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Three dimensional versus standard miniplate fixation in management of mandibular fractures: A systematic review and meta-analysis

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ABSTRACT

Purpose: The aims of the present study were to 1) evaluate clinical outcomes between standard and three-dimensional (3D) miniplate fixation in the management of mandibular fractures and 2) determine which fixation method is the best option for the treatment of mandibular fractures.
Materials and methods: A comprehensive electronic search language without date was performed in July 2015. Inclusion criteria were studies in humans, including randomized controlled trials, controlled clinical trials, and retrospective studies, with the aim of comparing the two techniques. In addition, the incidence of complications was evaluated.
Results: Seventeen publications were included: nine randomized controlled trials, three controlled clinical trials, and five retrospective studies. The meta-analyses showed statistically significant differences for the incidence of hardware failure, malocclusion, and postoperative trismus. There were no significant differences in the incidence of postoperative infection, wound dehiscence, non-union/malunion, and paresthesia. The cumulative odds ratio was 0.48, meaning that the use of 3D miniplates in the fixation of mandibular fractures decreases the risk of the event (postoperative complication) by 52%.
Conclusion: The results of this meta-analysis showed that the use of 3D miniplates was superior to the two-miniplate technique in reducing the incidence of postoperative complications in the management of mandibular fractures.

1. Introduction

Mandibular fractures are frequent in facial trauma. With increasing automobilization and industrialization, the treatment of mandibular fractures has become important (Agarwal et al., 2014) for the maxillofacial surgeon. The ideal method of treatment of mandibular fractures should have the objectives of perfect anatomic reduction, stable fixation, and painless mobilization of the injured region around its articulation (Gear et al., 2005). The use of 3-dimensional (3D) strut plates has been one of the methods of fixation to challenge the Champy technique for the fixation of mandibular fractures, and has been the topic of a growing number of clinical studies (Al-Moraissi et al., 2014). The 3D plates can be considered a two-plate system, with two miniplates joined by interconnecting crossbars (Kalfarentzos et al., 2009). Their shape is based on the principle of a quadrilateral as a geometrically stable configuration for support (Vineeth et al., 2013). Because the screws are arranged in the configuration of a box on both sides of the fracture, a broadband platform is created, increasing the resistance to twisting and bending of the long axis of the plate. There is a simultaneous stabilization of the tension and compression over that of conventional miniplates (Guimond et al., 2005). Moreover, this system is simple to apply because of its malleability, low profile

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Table 1
Studies comparing three-dimensional and standard miniplate fixation techniques in the management of mandibular fractures.

Study	Year published	Study design	Gender (M/F)	Mean age (Range) (y)	Patients(n)	Follow-Up period	MF fixation methods	Mean length of operation (min)	MFs	Region of MFs
Jain et al.	2010	RCT	(G1): 17/3 (G2): 18/2	(G1): 48 (G2): 47	(G1): 20 (G2): 20	1, 2, 4, 6 weeks 2 months	G1: two 2.0-mm miniplates G2: 3D 2-mm stainless steel plates	G1: 45 G2: 33	40	(G1):13 symphyseal and parasymphyseal 5 body, 2 angle (G2):13 symphyseal and parasymphyseal 5 body, 2 angle
Kumar et al.	2012	RCT	(G1, G2): 20/0	(G1, G2): 33.9 (19–63)	(G1):10 (G2): 10	1, 2, 4, 8 weeks 3 months	(G1): one 2-mm stainless steel (G2): 3D 2-mm stainless steel	(G1): 10.2 (G2): 6.3	34	G1: 10 (symphyseal and parasymphyseal) G2: 10 (symphyseal and parasymphyseal) (G1, G2): 2 body, 4 angle, 8 condyle
Khalifa et al.	2012	CCT	(G1, G2): 14/6	(G1, G2): 32.5 (15–50)	(G1): 10 (G2): 10	Up to 6 months	(G1): two 2.0-mm titanium miniplates (G2): 3D rectangular miniplates	(G1): 19.4 (G2): 10.8	30	(G1): 10 (symphyseal and parasymphyseal) (G2): 10 (symphyseal and parasymphyseal) (G1, G2): 4 angle, 6 condyle
Malhotra et al.	2012	RCT	(G1, G2): 15/5	(G1, G2): 29	(G1): 10 (G2): 10	1, 3, 6 weeks 3 months	(G1): two 2.0-mm miniplate (G2): 3D 2-mm stainless steel plates	NM	25	(G1): 10 (symphyseal and parasymphyseal) (G2): 11 (symphyseal and parasymphyseal) (G1, G2): 1 body, 2 angle
Agarwal et al.	2014	RCT	(G1): 37/3 (G2): 39/1	(G1): 26.62 (G2): 24.72	(G1): 40 (G2): 40	1, 3, 6 weeks 3 months	(G1): two 2.0-mm miniplates (G2): 3D 2-mm stainless steel plates	(G1): 38 (G2): 49	NM	NM
Sadhwani and Anchalia et al.	2013	CCT	(G1, G2): 18/10	(G1, G2): 18–60	(G1): 14 (G2): 14	NM	(G1): two 2.0-mm titanium miniplates (G2): 3D rectangular miniplates	NM	28	(G1): 9 (symphyseal and parasymphyseal) (G2): 9 (symphyseal and parasymphyseal) (G1): 3 body, 2 angle (G2): 3 body, 2 angle
Barde et al.	2014	CCT	(G1, G2): 34/6	(G1, G2): 35 (20–50)	(G1): 20 (G2): 20	1, 2, 3, 4, 6, 12, 24 weeks	(G1): two 2.0-mm miniplates (G2): 3D rectangular miniplates	(G1): 59.40 (G2): 50.60	40	(G1): 20 (symphyseal and parasymphyseal) (G2): 20 (symphyseal and parasymphyseal)
Singh et al.	2012	RCT	(G1, G2):4/46	(G1, G2):30.4	G1: 25 G2: 25	1, 4, 8, 12 weeks	(G1) Single 2.0-mm 4-hole miniplate at the external oblique line or on the lateral cortex (n = 10) (G2) Single rectangular 2.0-mm 6-hole 3D miniplate (n = 10)	G1: 49.57 G2: 43	56	Angle (n = 20) parasymphysis (n = 35) symphysis (n = 1)
Jain et al.	2012	RCT	NM	(G1, G2):16–60	G1: 10 G2: 10	1, 2, 4, 6 weeks and 2 months	G1: 2 mm titanium locking miniplates G2: 2 mm 4 holed 3-dimensional (3D) locking titanium miniplates	G1: 38 G2: 17	20	Inter mental foramina region: 20
Vineeth et al.	2013	RCT	NM	(G1, G2):19–51	G1: 10 G2: 10	1 day 1 week 1 month 3 months	(G1) Single 2.0-mm 4-hole miniplate at the external oblique line (n = 10) (G2) Single rectangular 2.0-mm 6- or 8-hole 3D miniplate (n = 10)	NM	29	Angle (n = 20) additional fractures (n = 9; G1, n = 5; G2, n = 4)
Xue et al.	2013	RCT	(G1, G2):18/0	(G1): 28 (G2): 28	G1: 6 G2: 7	1–2 weeks 4–6 weeks 6 months	(G1) Single 2.0-mm 4-hole miniplate at the external oblique line (n = 7) (G2) Single curved 2.0-mm 10-hole 3D miniplate (n = 6)	(G1):42 (G2):102	22	Angle (n = 13) parasymphysis (n = 8) subcondylar (n = 1)
Höfer et al.	2012	RS	(G1, G2):52/8	(G1, G2): (31.1)	G1: 30 G2: 30	7, 14, 28 days, 3, 6, 12 months	(G1) Single 2.0-mm 6-hole miniplate at the external oblique line (n = 30) (G2) single rectangular 2.0-mm 4-hole 3D miniplate (n = 30)	89 (G1) 81 (G2)	90	Angle (n = 60) (G1, G2): body (n = 25) ascending ramus (n = 5)

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