



# Lag Screws in Maxillofacial Trauma- A Review

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## **Author's contribution**

*The sole author designed, analysed, interpreted and prepared the manuscript.*

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## **ABSTRACT**

The etiology of mandibular fractures includes mainly assaults and road traffic automobile accidents. Additionally, fall and sports injuries are the foremost common causes for mandibular fractures. Mandibular fractures outnumbered zygomatic and maxillary fractures by a ratio of 6:2:1, respectively. Road traffic accidents is that the most typical etiology, followed by assaults and sport-related injuries. For the management of maxillofacial trauma, the treatment commonly done is open reduction and Internal Fixation using miniplates. Lag screws as compared with plates, have a plus of the necessity of minimum implant material which they also provide maximum stability. The lag screw placement is a simple method of rigid fixation. The choice of the lag screw technique depends on patient factors, kind of fracture, site of fracture, and thus the skill of surgeon. The aim of this review is to assess the efficiency of Lag Screws for the management of maxillofacial trauma.

**Keywords:** *Lag screws; maxillofacial trauma; miniplate fixation.*

## **1. INTRODUCTION**

The maxillofacial trauma has increased by many folds in recent times, due to an increase in road traffic accidents (RTAs). Incidence of mandibular fractures is high as it is the most prominent and mobile bone of the facial bones. Literatures have shown that mandibular fracture is the most

common fracture followed by zygomatic and maxillary fractures (6:2:1). Literature suggested that most of the mandibular fractures were reported in males than females with a mean age of 23 years [1,2].

Road Traffic accident is the most common etiology, followed by assaults and sport-related

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injuries. These fractures can be single or multiple, with condyle being the most common site [1,2]. The treatment goal of any fracture management is to restore the original anatomic form and function, without causing any discomfort to the patient. The treatment methods for maxillofacial fractures include closed reduction by means of wiring, arch bars, cap splints, gunning splints, and open reduction by transosseous wiring, miniplates, compression and non compression plates. Open reduction and internal fixation is the widely accepted method of treatment. Lag screws when compared with plates, have an advantage of the requirement of minimum implant material and they also provide maximum stability [3–5].

Brons and Boering in 1970, first introduced lag screw to maxillofacial surgery to immobilize and compress the fracture fragments [6]. Lag screw is based on the concept of bone compression and is not used in complex fractures and fractures with bone loss. Lag screw is widely employed in anterior mandibular fractures, oblique fractures of body mandible, and in the angle of the mandible. In some cases, lag screws are placed along with plates to secure fracture fragments [6,3–5].

Lag screw approach requires a special set of instruments and screws up to 40 mm in length and diameter of 2.7 mm. Niederdellmann *et al.* described this procedure in 1981 and reported uneventful healing of mandible angle fractures and described it as technique-sensitive procedure [7]. The lag screw does not need adaptation as in miniplate. Lag screw technique is a form of rigid fixation. The lag screw technique needs surgeon skills, and it depends on the fracture site and type of fracture [7,3–5].

### 1.1 Lag Screws

Lag Screw (Fig. 1) fixation uses compression and it needs stable bone for good stability.

Lag screws should always be placed perpendicular to the bevel of the fracture to prevent displacement of the fragments when the screws are tightened, and the bones are compressed. In general, the lag screw is placed prior to the miniplate because the lag screw will compress the fracture, providing better reduction.

### 1.2 Symphysis Fracture

Lag Screws Fixation (LSF) can be used for undisplaced linear fracture of anterior mandible which include sagittal fractures with split buccal and lingual cortical plates of the mandible, vertically oriented fractures, and short oblique fractures with sufficient access along the curve of the anterior mandible for screw placement. Contraindications include displaced fracture patterns (complex comminuted mandibular fractures, flat mandibular plane), where it cannot be placed tension banding because of poor dentition, inability to determine the fracture pattern preoperatively and inexperienced surgeon.

### 1.3 Angle Fractures

Of all mandibular fractures, the treatment for fracture of mandibular angle is crucial and it is associated with complications post operatively. It has been suggested that rigidity is important to resist infection in mandibular fracture. As a result, many forms of treatment have been used to manage such fractures. Open reduction and internal fixation of mandibular fractures, using miniplates has become a widely accepted treatment. In contrast to orthopedic surgery, lag screws play a minor role in maxillofacial osteosynthesis. However, besides rigid fixation, lag screws have distinct advantages compared with plates [2].



Fig. 1.

## 1.4 Mid Face Fractures

The contours of the orbit and zygoma, unlike the mandible, will allow perpendicular placement of screws in less oblique fracture lines. The fractures are usually approached via the existing laceration or some approaches like transconjunctival incision. Lag screw fixation can be done for Fronto-Zygomatic fractures, Orbital rim Fractures, comminuted malar fractures. LSF can produce as much as five times the compressive force at the fracture line as a compression plate. Moreover, the compression between the fragments using Lag Screw Fixation is evenly distributed along the fracture line.

## 1.5 Surgical Technique Involves

1. Determining the path of screw insertion
2. Drilling the near cortex
3. Preparation of counter sinking
4. Drilling the distal segment
5. Selection of screw length
6. Preparation of tapping
7. Screw insertion
8. Post operative care and follow up.

## 2. DISCUSSION

Degree of mobility of fracture segments plays a vital role in fracture healing in terms of periosteal callus formation. More the mobility of fragments, more periosteal callus formation. Mandible is one of the most esthetic and functional part of the face and it requires proper treatment plan. Failure to do so will result in facial asymmetry, malocclusion, mal union, non union and infection, Intermaxillary fixation delays functional rehabilitation in the management of mandibular fracture [5,6].

Niederdelmann *et al.* described the lag screw osteosynthesis conception as the stable union of bony fragments under pressure with the help of screws, which in turn are under tension [8]. These lag screws can be used alone or can be used in combination with compression plate for fracture stability. Screws having a constant thread diameter along their entire length were considered as the best ones [5,6,8]

Lag screws can be used to fix fractures of the mandible, rarely maxilla, zygoma, and also for fixing grafts. Champy advised the use of small plates in most regions of mandible and for symphysis alone advised two plates [9]. Brons and Boering in 1970 advised the use of at least

two screws to prevent rotational movements of the fragments in oblique fractures of mandible due to shear forces that act around the screw.

In case of lag screw fixation accessibility is the major concern, especially in angle region. In such cases, with the help of trocar the procedure can be performed. Since there are no anatomic hindrances in symphysis region, lag screws can be used easily. In case of parasymphysis and body region, presence of mental foramen makes the procedure cumbersome. In case of condyle, it is even more sensitive because of the presence of vital structures.

Spiessel in his study found that compression between the fragments can be done with lag screws. It is based on the principle that they engage fragments together and compresses them when tightened [9–11] Lag screw technique involves drilling the screw at an angle which bisects between the line of fracture and outer cortex, but if there is linear fractures of symphysis due to curvature, this not applicable. Screws should be placed perpendicularly to the line of fracture to achieve better stability. This prevents displacement of fractures while tightening. Lag screw achieves 1000–4000N of rigid compression compared to 600N with compression plates. Lag screw when properly used provides the most rigidity of all rigid fixation techniques [7,9–12].

The cortical screws are preferred over lag screws in the lag screw technique as in the presence of reverse cutting threads the removal of true lag screws is difficult, as the bone grows around the narrower smoother part of the shaft creating an obstruction. Spiessel indicated lag screw osteosynthesis in situations such as wide lamellar fractures of mandible, short lamellar fracture of mandible in combination with neutralization plate, fracture of angle mandible, edentulous jaw fractures, bone graft fixations, rigid internal fixation after orthognathic surgeries, rigid internal fixation of zygomatic maxillary fractures, and in comminuted fractures to simplify fracture situation along with plates [7,9–12].

Studies have shown that the mandibular fracture management is guided by various dental and orthopedic rules such as restoration of occlusion, anatomical reduction of the fractured segments, rigid immobilization to aid healing, early restoration of function, prevention of infection, nonunion, and malunion. Lag screw fulfills all these principles. Intermaxillary fixation has

certain disadvantages such as loss of weight, social inconvenience, physical discomfort, poor oral hygiene, respiratory complication, and communication difficulties [13,14].

## 2.1 Advantages

A small single incision in our technique has potential advantages over the traditional methods that include less postoperative scarring and swelling, improved dental hygiene, faster recovery, decrease chances of injury to mental nerve, maintenance of vascular supply of bone fragments, fewer amounts of implant material, and a decrease operative time. Advantages of lag screw osteosynthesis, when compared with plates, are that it is a simple technique, needs less implant material, limited surgical exposure, and result in fewer postoperative infections [ 9,10].

## 2.2 Disadvantages

Technical complications with this technique are breakage of the drill bit and lingual cortex breach. Drill bit breakage usually occurs due to forceful drilling and change in angulation ones it is in the cortex. Lingual cortex breach occurs because of over drilling the cortices and wrong direction.

## 3. CONCLUSION

The use of Lag Screws in maxillofacial trauma needs experienced surgeon and the time for surgery is also reduced. It also decreases hospital stay. Using Lag Screws can achieve good stability and good compression. The technique is simple and easily performed, reducing the surgical time, reducing the chances of infection due to less exposure and promoting the healing process by producing stress in the fracture lines.

## CONSENT

It is not applicable.

## ETHICAL APPROVAL

It is not applicable.

## COMPETING INTERESTS

Author has declared that no competing interests exist.

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