ORIGINAL ARTICLE

Response of Inferior Alveolar Nerve to Mandibular Angle Fractures

Parveen. Lone, Tasleem Kouser*, Annuradha Gandral

Abstract

The study was performed on 40 patients who reported the department of oral & maxillofacial surgery Indira Gandhi Government Dental College Jammu with trauma sustaining mandible, midface injuries along with other body injuries. Those patients were selected who had isolated, unilateral mandibular angle fracture. Patients were selected for the treatment method depending on degree of nerve injury (paresthesia , dysesthesia or anesthesia) & approximate gap between two fractured fragments on OPG. Neurosensory deficit due to inferior alveolar nerve damage was compared with other normal side. The aim of this study was to find out response of inferior alveolar nerve to mandible angle fracture, whether inferior alveolar nerve is always injuried as reported in literature & what type of injuries are most commonly seen. The study also was aimed to know how much displacement/gap between the fragments will lead to paresthesia of lower lip & chin & postoperative recovery thereof.

Key Words

Lower Lip, Paresthesia, Angle Fracture, Inferior Alveolar Nerve

Introduction

Trigeminal nerve is largest cranial nerve composed of large sensory root &small motor root. It gives sensation to meninges, skin of anterior part of head, nasal & oral cavities & teeth. It provides motor innervations to the muscles of mastication . The sensory branches of the trigeminal nerve carries sensations about mastication facial expressions, talking and stimuli that come into contact with the facial & oral l tissues. Injury to peripheral trigeminal nerve results in degeneration, the degree of which depends in part upon the magnitude of injury .The age of patient & location of the injury (1). Thus for a given age range & site of injury, the type of injury often are the dependant variable that predicts the outcome. There are two predominant schemes proposed for classification of peripheral nerve traumatic injuries Seddon in (2) & Sunderlandin (3). According to seddon classification Nerve injuries are of three types , the lowest degree of nerve injury in which the nerve remains intact but signal ability is damage is called neurapraxias. Neurapraxia which is conduction block resulting from mild insult to the nerve trunk.There is no axonal degeneration ,& sensory recovery is complete & occurs in a matter of hours to several days.The sensory deficit is usually mild & characterized by paresthesia.(3) Axontmesis is a more sever injury. Afferent fibers undergo degeneration ,but the nerve trunk is grossly intact with variable degree of tissue injury. sensory recovery is good but incomplete .The time course for sensory recovery depends upon rate of axonal regeneration & usually takes several months .the neurosensory deficit is characterized by a sever paresthesia or in which axon is damaged but surrounding connective tissue remains intact is called axontmesis.The neurotmesis is a complete disruption of the nerve ,the most sever injury in seddon classification. Sensory recovery is not except when the nerve courses through a canal like mandibular canal. The sensory deficit is characterized by anesthesia. The last degree in which both axon & connective tissue is damaged is called neurotmesis. (4) Another system was given by Sunderland in 1951 which includes five classes as follows First Degree. It is similar to Seddon's neuropraxia and due to compression or ischemia, a local conduction block and focal demyelinization occur which recovers in 2-3 weeks. *Second Degree:* It is similar to Seddon's axonotmesis and recovery occurs at the rate of 1mm/ day as the axon follows the "tubule."

From: Deptt. of Oral & Maxillofacial Surgery Indira Gandhi Government Dental, College, Jammu & *Consultant Radiodiagnosis J&K Health Services -180005

Correspondence to : Dr. Parveen. Lone, Associate Professor & Head, Department of Oral & Maxillofacial Surgery IGDC, Jammu-180005

Third Degree: In this class, the endoneurium gets disrupted while the epineurium and perineurium remain intact. Recovery may range from poor to complete and depends on the degree of intrafascicular fibrosis.

Fourth Degree: In this class there is an interruption of all the neural and supporting elements although the epineuriumis intact and the nerve becomes usually enlarged. *Fifth Degree:* This class involves a complete transection of the nerve with the loss of continuity (5).

Most studies have shown that if the paresthesia follows inferior alveolar injury after angle fracture. it is likely to be temporary and to be resolved within the first 3 months. However, if no improvement is seen after 2 years of follow up, the altered sensation is likely to represent nerve dysfunction that may be in the form of permanent neurosensory disability, a complete loss of sensory function, and neurogenic symptoms (6). The lesions that recover within the first 3 months are probably neurapraxias or Sunderland first- or second-degree injuries, which are more common, and long-standing injuries could represent more severe axonotmesis or Sunderland third- or even fourth-degree injuries. Delayed recovery from IAN injuries after more than 1 year has also been reported in the literature.

Whatever the cause, damage to the inferior alveolar nerve negatively affects the quality of facial sensibility as well as the patient's ability to translate patterns of altered nerve activity into functionally meaningful motor behaviour. In the normal state stimulation of face or lips through facial expression or eating ,other contact with external environment stimulates the sensory receptors of the skin & profile of neural impulse which describe pattern of stimulation .Injury to trigeminal nerve alters this profile resulting in plasticity changes in neural substrates at cortical levels within the CNS (7) .Thus after a nerve injury ,the same stimulation of face, lip or skin elicits a different response ,which affacts the patients symptoms .These symptoms range from complete or partial loss of sensation ,to non painful tingling sensation ,to increased sensitivity to touch or pressure with or without numbness & pain. The majority of injuries result in transient sensory disturbance but in some cases ,permanent paresthesia (abnormal sensation) hypoesthesia (reduced sensation) or even worse ,some form of dysesthesia (unpleasant abnormal sensation) can occur. These sensory disturbences can be troublesome, causing problems with speech & mastication & may adversely affect the patients quality of life & also contribute as one of the most frequent cause of litigation & complaint (8). There is generally no accepted standard method of estimating sensory disturbances in the distribution of the inferior alveolar nerve following injury.

Material and Methods

The prospective study was done in patients visiting deptt of oral& maxillofacial surgery Indira Gandhi Govt Dental College Jammu. 40 cases were selected for the study who had isolated mandible fractures with unilateral angle fractures. Preoperative predictive variables were recorded like age, sex, cause of injury, date & time of injury etc. Findings like swelling step deformity occlusal discrepancy was also recorded. Data concerning the location & pattern of fracture were obtained & analysed on orthopantomogram & posterior anterior radiograph. The radiologic findings were recorded as fracture site ,presence of any other associated fracture , degree & displacement or dislocation , approximate gap between two fractured fragments. Paresthesia/ anesthesia & dysesthesia on tongue, lip chin was recorded by questioning .which was confirmed by neurosensory tests like pin prick , light touch, two point discrimination on the day of examination seventh day, fifteenth day one month ,three months six months & one year. Measurement was done on dry skin & skin was first cleaned with 70% alchol Treatment was divided into two catogeries, conservatively by maxilla mandibular fixation in undisplaced fractures & where gap between fragment was between 4-5mm approximatly. Those having paresthesia & gap between two fragments between 5-6mm approximatly, were treated by bone plating. At postoperative visits patients were asked difference in sensation of lower lip or chin ,burning ,tingling sensation, pain , bitting of lips, food running down from the mouth, findings were compared with opposite unaffected side. Post operative follow up was done at 7 days, 2weeks 1, 3, 6 & 9 months.

Results

In our study road traffic accident was most common cause of facial injury (*Fig 1*) . Males were more affected than females (*Fig 2*). In our study mandible fractures were most commonly seen in parasymphysis region (60%) followed by condyle in association with them (35%). Angle fractures were seen in 30% of cases with other mandible fractures where as isolated angle fractures were seen in 20% of cases.(*Fig 3*).

Eighteen Patients had 5-6 mm approximate gap between two fractured fragments horizontally. Post traumatic Neurosensory deficit i.e paresthesia of lower lip & chin was present in all these eighteen cases. These patients were treated by open reduction & boneplating. Post operatively paresthesia was present till four weeks. In five patients radiographic gap between two fractured fragments 4-5 mm approximately, also had paresthesia of lower lip & chin. These patients were treated

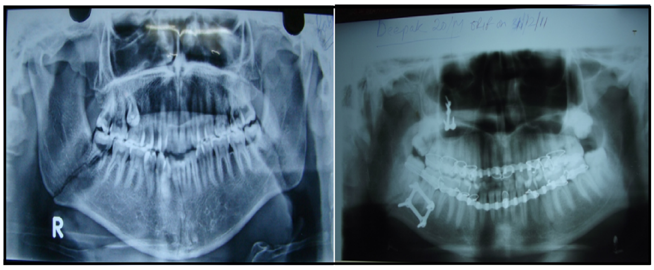

Fig 1&2. Pre Operative Radiograph Showing Angle Fracture & Gap Between Fragments 5-6mm and Post Operative Radiograph After Reduction & Bone Plating

Fig 5. Measurement of Gap Between Fragments

Fig 3 &4 . Pin Prick & Brush Technique For Paresthesia

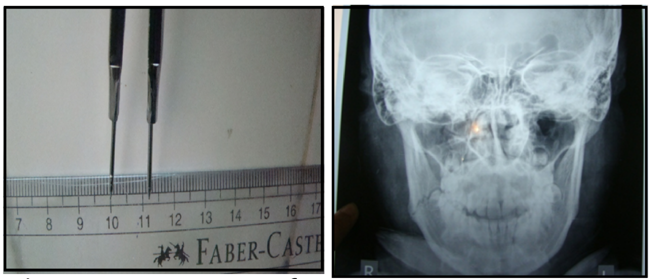

Fig 6 &7. Measurement of Gap on Scale & Showing Gap Between Fragments Less Than 4 mm

conservatively. postoperative paresthesia disappeared in seven to ten days .where as in seventeen cases gap between two fragments was less than 4 mm ,these patients had no neurosensory deficit. These patients were also treated conservatively. (*Fig 4-12*)

Discussion

Maxillofacial injuries amount from 3.2% to 8% of the total injuries in accordance with Moos *et al* (9). Of all facial injuries79.7% are mandible fractures in a study by Campbell (10), angle fractures are seen in 18 to 30% 0f cases cabrini *et al* (11). In our study mandible fractures were most commonly seen in parasymphysis region (60%) followed by condyle in association with them (35%). Angle fractures were seen in 30% of cases with other mandible fractures where as isolated angle fractures were seen in 20% of cases. In our study out of 40 patients were selected for the study 28 were males & 12 were females in accordance with HAUG *et al* (12). Road traffic accidents were responsible for 65 .% of cases followed by Interpersonal rivelary 25 .% fall by 10%.in the present study supported by Nobel *et al* (13) who reported that Traumatic injury to peripheral nerves result in considerable disability across the world .The peripheral nerve injury commonly results from road traffic accidents, less commonly from penetrating trauma, fall ,industrial trauma. What determines the degree of inferior alveolar lesion in case of mandible angle fractures, Dainius *et al* (14) has reported that minor neural lesion occurs more frequently when minimum stump dislocation takes place (15.8%)rather than significant dislocation (1.5%) contrary to our study has shown that neural lesion occurs most frequently when there is gross displacement/ dislocation of stump. Gintaut Dainius (15) has shown in his study that inferior alveolar nerve is always injuried in angle fractures .which can be minor moderate & sever, contrary to present study , seventeen patients had no neural lesion like ,paresthesia ,hypoesthesia ,or anesthesia .patient had normal sensation when compared to opposite normal side .This may be explained by the fact that the normal nerve trunk is made of organized collections of axons that are the peripheral extensions of the cell bodies located in the trigeminal ganglion .Schwann cells envelop the axons in a predetermined fashion & produce various degrees of myelin .In the peripheral nervous system a single Schwann cell envelops one axon with myelin sheath. The endoneurium surrounds axons & consists of organized collagen fibers .The outer most layer of these fibers is basal Lamina of Schwann cell, called the band of bungner & is a basal lamina tube running the entire length of the axons .Outer region of fine collagen fibers is further organized into sheaths referred to as endoneurium. Many axons with their endoneura l sheaths are surrounded by a second organization of collagen fibers called perineurium ,which forms the fascicles & this pattern is quite variable as reported by Svane *et al* (16) , Girod *et al* (17) .The nerve trunk is completed by internal epineurium ,external epineurium& mesoneurium .Various literature available on degeneration& regeneration of & role of microenvironment is also supported by Seckel (18).Axon degeneration in both directions from injury site characterizes complete transaction of nerves, called wallerian degeneration. Gordon (19) & Seil (20)

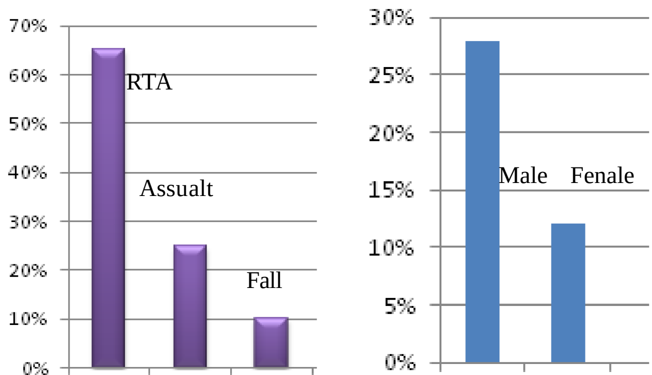

Fig.8 Showing Cause of Trauma & Male Vs Female Ratio

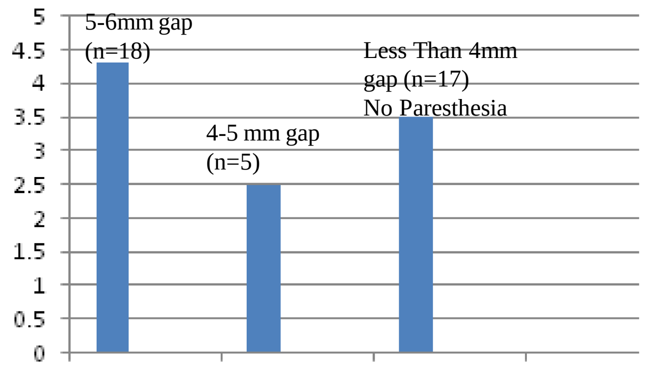

Fig. 9 Showing Post Traumatic Paresthesia Depending Upon Gap Between Fractured Fragmenta

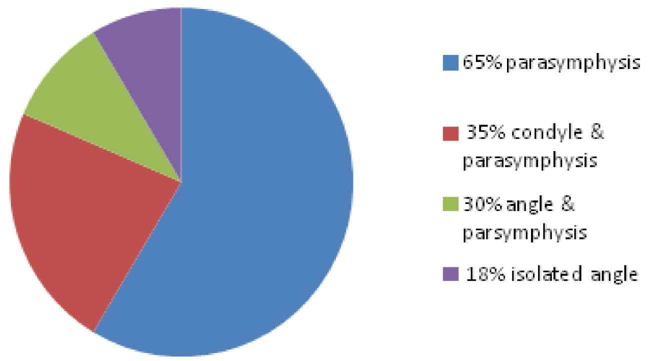

Fig.10 Showing Fractuers

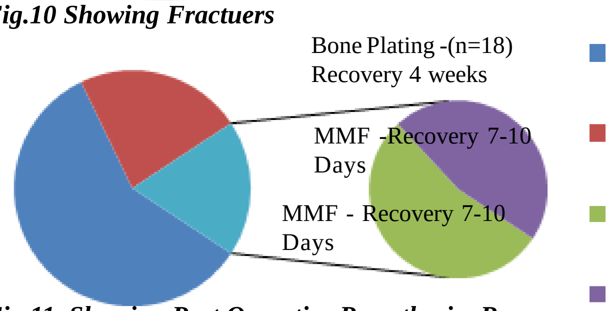

Fig.11 Showing Post Operative Paresthesia Recovery

documented that if death of nerve cell doesn't occur ,regenerative activity in form of nerve sprouts coming from proximal stump may begin as early as 24 hrs after injury.

Research is going on to establish the exact relationship of neural lesion to the stump dislocation. Shultz mosgua *et al* (21) stated that when stump dislocation is more than 1mm sensory recovery is longer ,when dislocation is more than 5mm anesthesia lasts for more than 6 months. This is contrary to our study, which has shown that no neural lesion is seen if horizontal gap between fractured fragments is up to .4 mm approximatly. undisplaced fractures showed no neural lesion like , paresthesia, hypoesthesia or anesthesia .patient had normal sensation when compared to opposite normal side This is supported by Kressa (22) in his study when comparing patients with mandibular fractures with patients based on subjective evaluation of the neurovascular bundles in MR imaging found that continuity of the nerve was interrupted in only 2 patients & intact in 19 patients & in all cases surgical exploration confirmed the MR imaging findings .He suggested that long term injury can be prevented by epineural repair of inter fasicular nerve grafting, before this is performed, interruption of nerve continuity must be diagnosed by MR imaging.The reason behind this is explained by Fenrich & Gordon (23) in his study that when the gap is present is present between the severed ends of nerve ,proliferating Schwann cells emerge from the stumps & form a series of nucleated cords which bridge the interval & this may persist for long time even in absence of satisfactory nerve regeneration. when axon tip reaches & successfully reinnervates the end organ ,the surrounding Schwann cells commence to synthsize myelin sheath , this myelin sheath thickens & fills the space inside the basal lamina of old endoneurial tube & axon regenerates (24).

In five patients Paresthesia of lip & chin was present ,where gap between fragments was 4-5mm approximatly. All these patients were treated conservatively by maxilla mandibular fixation & paresthesia disappeared from 7-10 days supported by Razukevicius (15). He stated that fractures heal more rapidly following closed reduction compared to open reduction methods since in former case reparatory regeneration proceeds . This is explained by Nauta *et al* (25) who stated that Reaction of neurons to physical trauma has been studied more extensively in motor neurons with peripheral axons & centrally where their axons form well defiened tracts. When axon is crushed or severed ,changes occur on both sides of lesion Distally the axon initially swells & subsequently breaks up into series of membrane-bound spheres .This process begins near the point of damage & progresses distally.

These antero grade changes which also involve the axon terminal continue to total degeneration & removel of cytoplasmic debris. Proximally a similar series of changes may occur close to the point injury followed by a number of sequential ,retrograde changes in cell body Gordon (19).The process of degeneration is followed by formation of new protein synthesizing orgenells that produce distinctive proteins, destined of re growth of axon ,where re growth of axon is possible .presence of an intact endoneurial sheath near & beyond the lesion is important if axon is to reestablish satisfactory contact with its previous end organ closely adjacent one French &Gordon (24). In 18 patients neurosensory deficit was seen when displacement/gap between two fractured fragments horizontally was from 5-6 mm approximatly on orthopantomogram. These patients were treated with open reduction & bone plating .Post operatively paresthesia continued till 4 weeks in accordance with Dainius (14) who in his studies have shown that fracture heal more rapidly following closed fixation methods as compared to open reduction. The repositioning & fixation of fractured fragments using open reduction methods results in higher traumatism of lower alveolar nerve compared to usage of open methods

Conclusion

All the angle fractures are not associated with inferior alveolar nerve lesions. Inferior alveolar nerve is protected by thick compact mandibular canal. Neurosensory deficit in angle fracture is mostly neurapraxia which is conduction block resulting from mild insult to the nerve trunk.There is no axonal degeneration & sensory recovery is complete & occurs in a matter of hours to days.The sensory deficit is usually mild & characterized by paresthesia. Undisplaced angle fractures & fractures where radiographic gap between two fragments is less than 4mm with or without can be treated successfully conservatively.

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