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### **Original Article**

# Anchor lag screw vs conventional lag screw in mandibular fractures: A series of 30 cases

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#### ABSTRACT

Lag screw osteosynthesis is a well proven technique. Its application is limited by the fact that the spherical head of the screw act as wedge. Combining this screw with a bioconcave washer has broadened the range of applications for lag screw osteosynthesis in the maxillofacial region.

*Purpose*: The aim of the study was to compare the efficacy of anchor lag screw with conventional lag screw in anterior mandibular fractures.

Patients and method: Thirty patients with anterior mandible fractures with no concomitant fractures, infection or extraoral communication, who visited our outpatient Department of Oral and Maxillofacial Surgery, were included in the study after obtaining their informed consent. Patients were randomly divided into two groups; where Group A underwent fixation using conventional lag screw and Group B anchor lag screw. The fixation system used included 2 mm titanium lag screws of sizes 25 mm, 27 mm and 30 mm and 3 mm titanium bioconcave washer. At each follow up visit, clinical data was collected detailing clinical presentation of healing and radiographic findings.

*Results*: Radiographic features at post surgery evaluation indicated loss of bone contact around the screw head and bone resorption in five patients of Group A, thus causing loosening of lag screw whereas none of the patient in Group B, was found to have any such complication.

*Conclusions*: The findings support the hypothesis that bioconcave washer aids in holding up the farthest fragment at the interface of the fracture fragment. Application of bioconcave washer provides easy loading of lag screw.

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#### 1. Introduction

Mandibular fractures deserve attention due to variability in treatment. In most cases, surgical intervention for reduction and rigid internal fixation of fractures by using miniplates and screws is indicated. The recent past has seen a veritable explosion of interest in the use of screws and plates. Lag screws osteosynthesis is a well proven technique. Its application is limited by the fact that the spherical head of the screw acts as a wedge. Combining this screw with a bioconcave washer (anchor lag screw) has broadened the range of application.

Lag screws facilitate and provide a reduced surgical time and may be undertaken under local anaesthesia or conscious sedation.

#### 2. Material and method

This study comprised 30 patients of anterior mandibular fractures, who attended the outpatient department and emergency unit of Oral & Maxillofacial Surgery, Faculty of Dental Sciences, King George's Medical University, Lucknow. Preoperative detailed medical history of the patients was recorded. Patients were diagnosed on the basis of clinical examination and radiographic interpretation routine investigations were done and informed consent was taken to participate in the study. Study was approved by the Institutional Review Committee.

Patients were randomized into two groups, irrespective of age, sex, caste and creed. Group A included patients who underwent osteosynthesis using titanium lag screw (2.0 mm shaft diameter) Figs.1 and 2; and Group B included patients who underwent osteosynthesis using titanium anchor lag screw (2.0 mm with 3.0 mm biconcave washer) Fig. 3. Stabilization of fracture was achieved by AO reduction roller forceps before fixation of lag screw Figs.4–7.

#### 3. Results

Road traffic accidents are the most common cause of fracture in the anterior mandible (60% of both groups). Males were most commonly affected Group A (80%) and Group B (93%). 21–40 years of age group was predominant in the study.



Fig. 1 - Titanium anchor lag screw 2 mm in diameter with 3 mm bioconcave washer.



Fig. 2 – Conventional lag screw and the vectors that shatter the bone.

Postoperative infection was noted in 20% of patients Group A but not seen in Group B. Postoperative wound dehiscence was seen in Group A in 10% of patients. The mean period of time required for functional rehabilitation was longer in Group A with the mean of (27.3 days) than for patients of Group B with mean 12 days. Bone resorption under the circumferential head of the screw in Group A was observed to be more when compared with the patient of Group B.

Pain reduction by visual analogue score (VAS) was higher in Group B than Group A. Healing was observed to be rapid in both the groups except in three patients of Group A where destruction of bone and resorption was observed around the head of the lag screws. Postoperative complication in conventional lag screw fixation was observed to be higher than anchor lag screw fixation. Three patients in Group A were observed to have mobility between the fracture fragments. Of these, two patients showed mobility in both vertical and



Fig. 3 – Anchor lag screw with bioconcave washer and the vectors that prevent shattering of the bone.



Fig. 4 – Reduction and fixation with conventional lag screw.

horizontal plane on 3rd and 6th week follow up. Only one patient showed mild mobility in vertical plane in postoperative recovery phase. Infection persisted in these three patients of Group A till 6th week follow up, leading to removal of the lag screw. Anchor lag screw can be tightened more thus offering more rigidity in fixation. None of the patients in Group B were observed with loosening of implants. Bite force was found to be more in patients of Group B than Group A.

Scintigraphy was done in two patients of both groups for evaluation of bone turnover and to see osteoblastic activity. Scintigraphy revealed more uptake of radioactive material in Group B on 3rd and 6th week follow up. Table 1 shows the results obtained in the two groups.

#### 4. Discussion

The titanium lag screw and bioconcave washer are biocompatible, and none of the cases in the two groups, was observed



Fig. 6 – Stabilization of fracture by AO reduction roller forceps and fixation of anchor lag screw.

with hardware failure. Good amount of bone was seen at the operative site with easy loading of implants in the study. Cortical thickness and curvature of the bone suited to be the best for application of the lag screw.<sup>1-4</sup>

Our selection of region and results correlate with other studies,<sup>2–5</sup> that anterior mandible, from one mental foramen to other, is uniquely suited to the application of lag screw fixation. Curvature of anterior mandible allows placement of lag screws, across the symphysis for sagittal fractures, oblique fractures and fractures of the anterior body region. Its bony cortices provide extremely secure fixation when screws are properly inserted there are also no anatomical hazards below the apices of the teeth until the mental foramen are encountered.

AO reduction roller was easy to use in the anterior mandible region in the study. This correlates the text about the rigidity obtained in fixation<sup>6,7</sup> which is best achieved by lag screw. Loss of cortical bone was seen with conventional lag screw head coming closer to the cancellous bone during fixation after countersink preparation in Group A,<sup>8–11</sup> this resulted in a weak contact between the screw head and bone. In such cases, the force vectors destroy the bone around and thus loosen the lag screw. Anchor lag screw use is unique and



Fig. 5 – Fixation by conventional lag screw shows sacrifice of noticeable amount of cortical bone during counter sink preparation.



Fig. 7 – Anchor lag screw in place.

Table 1 – Follow up observations in the two groups.							
Parameters for follow up assessment		3rd week		6th week		12th week	
		Group A	Group B	Group A	Group B	Group A	Group B
Pain: VAS (Mean $\pm$ SD)		$\textbf{2.00} \pm \textbf{1.15}$	$\textbf{3.13} \pm \textbf{0.92}$	$\textbf{3.40} \pm \textbf{1.35}$	$\textbf{4.87} \pm \textbf{1.19}$	$4.20\pm1.74$	$5.20\pm1.08$
Infection (no. of cases)		4	2	3	1	3	1
Bite force (Mean $\pm$ SD)	Incisors	$\textbf{2.98} \pm \textbf{1.48}$	$\textbf{3.77} \pm \textbf{1.65}$	$4.73\pm2.20$	$\textbf{6.96} \pm \textbf{2.91}$	$\textbf{7.41} \pm \textbf{1.79}$	$\textbf{8.70} \pm \textbf{3.03}$
	Rt Molar	$\textbf{6.67} \pm \textbf{6.70}$	$\textbf{6.67} \pm \textbf{2.13}$	$12.14\pm7.50$	$\textbf{17.13} \pm \textbf{4.27}$	$\textbf{18.84} \pm \textbf{9.11}$	$\textbf{25.33} \pm \textbf{8.25}$
	Lt Molar	$\textbf{3.26} \pm \textbf{2.45}$	$\textbf{8.87} \pm \textbf{5.08}$	$47.47 \pm 4.64$	$18.73\pm5.69$	$\textbf{23.46} \pm \textbf{10.53}$	$\textbf{29.47} \pm \textbf{8.76}$
Mobility (no. of cases)		3	None	3	None	3	None
Loosening of Implant (no. of cases)		3	None	3	None	3	None
Scintigraphy ( $n = 2$ in each group)				Group A			Group B
Mean uptake ratio on 3rd, 6th & 12th week			2.44			4.66	
Time required for functional rehabilitation (Mean in days)				27			13.67

versatile than the conventional lag screws, as it provides a good uniform surface at anterior mandible, where the curvature of buccal cortical bone often gives sliperage to conventional lag screw, which may seat closer to cancellous bone whereas anchor lag screw (ALS) has a firm contact when loaded over bioconcave washer.

Loosening of the implant was observed in five patients of Group A, of which theree underwent lag screw removal. However two patients were managed under specific antibiotic cover and longer duration of maxillomandibular fixation till 12th week follow up.

Krenkel,<sup>8</sup> 1996, Schuller<sup>9</sup> and Terheyden<sup>11</sup> 1999 have significantly shown the major disadvantage of conventional lag screw that is loosening of implants in post healing phase. Bioconcave washer aids in holding up the farthest fragment<sup>2</sup> on resorption and sintering at the interface of the fracture fragment. Advantages of self adapting bioconcave washer is that aids in easy loading and mechanically support the lag screw as well.<sup>8,11</sup> The versatility of the lag screw at anterior region of mandible fractures where curvature of bone does not give uniform surface to seat the lag screw is increased with the aid of bioconcave washer that lag screw can be firmly adapted.

The lag screw fixation uses the minimal use of hardware to give rigid fixation.<sup>5,12</sup> Our study co-relates with Tominaga<sup>6</sup> who summarized that lag screw gives the most rigid fixation of all the osteosynthesis implants used to treat the mandible fracture. Transverse placement of lag screw was noticed to be easier using bioconcave washer in two patients of Group B. Serletti,<sup>13</sup> have shown the use of transverse lag screw in anterior mandible where much of bone was sacrificed at the cortices and bioconcave washer prevented the loss.

Postoperative infection in Group A was noted in 35% patients, of which three had to undergo second surgery for removal of lag screws. However, two patients resolved under specific antibiotic coverage. The bone pattern around the screw head was observed to be in resorption phase in postoperative recovery follow ups. Radiological findings showed progressive radiolucency around the screw head which presented with extraoral sinus and discharge of pus until the removal of lag screws.

Uptake of radioactive material i.e. Tc 99 was noted to be more in Group B; 30% increased uptake than Group A in 3rd and 6th follow up weeks, suggesting more osteoblastic activity in Group B and rapid healing.<sup>14</sup> Group A was observed with noticeable sacrifice of cortical bone in the countersink preparation therefore healing phase differed on comparison with Group B.

Bite force in Group A was comparatively less in recovery phase whereas bite force of Group B increased more persistently on progressive healing period. Gerlach et al<sup>15</sup> also showed gradual increase of bite force using miniplate osteosynthesis in mandibular angle fracture fixation.

#### 5. Conclusion

Bioconcave washer aids in holding up the farthest fragment on resorption and sintering at the interface of the fracture fragment. Application of bioconcave washer provides easy loading of lag screw as it prevents the sacrifice of cortical bone at anterior region of mandible whereas conventional lag screw seats more towards cancellous bone.

#### **Conflicts of interest**

All authors have none to declare.

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