



3-Dimensional Plates Versus Conventional Mini plates in Maxillofacial Trauma- A Review

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ABSTRACT

Maxillofacial trauma is any physical injury to the facial bones. Facial bones are frequently fractured bones in RTA, Assault, Domestic violence etc. Facial trauma includes Maxillary fractures, Mandibular fractures, Orbital Fractures, Nasal Bone Fractures, soft tissue injury such as lacerations, bruises etc. Over the years, there are many refinements in the management of maxillofacial trauma. The incidence of maxillofacial trauma is more in males because they are involved in more physical activities and assault compared to women. In Older times for facial bone fractures, surgeons performed maxillomandibular fixation using wire osteosynthesis for minimum three weeks to 6 weeks, and mouth opening was difficult, poor oral hygiene leading to periodontal problems, difficulty in speech and masticatory functions. The management of maxillofacial trauma includes the use of Maxillomandibular fixation using wire osteosynthesis, conventional mini plates and 3-D plates. For the management of facial bone fractures, Maxillofacial surgeons perform open reduction and internal fixation (ORIF) whenever needed. In the case of ORIF, Surgeons use mini plates either 3D or Conventional Plates for stabilising the fractured segments. This technique requires skill and experience and is also expensive. The advantages of this method are improved quality of life. The objective of this review is to compare 3-Dimensional plates and Conventional Plates in Maxillofacial trauma.

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INTRODUCTION

Maxillofacial trauma is any physical injury to the facial bones. Facial bones are frequently fractured bones in RTA, Assault, Domestic violence etc.

This is because the mandible being a prominent bone (Manson, 2006). Facial trauma includes Maxillary fractures, Mandibular fractures, Orbital Fractures, Nasal Bone Fractures, soft tissue injury such as lacerations, bruises etc. Since mandible helps in maintaining the airway, deglutition, speech it should be addressed (Gerlach, 2017). Other facial bones are also equally crucial for airway, vision and cosmetic reasons.

In Older times for facial bone fractures, surgeons performed maxillomandibular fixation using wire osteosynthesis for minimum three weeks to 6 weeks, and mouth opening was difficult, poor oral hygiene leading to periodontal problems, difficulty in speech and masticatory functions (Jaques et al., 1997).

For the management of facial bone fractures, now

Maxillofacial surgeons perform open reduction and internal fixation (ORIF) whenever needed. In the case of ORIF, Surgeons use mini plates either 3D or Conventional Plates for stabilising the fractured segments. This technique requires skill and experience and is also expensive. The advantages of this method are improved quality of life (Jaques *et al.*, 1997).

The objective of this review is to compare 3-Dimensional plates versus Conventional plates in the management of maxillofacial trauma.

3-Dimensional Plates

3-D plates (Figure 1) were first introduced by (Farmand and Dupoirieux, 1992) in 1992. It is quadrangular in shape. It is two mini plates connected by interconnecting bars. Because of this configuration, these plates are stable enough to withstand forces, and it is resistant to torsional forces. The significant advantage of these plates is relatively easy.



Figure 1: 3-Dimensional Plates

Conventional Plates

For the management of facial fractures, two different treatment modalities are performed using mini plates and screws.

Rigid Fixation

Using bicortical screws, the lower border of the mandible is fixed using compression plates. These plates were introduced by (Spiessl, 1973; Farmand and Dupoirieux, 1992). The fractured bones healed by primary intention. The disadvantages of these plates are it is difficult to adapt, bulkier, nerve injury due to different oral approach.

Semi-Rigid Fixation

Champy *et al.* (1980) defined the concept of "Ideal line of Osteosynthesis". This technique was performed with monocortical screws without compression, and fixation was done using mini plates (Figure 1). The advantages of using these plates are relatively thin, can be done by intraoral approach, easy

to adapt, easy to place. Champy *et al.* (1980); Luhr (1987) found that these conventional mini plates were not stable enough to withstand forces which necessitated the need of the IMF.

DISCUSSION

Facial trauma includes Maxillary fractures, Mandibular fractures, Orbital Fractures, Nasal Bone Fractures, soft tissue injury such as lacerations, bruises etc. Over the years, there are many refinements in the management of maxillofacial trauma. The incidence of maxillofacial trauma is more in males because they are involved in more physical activities and assault compared to women.

Sadhvani and Anchlia (2013); Yadav and Shrestha (2017) reported that the significant aetiology of maxillofacial trauma was Road Traffic Accidents (RTA)

The management of maxillofacial trauma includes the use of Maxillomandibular fixation using wire osteosynthesis, conventional mini plates and 3-D plates.

In the case of angle fractures, where powerful elevator muscles are attached, powerful forces are created. So a heavy plate is needed to counteract the forces. In such cases, instead of using conventional plates, 3-D plates can withstand the forces since the screws are fixed in box configuration. Since it is broad, it may act as a platform to resist the torsional forces. This was discussed by Alkan (2007).

In the case of the symphysis and parasymphysis fracture also the stability of 3-D plates are reasonable compared to conventional plates. In the case of midfacial fractures reported by Singh (2015) there was a significant reduction of 72% and occlusal stability of 72%, and there was no neurosensory deficit.

Duration of surgery is minimal while the surgeons used 3D plates compared to conventional plates. Al-Moraissi and Ellis (2014); Shapoo *et al.* (2017) also reported that the operative time is shorter while they used 3D plates. However in angle region placement of 3-D plates required extra time as reported by Feledy *et al.* (2004); Sadhwani and Anchlia (2013).

Some authors Barnard and Hook (1991); Regalo (2008) reported a complication rate of 3-28% after using conventional mini plates like tooth damage (Spronsen *et al.*, 1992) infection, malunion, non-union, delayed union (Ikebe, 2005) and occlusal derangement. In the case of 3D plates, the complication rate was between 0 and 10%. The infection rate was 6% in the case of 3D plates as reported by Saad and Shuman (2019). However Melek *et al.* (2015)

reported that there were no such complications in both the plates.

In the case of occlusal stability [Feledy et al. \(2004\)](#); [Zix et al. \(2007\)](#) reported that occlusal disturbances ranged from 0-20%. There was no significant difference between conventional plates and 3D plates in case of occlusal disturbances.

[Guimond et al. \(2005\)](#) reported that there was no neurosensory deficit associated with plates. The main reason for the neurosensory deficit was trauma itself. [Singh \(2015\)](#) reported that it was challenging to place 3D plates in symphysis region due to mental foramen, and they faced mental nerve paresthesia.

In case of pain and swelling, there was no significant difference between the two groups as reported by [Melek et al. \(2015\)](#). In case of maximum mouth opening, there was no significant difference between the two groups as reported by [Melek et al. \(2015\)](#).

Although we had discussed the above-said things, the reliability of results is still questionable. This is because of variation in gender, age, malocclusion.

CONCLUSION

From the review, we can conclude that 3-Dimensional plates are better than conventional plates as 3D plates have better stability, lesser duration of surgery, resistance to torsional forces, reduced infection rate and it is small.

Conflict of Interest

The authors declare that there is no conflict of interest for this study.

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