Acta Scientific Dental Sciences

Volume 2 Issue 5 May 2018

Review Article

Advancements in Management of Mandibular Fractures

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Received: March 19, 2018; **Published**: April 11, 2018

Abstract

Increasing urbanization has led to the rapid influx of high speed automobiles, poor road conditions and the road traffic accidents are scaling heights. In addition to that inter-personal assaults and sports injuries tip the scale. The incidences of traumatic injuries to the maxillofacial skeleton are increasing with alarm. The history of treatment of facial bone fractures parallels the development in modern Oral and Maxillofacial surgery. Many of the advances made in the treatment have stemmed from what we have learned from both research and clinical studies. The purpose of this study was to discuss the new techniques in management of mandibular fractures.

Keywords: Urbanization; Mandible Fractures; Advancements

Introduction

Science is always in a state of flux. The treatment options for maxillofacial injuries are numerous and are not without any controversies. Accurate reduction of the fractured segments and achievement of satisfactory occlusion with least discomfort to patient and convenience to surgeon are the fundamental requirements in the management of the maxillofacial trauma. The history of treatment of facial bone fractures parallels the advancements in modern Oral and Maxillofacial surgery. Many of the advances made in the treatment have stemmed from what we have learned from both research and clinical studies. If put on the time line, the management of trauma has evolved greatly over the years from supportive bandages, splints, circum-mandibular wiring and extra-oral pins to rigid and more lately semi-rigid fixation. It was after the Second World War that the treatment modality has changed from closed reduction to open reduction and direct fixation using bone plates and screws. Plating systems too have evolved with respect to designs and materials. Material of bone plates evolved from iron to stainless steel to titanium, vitallium and recently the bio resorbable poly-lactide. As material changed, so did the design from compression plates to non-compression plates, miniature plates, x-plates and more recently the 3D plates and locking plates.

Historical Background

Hippocrates in 460-375 B.C was the first to mention bandages, as a method to immobilize fractures of jaw using leather straps with a paste so as to adhere them to the skin so that direct traction could be applied. Rutenik in 1799 added steel connecting clamps attached to a wooden chin piece by spikes. G.V. Black in 1836-1915 was the first American to mention reduction of fractures of the jaws by means of circumferential wiring. Buck (1846) and Kinlock (1859) are credited with being the first to place an intra-osseous wire for the mandibular fracture just after the introduction of ether anesthesia. Thomas Brian Gunning in 1862 was the first to use a reverse arm form of an interdental splint. He also used double arms extraorally for anchorage to a head cap and soft rubber chin splint. He was also the first to use vulcanite in a custom fitted splint to immobilize a fracture and if the fracture was difficult to reduce then single vulcanite splint for both the jaws was used to provide intermaxillary fixation. Hausmann in 1886 was the first to describe a method of screw plate system. Thomas Splint in 1893 constructed a splint consisting of two metal pieces that fitted on the lingual and buccal surfaces of the mandible and were held in place by spikes that were driven into the mucosa and bone. Marliudate in 1894 made a swedged metal splint that was used to reduce and immobilize the fractured segments. Spiessl in

1971 used dynamic compression plate based on AO/ASIF principles in fixing and stabilizing mandibular fractured segments. However, this plate had to be supplemented with one more plate or an arch bar to achieve desired inter-fragmentary immobilization in the tension area. These plates however had a tendency to create a flare on the lingual cortex area. Champy., et al. in 1978 developed, modified and improvised the technique of miniplate bone osteosynthesis in maxillofacial region [1]. This consisted of monocortical, juxta-alveolar and subapical osteosynthesis without compression inserted through an intra-oral route with intermaxillary fixation. They advocated this technique as a routine treatment procedure for any mandibular fractures. Taking into consideration all the bio mechanical forces they used photoelastic method and described ideal osteosynthesis lines. Monocortical screws were sufficient and were placed below the roots and either above or below the inferior alveolar canal. At the angle of the jaw the plate was fixed on the vestibular flat osseous area located besides the third molar. Anterior to mental foramen in addition to subapical plate, another plate near the lower border of the mandible was fixed. They documented that, compression osteosynthesis was not advantageous as their existed a natural compression along the lower border of the mandible and it is impossible to measure this force of compression which if excessive could lead to bone necrosis. Pogrel M.A. in 1986 used dynamic compression osteosynthesis by means of compression plates in 26 cases of mandibular fractures and discussed their advantages and disadvantages [2]. He stated that this could be an alternative way of treating mandibular fractures without using maxillomandibular fixation and more rapid healing without callus formation. Ellis Edward and Lee Walker in 1994 carried out a study on 37 consecutive patients having 69 fractures of the mandibular angle to evaluate treatment using two 2.0 mm non-compression miniplates without intermaxillary fixation [3]. Wittenberg., *et al.* in 1997 performed a biomechanical study to investigate the effectiveness of fixation devices in an animal study [4]. In this study, a titanium three dimensional plate, a mesh plate and a reconstruction plate using mono and bicortical screws were evaluated. P Kelley., *et al.* in 2004 conducted a study on 294 consecutive facial fractures in urban trauma centers for review of complications during/ after surgeries [5]. They found that in fracture of angle of mandible, while placing fixation using the intraoral approach, the 3D matrix or strut plate to be very useful. The plate itself needs no contouring and provides excellent stabilization. C Guimond., *et al.* in 2005 stated after retrospective evaluation of 37 patients that fixation of non-comminuted mandibular angle fractures with a 2.0-mm curved angle 3D strut plate was predictable [6]. This plate is low in profile, strong yet malleable, facilitating reduction and stabilization at both the superior and inferior borders. Development of a postoperative infection appeared to be related to failure of removal of a molar in the fracture line. J Zix., *et al.* in 2007 after his study on 3-Dimensional plates on 20 fractures of angle of mandible and 6 months post-operative observation stated that 3-Dimensional plating system is suitable for fixation of simple mandibular angle fractures and is an easy to use alternative to conventional miniplates [7].

Discussion

The evolution of science has gradually embarked newer horizons of knowledge and applications over a period of time. The incessant attempts to make science perfect or near to perfect phenomenon has more often than not revealed the fact that "perfection is achieved, not when there is nothing more to add, but when there is nothing left to take away". With the advent of the progressive inventories in the field or oral and maxillofacial surgery, the scope for enhancement of each inventory becomes ceaseless. Therefore, a consistent comparison between the advantages and disadvantages is observed among all the systems that have invaded the market. Every demerit has been complemented with a benefit which makes the system a comprehensive study model for further analysis and developments in forming newer systems. The advantage of one system is the disadvantage of the other and therefore, summiting a picture perfect scenario in the field of newer advancements is just an illusion than a reality.

As of this day, convenience is encroaching in every aspect of life and so will it be in the future. The more convenient forms of tools or systems are likely to improvise the preceding ones to make life easy. It will be unwise to comment on these fixation systems based on such a little study. According to studies conducted on mandibular fracture it appeared that Locking plating system shows certain "Theoretical" advantages over current systems, but as the further studies were conducted, they did not find any added benefit "Clinically" in fixation of mandibular fractures. Certain edge was found in usage of these systems where reconstruction of bone was considered. Resorbable plating systems certainly proved their point in application in craniofacial fixations where the plate and screws resorb gradually avoiding secondary intervention. But when used in mobile, force bearing mandible bone it was found that their strength may not be sufficient to withstand forces. Also it remains the most expensive internal fixation system making it difficult as a wide spread usage in developing countries. With the current advances, there is no doubt that in coming years resorbable plating systems will be the absolute treatment for fixation of all fractures. Talking of present, 3-D system is the one internal fixation system which is found to be promising enough to be an appreciable alternative to conventional plating system. 3-D plates are efficient, effective, economical and time saving thus fulfilling almost all requirements of an internal fixation system. Although 3-D plate can-

not be used at mental foramen region, it was found to be superior in all other regions of mandibular fractures with least complication rates. No single system is entitled to be the most comprehensive and will never be. Each system has unique applications in the treatment of mandibular fractures. Each distinctive case demands a certain option of the system which has its benefits and demerits and it wholly depends on the diagnostic expertise and competence of the clinician to vigilantly adopt the appropriate method of selection.

Conclusion

Based on this study, it was concluded that each system has unique applications in the treatment of mandibular fractures. Each distinctive case demands certain option of the system which has its benefits and demerits and it completely depends on the diagnostic expertise and competence of the clinician to vigilantly adopt the appropriate method of selection of the treatment.

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