

Quantitative and qualitative assessment of anchorage loss during en-masse retraction with indirectly loaded miniscrews in patients with bimaxillary protrusion

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Introduction: This study provides vital insight in assessing anchorage loss when miniscrews are indirectly loaded. **Methods:** The study sample comprised 18 patients with bimaxillary protrusion (14 girls, 4 boys; mean age, 17.3 ± 4.6 years) selected from a database of 89 patients treated with miniscrews. All subjects who were selected required extraction of all first premolars and maximum anchorage. After initial leveling and aligning, miniscrews were placed between the first molar and the second premolar in all 4 quadrants and loaded by the indirect method at 3 weeks after placement with 200-g nickel-titanium alloy closed-coil springs for en-masse retraction. Mean treatment duration was 29.7 ± 6.8 months. Pretreatment and posttreatment lateral cephalograms were analyzed to measure the amount of anchorage loss, incisor retraction, and the incisors' angular change in reference to the pterygoid vertical reference line and were evaluated by the structural superimposition method. **Results:** The ratio of incisor retraction to molar protrusion was 4.2 in the maxilla and 4.7 in the mandible. The first molars showed mean extrusion of 0.20 mm in the maxilla and 0.57 mm in the mandible; these were statistically insignificant. The mean angular change of the first molars was -2.43° in the maxilla and -0.03° in the mandible. The mean anchorage loss in reference to the pterygoid vertical was 1.3 mm in the maxilla and 1.1 mm in the mandible; these were statistically significant. Structural superimpositions showed mean change in molar position of 0.83 mm in the maxilla and 0.87 mm in the mandible, and 5.77 mm in the maxillary incisor and 5.43 mm in the mandibular incisor. These results were compared with the direct anchorage method reported in the literature. **Conclusions:** Indirect miniscrew anchorage can be a viable alternative to direct anchorage. (Am J Orthod Dentofacial Orthop 2016;150:274-82)

Bimaxillary protrusion has been described as a malocclusion that mars or deforms the human face to a magnitude like no other dentofacial malocclusion and should be treated by extraction of the 4 first premolars and retraction of the anterior segments; otherwise, the patient should be left untreated.¹ The objective for these patients is usually to reduce the lip

protrusion and correct the incisor proclination with minimum anchorage loss because they often have Class I molar relationships. Although headgear has traditionally been the gold standard anchorage saver, the intermittent force that it delivers and the prerequisite for patient compliance have led orthodontists to explore alternative anchorage savers, an example of which is the miniscrew.²

The miniscrew is a novel, albeit transient, device for anchorage management. Miniscrews have gained immense popularity in eclectic clinical applications because of their miniature size, ease of placement, nondependence on the patient's compliance, minimal discomfort, and lack of residual surgical defects. The use of miniscrew implants has proven particularly effective, whether the miniscrews are directly loaded (direct anchorage) or used indirectly to stabilize a dental anchorage unit (indirect anchorage).³⁻⁵

A recent study documented that in a clinical scenario entailing major orthodontic forces, it is preferred to opt

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Table I. Studies on anchorage loss with miniscrews and conventional anchorage

Author/year	Sample	MSI (n)	Age/sex	Malocclusion	Treatment duration (mo)	Type of anchorage	Mode of anchorage measurement	Anchor loss, mean/SD in MIS group (mm)	Anchor loss, mean/SD in conventional anchorage group (mm)
Thiruvengkatachari et al, ¹² 2006	10	18	19.6 y (18 to 25 y) (M/F 3/7)	Class I/Class II	Retraction: 4 to 6	Direct anchorage	Ceph	U6M-0 L6M-0	Nonimplant side Max: 1.60/0.35 Mand: 1.70/0.27
Upadhyay et al, ⁸ 2008	30: 15 MSI group (G1)/15 conventional group (G2)	15	14 y 5 m to 22 y 3 m (M/F 9/21)	Class I/Class II	Retraction: G1: 9.2, G2: 10.6	Direct anchorage	Ceph	-0.83/1.4	Conventional method of anchorage: 2.07/0.68
Lai et al, ⁹ 2008	40: Headgear (Group 1): n = 16 Miniscrew (Group 2): n = 15 Miniplate (Group 3): n = 9	30	Group 1 = 21.7 ± 2.5 y (M/F 0/16) Group 2 = 25.1 ± 4.7 y (M/F 1/14) Group 3 = 24.1 ± 3.2 y (M/F 2/7)	Class I/ Class II	Group 1 = 33.6 ± 7.2 Group 2 = 27.1 ± 4.2 Group 3 = 31.4 ± 4.7	Direct anchorage	Model	1.3/1.0	1.4/1.3 with miniplate 2.5/0.9 with headgear
Yao et al, ¹¹ 2008	47: Headgear (Group 1): n = 22 Mini-implants (Group 2): n = 25	50	Group 1 = 22.32 ± 3.92 y (M/F 2/20) Group 2 = 24.72 ± 4.15 y (M/F 2/23)	Class I/Class II	Group 1 = 29.81 ± 6.41 Group 2 = 32.29	Direct anchorage	Ceph	0.88/1.24	Headgear: 2.07/2.31
Kuroda et al, ⁷ 2009	22: Implant group (G1): n = 11 Headgear group (G2): n = 11	22	G1 = 18.5 ± 3.3 y (M/F 0/11) G2 = 21.8 ± 7.9 y (M/F 0/11)	Class II	NM	Direct anchorage	Ceph	Max: 0.7/0.64 Mand: 1.4/1.65	Headgear Max: 3.0/0.76 Mand: 3.3/2.03
Lee and Kim, ¹³ 2011	40: Conventional (Group 1): n = 20 Mini-implants (Group 2): n = 20	40	Group 1 = 22.16 ± 3.11 y (M/F 0/20) Group 2 = 24.64 ± 7.85 y (M/F 0/20)	Class I	Group 1 = 28 ± 8.37 Group 2 = 24.95 ± 4.55	Direct anchorage	Ceph	U6M: 0.24/1.62 U6A: 0.27/1.15	Headgear U6M: 2.19/1.40 U6A: 2.42/1.68
Davoody et al, ¹⁰ 2012	28: Differential moment (G1): n = 15 Miniscrew (G2): n = 13	26	G1 = 17.9 ± 8.96 y (M/F 5/10) G2 = 17.4 ± 8.85 y (M/F 7/6)	Class I/Class II	NM	Direct anchorage	Ceph	-0.69/0.97	Canine retraction followed by incisor: 2.55/1.8

MSI, Miniscrew implant; F, female; M, male; Ceph, cephalogram; U6M, maxillary molar mesial point; U6A, maxillary molar apex; NM, not mentioned; L6M, mandibular molar mesial point.

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