarına ayrılarak üst kesici dişlerin intrüzyonu gerçekleştirilen bireylerde üst 1. büyük azılarda ortaya çıkan etkileri değerlendirilmiştir. İntrüzyondan önce (T1) ve sonra (T2) alınan konik ışınlı bilgisayarlı tomografi (KİBT) verileri 3 boyutlu (3D) sefalometrik analizle incelenmiştir. Tedaviye bağlı değişenlerin grup içi değerlendirilmesinde “Bağımlı örneklerde t-testi”; gruplar arasındaki karşılaştırılmasında “Bağımsız örneklerde t-testi” uygulanmıştır.

Bulgular: Üst kesici dişlerin intrüzyonu gerçekleştirilen hastalarda, üst 1. molar dişler yalnızca CTA grubundaki bireylerde distale devrilmiş (1.48 mm/7.63 derece) ve bu durum gruplar arasında istatistiksel olarak önemli bulunmuştur ($p < 0.05$). Üst birinci molar dişin direnç merkezleri arası mesafe yalnızca CTA grubunda artarken (0.31 mm), gruplar arasında oluşan değişim istatistiksel olarak önemli çıkmıştır.

Sonuç: Tedavi sonunda CTA veya MAIS teknikleri genel olarak benzer intrüzyon etkileri oluşturmuşlardır. Özellikle derin örtülü kapanışa sahip bireylerde posterior bölgeden ankraj alınmak istenmediğinde MAIS prosedürünün kullanılmasını önerilirken, minivida uygulamasının yapılamayacağı bireylerde ise CTA uygulamasının başarılı bir alternatif olacağını düşünmekteyiz.

Anahtar Kelimeler: Derin örtülü kapanış, intrüzyon, minivida, üç boyutlu sefalometrik analiz.

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INTRODUCTION

Deep anterior overbite is a common orthodontic problem and also can be seen with many malocclusion types.¹⁻³ According to clinical and radiological examinations, excessive overbite can be treated either extruding the posterior buccal segments, intrusion of maxillary and mandibular anterior teeth or both.³⁻⁷ Decision of treatment depends on miscellaneous factors like an optimal incisor position, incisor display, smile line, upper lip length, and vertical dimension.⁵⁻⁷ For example, maxillary incisor intrusion is recommended for the patients with normal vertical dimension and gummy smiles⁸ with over-eruption of incisors that produces anterior deep bites in non-growing patients.^{2, 9-13} Traditionally, incisor intrusion performed by anterior bite plate⁶, functional appliances^{14, 15}, j-hook headgears¹⁶, reverse curved arches¹⁷, step-up/step-down bends¹⁰, 2x4 appliances like a utility arches¹⁸ or 3-piece intrusion arches.⁴

In addition to this, extrusion of posterior teeth, retroclination of molars and labial tipping of anterior teeth is generally outcome of these techniques.^{3, 8, 19-22} Clockwise rotation of mandibula forced by lifting of molar teeth within alveolar sockets is an unfavorable feature that increases risk of relapse in adults.^{4, 23, 24}

To eliminate above-mentioned negative aspects of intrusion of incisor teeth, treatment of deep overbite by miniscrew supported bone anchorage has been introduced during the last quarter-century.^{25, 35, 48} Miniscrews has numerous advantages such as allowing for placement in many intraoral regions; low cost; immediate loading opportunity, and simple placing and removing procedure compared with conventional dental implants.^{49, 50} Impacts of various techniques used for intrusion of incisor teeth on skeletal and dentoalveolar structures have been comprehensively evaluated through utilization of cephalometric analyses.^{4, 5, 8, 16, 19, 21, 25-30} However, to our knowledge, there is no study investigating

their effects on posterior teeth by three-dimensional cephalometric analysis.

The aim of this study was to investigate the impacts of intrusion of each upper incisor tooth of patients with deep overbite, by either Connecticut intrusion arch (CTA) or miniscrew anchored intrusion system (MAIS), on permanent first molar teeth, by using three-dimensional cephalometric analysis.

MATERIAL AND METHODS

This study was approved by the Medical Scientific Ethics Committee of Atatürk University. Informed consent form was obtained from the patients and parents. Subjects that had been referred to Atatürk University Dentistry Faculty Orthodontics Department for treatment were enrolled to the study.

Inclusion criteria to this prospective clinical study were supra-positioning of upper incisor teeth according to occlusal plane, increased overbite (>4 mm), increased gingival display on posed smile (≥ 2 mm), increased incisor display at rest (≥ 3 mm), post-pubertal period, and good periodontal health condition. Patients were excluded from the study if following criteria were present: orthodontic treatment history, any dental abnormality in upper incisor region (malformation, supernumerary tooth, etc.), root abnormality of incisor teeth as detected by radiological examinations (resorption, dilaceration, alveolar crest resorption, and presence of impacted canine teeth extending to upper incisor region).

A total of 36 patients were randomly assigned to two different intrusion technique groups. Group 1 consisted of 18 patients (14 females and 4 males) who underwent maxillary incisor intrusion by Connecticut intrusion arch (CTA), and Group 2 consisted of 18 patients (13 females and 5 males) who underwent maxillary incisor intrusion by miniscrew anchorage (MAIS). Two subjects were further excluded from the study due to lack of oral

hygiene, yielding a total of 34 patients who completed the study.

No other orthodontic treatment was applied before intrusion of all the patients were completed.

In CTA group, a molar band was placed on upper first molar teeth before leveling, and passive transpalatal arch (TPA) was applied to increase anchorage. For avoiding incisor protrusion during intrusion, 0.017x0.025-inch long-form CTA was cinched back from molar band, and it was bilaterally tied anteriorly by ligature wires to hooks distal to lateral incisors. A total of 80 g force was applied onto maxillary incisors, 40 g in average for each tooth. Force calibration was performed by either increasing or decreasing CTA-exclusive V-bends through intraoral dynamometer (Dentaurum, Ispringen, Germany) at every three weeks. Intrusion of maxillary incisor teeth was terminated in both active intrusion groups when amount of resting displayed incisor reached at esthetic margin or incisal surfaces of incisor teeth were intruded till the level of occlusal plane.^{13, 31}

In MAIS group, after radiological screening, miniscrews were inserted into the alveolar bone between roots of lateral and canine teeth. Miniscrews, we used in our study were 1.5 mm in diameter and 6 mm in length (Absoanchor, Dentos, Daegu, South Korea). One week after insertion, closed coil springs (G&H 9F NiTi Feather Light Close Coil Spring, Indiana, USA) were placed between miniscrews and anchor twists distal to lateral teeth. Afterwards, 80 g force was applied, 40 g in average for each tooth with a follow-up interval of three weeks.

CBCT records of patients were obtained through Cone Beam Volumetric Computed Tomography (NewTom 3G, Verona, Italy) device in Department of Oral and Maxillofacial Radiology of Ataturk University Faculty of Dentistry. Irradiation parameters of

the device were 110 kVp with an effective dose of 60 μ Sv (2007 IRCP) per adult.

Computed tomography data of 34 patients, which had been acquired just before (T1) and after (T2) intrusion, were analyzed in a three-dimensional cephalometric method via Simplant Pro O&O (Materialise, Leuven, Belgium). In this software, position of the head was calibrated in a way that Frankfurt horizontal plane was parallel to the ground in sagittal section, lower orbital borders were at the same level in coronal section, and median palatine suture was perpendicular to the ground in axial section in 3D model. All cephalometric assessments were performed by the same investigator (FK). Pal 3D cephalometric analysis, developed by Ilhan M. Dagsuyu, was utilized in this study.

Skeletal landmarks regarding 3D cephalometric analysis were indicated at Table 1.

Table 1: Skeletal landmarks regarding 3D cephalometric analysis.

Skeletal landmark	Definition
OrR-OrL	Deepest external point of infraorbital border (double points; right and left)
Mid-Orbital	Midpoint of OrR and OrL points
(PoR-PoL)	Most superior midpoint of external acoustic meatus (double points; right and left)
PIR-PIl	Most inferior midpoint of foramen rotundum it reaches on pterygomaxillary fossa (double points; right and left)
CP	Center point; midpoint of right and left pterygoid points
FSR-FSL	Geometrical center of foramen spinosum (double points; right and left)
ELSA:	Midpoint of right and left foramen spinosum points
ANSR-ANSL	Most anterior and apical point of hard palate at the sagittal plane (double points; right and left)
ANS	Midpoint of ANSR and ANSL
PNS	Most posterior and apical point of hard palate at the sagittal plane
IFR-IFL	Most external right and left point of incisive foramen (double points; right and left)
Incisive foramen	Midpoint of IFR-IFL points
UICr	Apical point of alveolar crest that is mesial to upper central teeth
UR2Cr-UL2Cr	Apical point of alveolar crest that is between upper lateral and canine teeth (double points; right and left)
Dental Landmarks	
URI-ULI	Midpoint of incisive border of upper central incisor tooth (double points; right and left)
MoR-MoL	Apical point of mesiobuccal tubercle of upper maxillary first molar tooth (double points; right and left)
ApUR1-ApUL1	Apex of upper central incisor tooth (double points; right and left)
ApUR6-ApUL6	Mesiobuccal apex of upper first molar tooth (double points; right and left)
TriUR6-TriUL6	Midpoint of trifurcation of upper first molar tooth (double points; right and left)
Ur1ResCrestal-UL1ResCrestal	Point at the proximal 1/3 of the distance that extends from alveolar crest within the tooth on the long axis of upper incisor teeth to ApUR1 point (double points; right and left)
Reference Planes Used in Current Study	
FH	Frankfort horizontal plane. Horizontal reference plane passing through right (PoR) and left (PoL) porion and MidOrbital points
PP	Horizontal palatine reference plane passing through ANSR, ANSL, and PNS points
VPP	Vertical palatine reference plane that is perpendicular to palatine plane that passes through ANSR and ANSL points and crosses it at ANS

Landmarks and reference lines and planes that were used in the study were based on the

published studies in the literature.³²⁻³⁴ 3D cephalometric measurements used in current study indicated at Table 2.

Table 2: 3D cephalometric measurements used in current study.

Measurement	Definition
UIRCrPPort:	Mean of the perpendicular distance that extends from both UR1ResCrestal and UL1ResCrestal points to PP reference plane
UIRCrVPPort:	Mean of the perpendicular distance that extends from both UR1ResCrestal and UL1ResCrestal points to VPP reference plane
MorMol	Shortest distance between MoR and MoL points
TriUR6TriUL6	Shortest distance between TriUR6 and TriUL6 points
MoPP	Mean of the perpendicular distance that extends from both MoR and MoL points to PP reference plane
MoVPP:	Mean of the perpendicular distance that extends from both MoR and MoL points to VPP reference plane
TriU6PPort:	Mean of the perpendicular distance that extends from both TriUR6 and TriUL6 points to PP reference plane
TriU6VPPort:	Mean of the perpendicular distance that extends from both TriUR6 and TriUL6 points to VPP reference plane
U6AngleOrt:	Mean of the angles formed between PP reference plane and both UR6Axis and UL6Axis lines

Statistical Analysis

Statistical analysis was performed using IBM SPSS Statistics (version 20.0.0 New York, USA) The Kolmogorov-Smirnov test was used to evaluate normality; independent-sample T test and Mann-Whitney U test were used to analyze the relationships between parameters in two time-points (T1, T2). All statistical analyses were performed at the 5% significance level.

All measurements were repeated in 15 randomly selected samples after 10 months by the same investigator (FK). The Houston error analysis³⁵ was used to examine the differences between T1 and T2 time-points (Houston analysis reports that all measurements are between 0.9710 and 0.9986 coefficients). All landmarks and measurements were found highly repeatable.

RESULTS

Ages, total duration of intrusion, and mean values (and standard deviations) of the subjects in CTA and MAIS groups before the intrusion were shown in Table 3. While pre-treatment age statistically differed between treatment groups ($p < 0.05$), duration of intrusion of upper incisors did not show a significant difference ($p > 0.05$).

Table 3: Comparison of chronological ages and duration of intrusion of upper incisors in CTA and MAIS groups.

Parameter	CTA		MAIS		Test
	Mean	St. Deviation	Mean (St. Dev.)		
Chronological age (months)	191.88	11.62	200.17 (11.09)		S*
Duration of intrusion of upper incisors	3.64	0.82	3.36 (1.25)		NS

* $p < 0.05$, S: significant; NS: non-significant

3D Cephalometric Analysis Findings

Intergroup Baseline Characteristics

Baseline characteristics of the groups with comparisons were indicated in Table 4. Study groups did not statistically differ in terms of any pre-treatment parameters.

Table 4: Comparison of baseline characteristics by groups.

Parameter	CTA		MAIS		Test
	Mean	St. Deviation	Mean (St. Dev.)		
MoVPP	28.72	2.31	30.60 (4.19)		NS
MoPP	22.78	2.57	23.26 (2.00)		NS
TriU6VPPort	31.39	1.68	32.85 (3.42)		NS
TriU6PPort	11.32	2.48	12.06 (1.86)		NS
U6AngleOrt	90.42	4.51	90.11 (4.52)		NS
MorMol	50.29	3.33	50.74 (2.41)		NS
TriUR6TriUL6	44.13	2.75	45.56 (2.39)		NS

* $p < 0.05$, S: significant; NS: non-significant

Comparison of Intragroup Parameters Before and After Intrusion

CTA Group

CTA group showed significant alterations from baseline (T1 to T2) in MoVPP, U6Angleort, MorMol, TriUR6, and TriUL6 parameters ($p < 0.05$). All other values were found similar (Table 5).

Table 5: Assessment of parameters before and after treatment in CTA group.

Parameter	Before Treatment		After Treatment		Test
	Mean	St. Deviation	Mean (St. Dev.)		
MoVPP	28.72	2.31	30.20 (2.26)		S *
MoPP	22.78	2.57	22.96 (2.43)		NS
TriU6VPPort	31.39	1.68	31.27 (1.44)		NS
TriU6PPort	11.32	2.48	11.49 (2.47)		NS
U6AngleOrt	90.42	4.51	82.78 (4.66)		S *
MorMol	50.29	3.33	50.94 (2.84)		S *
TriUR6TriUL6	44.13	2.75	44.44 (2.66)		S *

* $p < 0.05$, S: significant; NS: non-significant

MAIS Group

MAIS group did not show any statistically significant difference in terms of any parameter from baseline (T1) to study end (T2), as demonstrated in Table 6.

Table 6: Assessment of parameters before and after treatment in MAIS group.

Parameter	Before Treatment		After Treatment	Test
	Mean	St. Deviation	Mean (St. Dev.)	
MoVPP	30.60	4.19	30.60 (4.27)	NS
MoPP	23.26	2.00	23.20 (2.08)	NS
TriU6VPPort	32.85	3.42	32.93 (3.50)	NS
TriU6PPort	12.06	1.86	11.96 (1.83)	NS
U6AngleOrt	90.11	4.52	90.29 (4.45)	NS
MorMol	50.74	2.41	51.02 (2.63)	NS
TriUR6TriUL6	45.56	2.39	45.52 (2.42)	NS

NS: non-significant

Comparison of Intergroup Parameters Before and After Intrusion

Comparison of changes from T1 to T2 between study groups were presented in Table 7. While U6AngleOrt was found as elevated in MAIS group, it was decreased in CTA group, where the difference was statistically significant.

Table 7: Intergroup comparison of mean changes after incisor intrusion in CTA and MAIS groups.

Parameter	CTA Group		MAIS Group	Test
	Mean	St. Deviation	Mean (St. Dev.)	
Duration	3.64	0.83	3.36 (1.25)	NS
MoVPP	1.48	.55	.00 (.47)	S *
MoPP	.18	.60	-.06 (.41)	NS
TriU6VPPort	-.12	.67	.08 (.41)	NS
TriU6PPort	.17	.44	-.09 (.41)	NS
U6AngleOrt ♦	-7.63	2.71	.18 (1.06)	S *
MorMol ♦	.65	1.14	.28 (.59)	NS
TriUR6TriUL6	.31	.50	-.03 (.47)	S *

* $p < 0.05$, S: significant; NS: non-significant

♦ non-normally distributed parameter where Mann-Whitney-U test was performed.

Despite being significantly increased in CTA group, the distance (MoVPP) between crown of upper first molar teeth (MoR, MoL) and vertical palatal reference plane (VPP) did not alter in MAIS group. This intergroup difference was also found as statistically significant.

While the distance between resistance centers of upper first molar teeth was

statistically lengthened in CTA group, it was non-significantly shortened in MAIS group. The difference between the groups was also found as statistically significant. No other parameters were statistically significant between study groups.

Intrusion was achieved on the resistance center of upper central incisor teeth in CTA and MAIS groups (intrusion: CTA/MAIS: 1.46/1.78 mm), where no difference was detected for the amount of intrusion.

DISCUSSION

Management of deep overbite consists of three principal approaches, namely extrusion of upper/lower posterior teeth, intrusion of upper/lower incisors, and combination of intrusion and extrusion.^{4, 15, 23, 24} In addition, orthognathic surgery may also be preferred for extreme cases.^{24, 36}

Intrusion performed with either CTA or MAIS has distinctive impacts on upper first molar teeth. Since no anchorage was performed from posterior teeth in MAIS group, no significant alteration was detected in crown or resistance center of molar teeth for either sagittal or vertical direction. Therefore, anchorage was preserved in MAIS group in our study. This is consistent with other studies regarding performance of incisor intrusion via miniscrew anchorage.^{5, 8, 16, 37-39}

In CTA group, while 1.48 mm distal displacement of upper first molar teeth crown was found as statistically significant ($p < 0.001$), its vertical displacement was not significant ($p > 0.05$). This is consistent with the finding of Nanda who reported distal bending moment of CTA on the crown of molar tooth during creating the intrusion force.⁷ Also consistent with our results, Senisik et al. reported distal advancement of the crown after incisor intrusion by CTA.³⁰

Absence of extrusion in upper first molar teeth in CTA may originate from the ability of

sufficient anchorage of opposite occlusal forces against low vertical extrusion forces.^{3, 40} Moreover, TPA application that increases anchorage may also prevent extrusion. It was reported that extrusion of molar teeth after intrusion of incisors may cause relapses particularly in adults.²³ This is because extrusion of posterior teeth in adults may affect position of the condylar head by rendering clockwise rotation at lower jaw, which in turn, may influence temporomandibular joint and muscles. On the contrary, temporomandibular joint and its surrounding tissues that had not been adapted may lead to relapses after intrusion treatment by successful remodeling.⁹ Therefore, absence of extrusion in our study may imply a more stable property of our intrusion treatment. Our study is consistent with the vertical effects on molar teeth that was reported by the authors performing intrusion of upper incisor teeth via the other intrusion arch.³

Our study is not consistent with the findings of Senisik and Turkkahraman who reported 0.80 mm and 0.92 mm extrusion for the crown of upper first molar teeth after intrusion of upper incisor through CTA.³⁰ This may arise from lack of either intrusion in lower jaw or preventive measures improving anchorage (TPA, headgear) by the investigators.³⁰

We found no significant alteration of resistance center of upper first molar teeth in either sagittal or vertical direction after intrusion of incisor teeth in CTA group. This was inconsistent with those CTA-intrusion studies reporting mesial advancing of molar resistance center by 0.30 mm at anteroposterior axis.³⁰ This dissimilarity may be attributed to absence of anchorage-improving measures at upper jaw or observation of more protrusion in incisors.

In our study, a distal deviation of 7.63⁰ at the long axis of maxillary first molar in CTA group was statistically significant. It was

reported that anchorage from molar teeth by intra-arch intrusion techniques might lead to distal deviation of molar teeth.¹⁹ Our finding was in line with those of other authors performing intrusion through CTA.^{29, 30} On the other hand, there was no significant change in MAIS group. In fact, studies where miniscrew anchorage incisor intrusion was performed reported no significant alteration in the angle created by the molar tooth and palatal plane, consistent with our findings.^{8, 16, 39}

Evaluation of Transversal Direction Alterations

Expansion of the distances between each crowns and resistance centers of respective upper first molar teeth by 0.65 mm and 0.31 mm, respectively in CTA group was not clinically important, albeit being statistically significant. These increments were parallel to that of Van Steenberg et al. reporting increased width between molar teeth after only anchoring from upper first molar tooth by segmental arch for the intrusion of upper incisor teeth.¹⁹

In MAIS group, the distances between each crowns and resistance centers of corresponding molar teeth were not significantly altered. In fact, this is expected since no procedure was done posteriorly. This is consistent with Senisik's finding that showed unaltered distance between crowns of molar teeth after miniscrew anchored intrusion of incisor teeth.³⁷ On the contrary, Upadhyay et al., in their study where they closed extraction gaps and performed miniscrew anchored incisor intrusion, reported a 1.83 mm reduction in the distance between crowns of upper first molar teeth.³⁹ We attribute this discrepancy to the differences of investigators in mechanics and therapeutic strategies they used.

Statistical Comparison of Observed Alterations Between Groups

Mean differences of changes of resistance centers at sagittal and vertical planes showed

no differences between groups, which is consistent with those of Senisik & Turkkahraman and Polat-Ozsoy et al. using miniscrew anchored intrusion system alone or with utility arch, respectively.^{30, 8}

While upper first molar tooth was deviated distally in CTA group, this was not observed in MAIS group. Yielding a significant difference between groups, this finding is parallel to the reports of Senisik & Turkkahraman and other authors, utilizing CTA and miniscrew anchorage intrusion systems.^{30, 8}

In terms of alteration between groups at transverse plane, the distance between resistance centers of upper first molar teeth was increased by about 0.3 mm in CTA group, whereas it did not change in MAIS group, which was statistically significant. This may be explained by CTA's anchorage from upper first molar and by the possibility that TPA which we used as anchorage-improving measure might be prepared as slightly active during laboratory phase.

Our findings could be accepted as similar to the findings published in the literature overall. We suggest that the differences in intrusion values may result from the variety of techniques used, vector properties of the intrusion force (intensity, direction, application point), total duration of therapy, and diversity of age groups.

CONCLUSIONS

While the crown of upper first molar teeth were displaced to distal and buccal direction in CTA group, there was no displacement in MAIS group.

While upper first molar crown tipped and displaced distally, there was no alteration in MAIS group.

Though transpalatal arch was used in CTA group, crowns of upper first molar crown were displaced to buccal direction.

We recommend in favor of using MAIS procedure when anchoring from posterior region is not desired especially in patients with deep overbite and CTA may serve as an effective alternative where miniscrew technique could not be performed. Use of MAIS may offer advantages when no impact on posterior relation is desired in incisor intrusion.

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