

FREQUENCY AND PATTERN OF PRESENTATION OF MENTAL NERVE INJURIES AFTER OPEN REDUCTION AND INTERNAL FIXATION OF PARASYMPHYSIS FRACTURES

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ABSTRACT

The fractures of the anterior mandible are common and include parasymphysis fractures that often can be treated with open reduction and internal fixation (ORIF) to ensure proper bony alignment, stability and functional recovery. The mental nerve is closely related to the parasymphysis area and is a serious complication after surgery. The patient may experience numbness, tingling, altered sensation, pain or complete sensory disturbance of the mental nerve, which may affect his/her comfort and quality of life. Knowing the frequency and presentation pattern of these injuries are crucial to improving surgery outcomes and minimising postoperative complications. This study aims to find the incidence and type of mental nerve injury following open reduction and internal fixation of parasymphysis fracture. The study also evaluates the clinical features, sensory abnormalities, and risk factors for mental nerve impairment after surgery. This descriptive observational study is carried out on patients with a diagnosis of the parasymphysis fracture and undergoing open reduction and internal fixation. A clinical neurosensory examination is used as a method of postoperative assessment of mental nerve function. Demographic data, fracture pattern, surgical procedure and postsurgical sensory changes are gathered and analyzed. Assessment of frequency, type and presentation pattern of mental nerve injuries including associated contributing factors. The study defines the incidence of mental nerve injury after ORIF for parasymphysis fractures and notes the typical patterns of sensory deficits. The results indicate the correlation between the clinical and surgical factors and the postoperative mental nerve disturbance. Mental nerve injury is an important complication associated with surgical treatment of parasymphysis fractures. To optimize patient management and reduce sensory complications post-transplant, proper assessment of nerve function and identification of risk factors is crucial. The present study offers valuable insight into the frequency and pattern of mental nerve injuries after open reduction and internal fixation (ORIF) surgery.

Keywords: Mental nerve injury, Parasymphysis fracture, Mandibular fracture, Open reduction and internal fixation (ORIF), Inferior alveolar nerve, Neurosensory disturbance, Mandibular trauma, Postoperative complications, Oral and maxillofacial surgery

INTRODUCTION

Mandibular fractures constitute a large percentage of facial skeletal fractures, and are among the most common injuries seen in oral and maxillofacial trauma. The mandible is especially susceptible because it is highly mobile, prominent and exposed to traumatic forces. Parasymphysis fractures are frequently seen in the anterior part of the mandible and are frequently associated with road traffic accidents, falls, interpersonal violence and sports-related injuries among the various types of mandibular fractures. Such fractures often must be treated surgically to restore occlusion, continuity of the mandible and symmetry of the face and functional stability. For displaced parasymphysis fractures, open reduction and internal fixation (ORIF) is often the recommended treatment approach as it offers visualisation of the fracture, reduction of the fracture and rigid stabilisation using plates and screws (Ellis and Walker 2016).

The mental nerve is an important sensory branch of the inferior alveolar nerve, a branch of the mandibular division of the trigeminal nerve. It passes through the mental foramen and innervates the lower lip, chin and other soft tissues in the area. The mental nerve is in close proximity to the parasymphysis region and has a high potential for injury in trauma and during surgery such as fracture exposure and fixation. In case of nerve damage, a variety of post-operative neurosensory disturbances, such as hypoesthesia, anesthesia, paresthesia, dysesthesia, and altered tactile sensation, can impact the patient's well-being and comfort, as well as quality of life (Bagheri et al., 2017).

Surgical planning is important for the management of parasymphysis fractures to prevent damage to adjacent anatomy during ORIF. While rigid fixation has made fracture healing and functional outcomes better, problems with nerve damage are still an issue of concern. There are many factors that can lead to

mental nerve injury following ORIF, such as direct trauma from the fracture, soft tissue manipulation, positioning the fixation screws close to the mental canal, excessive retraction, and surgical handling of the mental nerve area. The degree of the sensory impairment is related to the degree of nerve injury, displacement of the fracture and surgical technique (Scolozzi et al., 2018).

A number of studies have been conducted to assess sensory disorders after the treatment of mandibular fractures and have found different rates of inferior alveolar and mental nerve lesions. One of the most significant complications encountered after mandibular fracture surgery is postoperative nerve dysfunction, which may necessitate a prolonged period of recovery – sometimes for months – and in some instances, may result in permanent sensory alteration. Furr et al. (2019) stated that assessment of postoperative nerve function using standardized neurosensory tests is crucial in determining the severity and development of nerve injury. Early detection enables patient counseling to be done appropriately and the management of postoperative complications is enhanced.

The development of surgical techniques, imaging, and fixation systems have helped to make mandibular fractures less hazardous to manage. Important factors in minimization of nerve-related complications include the use of three-dimensional imaging, careful identification of the mental foramen, and correct placement of plates and screws. Nonetheless, despite these advancements, the risk of mental nerve injuries following ORIF of a parasymphysis fracture is still clinically relevant, and should be further investigated (Sharma et al., 2020).

Mental nerve injury can present differently in different patients, and can cause numbness, altered sensation, tingling sensation, burning sensation or complete loss of sensation in the

lower lip and chin area. These symptoms can affect speech, eating habits, facial expression and mental health. The pattern of sensory changes and associated factors are significant because they can be used to enhance the surgical success and minimize post-surgical complications for the oral and maxillofacial surgeon (Al-Moraissi et al., 2021).

Background of the Study

Fracture of the mandible is one of the most frequently seen injuries in the field of oral and maxillofacial trauma. The mandible is very prone to traumatic injuries because of its location, mobility and vulnerability to external forces. Of the various patterns of fractures, the parasymphysis fracture is seen quite common as the area is very vulnerable between the canine and the midline of the mandible. Most of the time these fractures occur in road traffic accidents, falls, sports trauma and interpersonal violence. Treatment of parasymphysis fractures is designed to restore continuity of the mandible, occlusion, facial esthetics, and normal function. An effective treatment modality for displaced parasymphysis fractures is open reduction and internal fixation (ORIF). This allows direct visualization of the fracture site, accurate anatomical reduction and rigid fixation with plates and screws. Even with the improvements in surgical technique and fixation systems, there are still concerns with complications related to nerve injury. The mental nerve is in close proximity to the parasymphysis region and is especially susceptible during trauma and surgical procedures.

Sensory disturbances after ORIF of parasymphysis fractures may occur in the lower lip, chin, and surrounding soft tissues, which may be caused by mental nerve injury. The symptoms of these disturbances are numbness, sensation changes, tingling, pain, and a loss of tactile perception. Nerve dysfunction occurs and is dependent upon the relationship of fracture displacement, surgical manipulation, fixation technique and degree of nerve involvement.

Mental nerve assessment after mandibular fracture surgery is crucial to recognize postoperative complications and maximize patient outcomes. The prevalence and incidence of mental nerve injuries are important to understand to formulate the correct surgical plan, to reduce nerve trauma, and to offer proper postoperative management.

Anatomy and Function of the Mental Nerve

The mental nerve is a terminal sensory branch of the inferior alveolar nerve, a branch of the posterior division of the mandibular branch of the trigeminal nerve (cranial nerve V3). The inferior alveolar nerve passes through the mandibular foramen to run through the mandibular canal, supplying the lower teeth. Close to the region of the premolars, it branches into the mental and the incisive nerves.

The mental nerve exits the mandible through the mental foramen, which is usually located near the apices of the mandibular second premolar teeth. It leaves the mental foramen and branches to provide sensation to the skin of the chin, lower lip and adjacent mucosa. The nerve is vital in transmitting sensory information such as touch, pressure, temperature and pain.

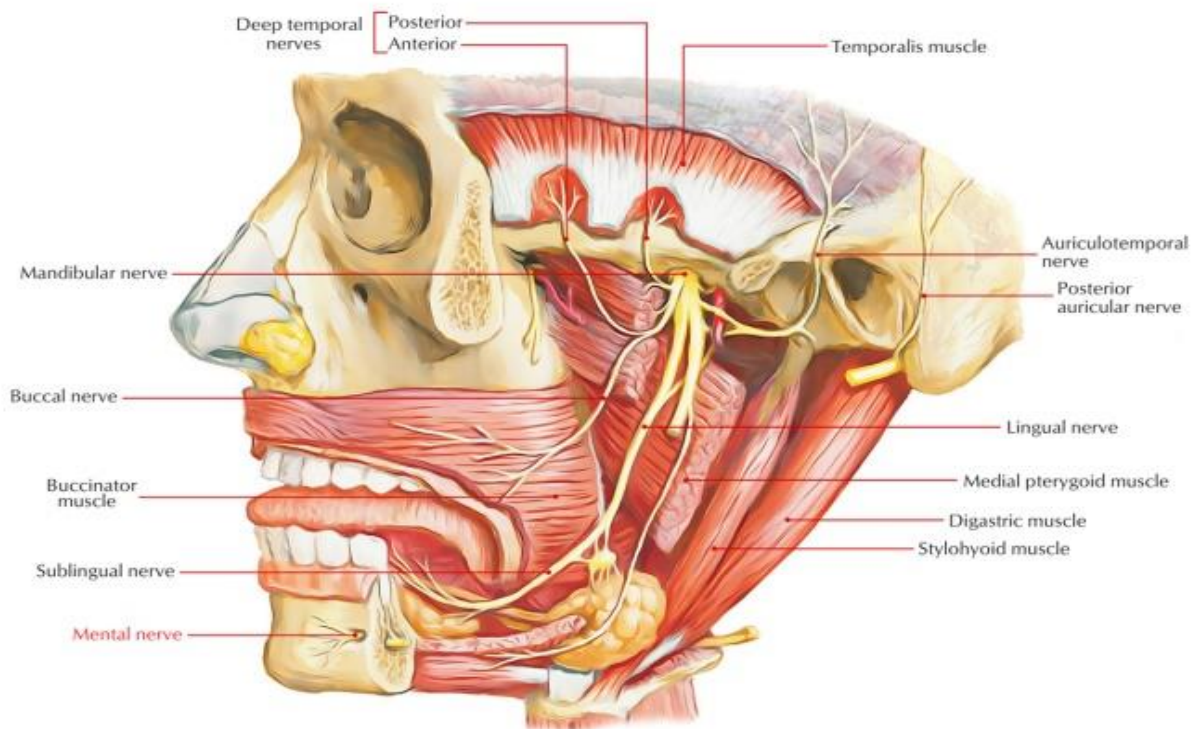


Fig 1.1 Anatomy and Function of the Mental Nerve

Due to its superficial location after exiting the mental foramen, the mental nerve is vulnerable to direct trauma and surgical manipulation. Damage to the nerve pathway can lead to any

type of sensory abnormality which can have short-term or long-term consequences for the patient's well-being.

Mental Nerve Injuries Associated with Mandibular Fracture Management

Trauma and surgical treatment of the mandible is known to cause mental nerve injury. The injury

can be caused by the first fracture or at the time of the operation. Before surgery, nerves may be affected by the displacement of the fracture, fragments of the bone, swelling, or compression.

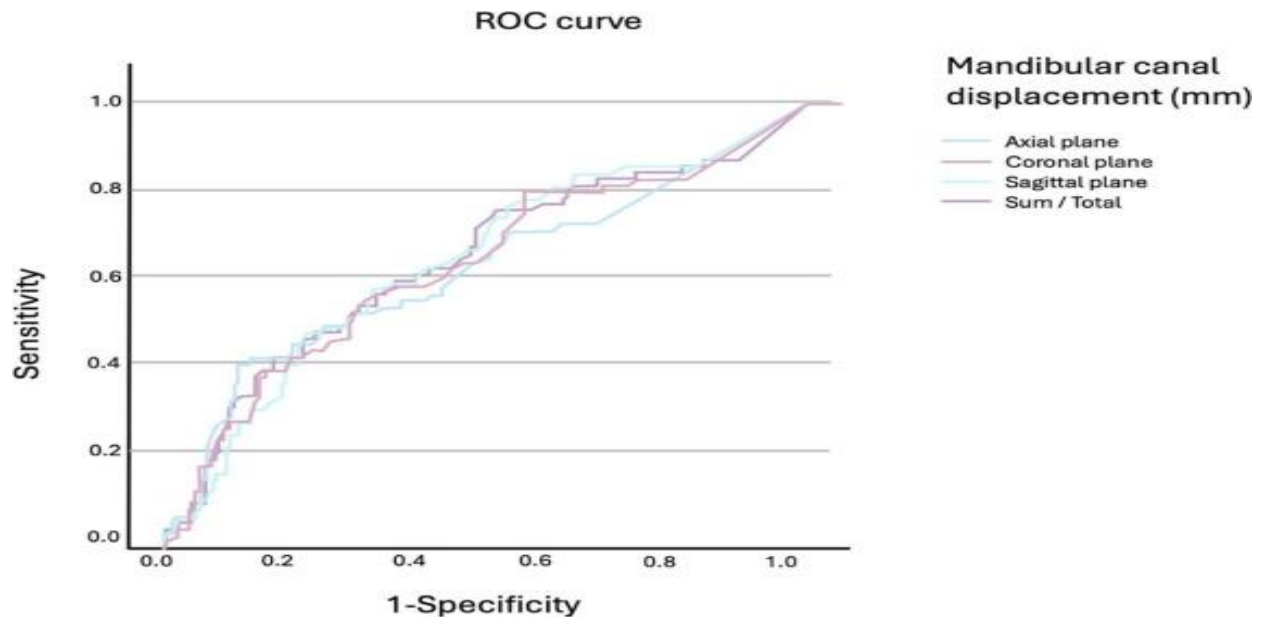


Fig 1.2 Mental Nerve Injuries Associated with Mandibular Fracture Management

The mental nerve can be exposed to potential injury in ORIF by too much retraction of tissues, drilling of the bone, placement of screws, or unintentional manipulation of the nerve. The extent of injury is dependent on the nature of the nerve damage ~ it can be a temporary compression or a complete disruption of the nerve.

Clinical Significance of Mental Nerve Damage

Clinical importance of mental nerve damage is that it impairs the sensation in the lower face. If mental nerve is injured, patients may experience numbness, tingling, burning, decreased or absent sensation.

Such sensory changes can have an impact on daily living and affect the person's ability to talk, eat, drink and care for their mouth. Sensory impairment may also have a negative effect on psychological wellbeing and patient satisfaction following fracture care.

Documentation and early identification of mental nerve dysfunction are key to ensuring monitoring of recovery and management. Postoperative neurosensory evaluation is used to determine the extent of damage and to direct further clinical management.

There are several categories of mental nerve injuries, depending on the extent of nerve involvement. Mild injuries could lead to temporary changes in the sense, with very severe injuries causing long-term or permanent sensory loss. Good surgical technique and careful anatomical identification is crucial to minimise the risk of nerve complications.

Problem Statement

Open reduction and internal fixation is often the surgical treatment of choice for parasymphysis fractures. ORIF is effective in stabilizing and function-recovery, but the mental nerve injury is one of the major postoperative complications. Among its reported cases, the frequency, clinical presentation and pattern of recovery after fixation of a parasymphysis fracture differ.

Little information is available on the pattern and factors of mental nerve injury after ORIF of parasymphysis fractures. Thus, it is essential to understand how often and how these injuries occur to enhance the surgical results and minimize the complications following surgery.

Rationale of the Study

This study aims to determine the incidence and distribution of mental nerve injuries after ORIF of parasymphysis fractures. However, knowledge of these injuries and their clinical presentation is useful to surgeons in risk assessment, surgical planning and postoperative monitoring.

Based on the results of this research, patients can be better counseled, early diagnosis of sensory complications can be made and strategies can be developed to limit mental nerve damage in the process of carrying out a mandibular fracture.

Research Questions

How common are mental nerve injuries after open reduction and internal fixation (ORIF) of parasymphysis fractures?

What are the usual patterns and types of mental nerve injury seen following surgical fixation?

What are the clinical and surgical factors that predispose to mental nerve injury?

Objectives of the Study

To find the frequency and the mode of presentation of mental nerve injury following the open reduction and fixation of parasymphysis fracture

To estimate the incidence of mental nerve injuries after ORIF of parasymphysis fractures.

To determine the pattern and type of mental nerve injury following surgical fixation.

To evaluate the risk factors for mental nerve injuries.

LITERATURE REVIEW

Many mandibular fractures occur in maxillofacial trauma and management of these fractures is an area of interest because of the functional and aesthetic significance of the mandible. Fractures of the mandible are often associated with mastication, speech and facial contour, and thus must be accurately diagnosed and treated to plan accordingly. Structurally and mechanically, one of the more commonly fractured parts of the mandible is the parasymphysis region of the mandible which is under considerable stress and trauma. Despite the improvements in surgical technique, postoperative complications with

nerve injury are still of concern, such as possible sensory disturbance (Ellis and Price, 2016).

Mental nerve is a significant sensory structure which innervates the lower lip, chin and surrounding soft tissues. It is a terminal branch of the inferior alveolar nerve, a branch of the mandibular division of the trigeminal nerve. The nerve is very close to the parasymphysis region because it travels through the mandibular canal and exits the mouth in the mental foramen. This anatomical relationship renders it susceptible to injury with traumatic trauma to the mandible and surgeries on the mandible that include fracture reduction and fixation. When the mental nerve is damaged, many sensory disturbances can occur such as hypoesthesia, anesthesia, paresthesia, dysesthesia and pain (Bagheri et al., 2017).

The mandible is divided into several parts: condyle, ramus, angle, body, symphysis and parasymphysis. Of these areas, the parasymphysis is clinically important due to its close relationship with the mental nerve, teeth-bearing area and important facial structures. The fractures are typically between the midline of the mandible and between the mental foramen and the midline. Parasymphysis fractures are more likely to occur in children and various factors may affect the pattern and severity of the fracture, including the direction of the trauma, the impact, age of the patient and associated fractures. Mandibular fracture is one of the most common fractures due to road traffic accidents, falls, interpersonal violence, and sports injuries, respectively (Scolozzi et al., 2018).

The goal of treating fractures of the parasymphysis is to restore mandibular function, occlusion, and anatomy. The choice of treatment depends on the displacement, stability, occlusal status and patient related factors of the fractures. The open reduction and internal fixation (ORIF) of displaced mandibular fractures is the most preferred method due to the direct visualization of the fracture site and provides rigid fixation. Plates and screws provide early mobilization, decrease healing complications and enhance functional recovery. Surgery at the parasymphyseal area however could cause injury

to the mental nerve as it lies in close proximity to the area (Furr et al., 2019).

Some reports have indicated that nerve problems are one of the more frequent concerns after surgery for a fractured mandible. The mental nerve can suffer injury from the initial blow, displacement of the fracture, compression from bone fragments and/or surgical handling. Excessive retraction of the soft tissues, installation of screws in an inadequate position, drilling too close to the mandibular canal, and lack of anatomical landmarks identification can all cause nerve damage during ORIF. The severity of the injury is directly related to the extent of nerve damage, and can also vary from transient sensory dysfunction to permanent neurological damage (Sharma et al., 2020).

Post fracture assessment of mental nerve function is crucial to the ability to detect possible complications after treatment of a mandibular fracture. There are several methods of neurosensory assessment of nerve function such

as light touch, 2-point discrimination, pin prick, thermal testing, and patient reported sensory testing. These techniques can be used to assess the extent and recovery course of nerve injury. An early postoperative evaluation is important for information about nerve recovery and helps guide management plans (Al-Moraissi et al., 2021).

Anatomy of the Mandible

The mandible is the longest and strongest bone of the lower facial skeleton and it is important for mastication, speech, facial aesthetics and maintenance of dental occlusion. It is a rectangular bone with the sides attached at an angle like the back of a horseshoe, comprising two vertical parts called the rami, and a horizontal part called the body. The temporomandibular joints are joints between the mandible and the temporal bone which enable movement of the mandibles required for chewing.

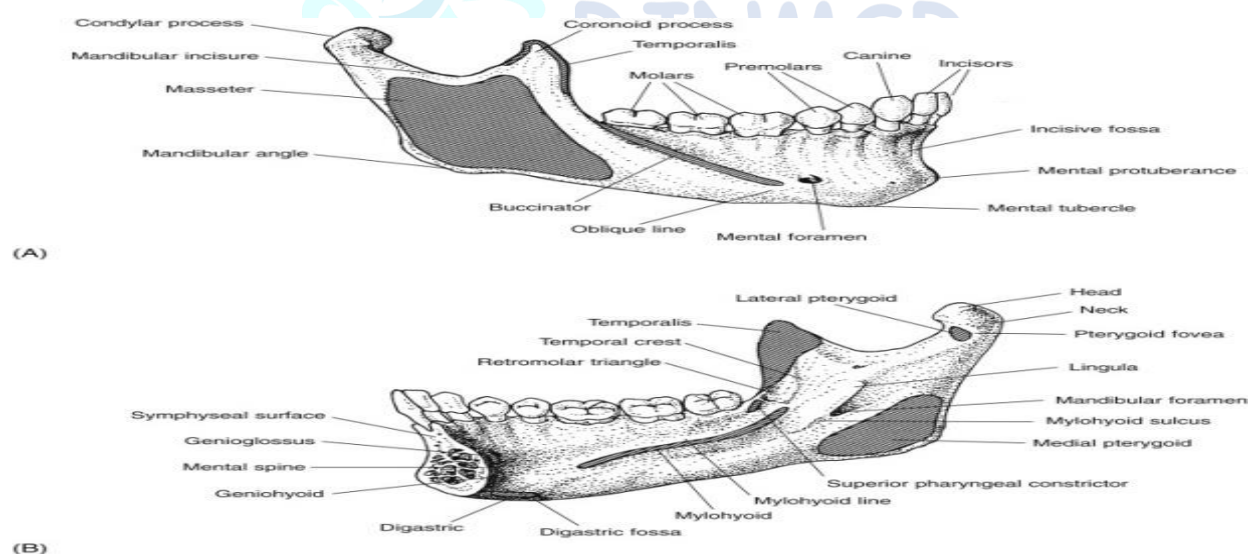


Fig 2.1 Anatomy of the Mandible

From the symphysis area at the middle to the angle of the mandible at the back of the body, is the body of the mandible. The anterior part is made up of the symphysis and parasymphysis regions containing the lower incisors, canine teeth and the region of the premolars. The inferior alveolar neurovascular bundle is located in the mandibular canal, which is located in the

body of the mandible. The mental nerve exits the jaw through the mental foramen, which is found in the middle of the face near the apices of the mandibular second premolar.

Mandibular Canal, Mental Foramen and Parasymphysis Area are clinically relevant in trauma management and surgical fixation due to their anatomical relationship. Damage to these

can cause sensory disorders, especially to the lower lip and lower jaw. Understanding anatomy of the mandible is therefore crucial for safe surgical intervention when treating fractures of the mandible (Ellis and Price, 2016).

Anatomy and Course of the Inferior Alveolar and Mental Nerve

The inferior alveolar nerve is a large sensory branch of the posterior division of the mandibular nerve (cranial nerve V3). It passes through the mandibular foramen with the inferior alveolar artery and vein in the medial surface of the mandibular ramus. The nerve supplies sensory nerves to the teeth and tissues of the lower jaw.

The inferior alveolar nerve bifurcates to form two terminal branches near the premolar area, which are the incisive nerve and the mental nerve. The incisive nerve runs forward in the mandible, innervating the anterior teeth; and the mental nerve passes through the mental foramen to innervate the skin and lower lip of the mandible. The mental nerve is especially susceptible to injury when undergoing surgery on the fracture of the parasymphysis, since it is exposed after leaving the mental foramen. The integrity of the nerve may be compromised due to trauma, displacement of fracture, surgical exposure, or surgical fixation procedures. Knowing the course of the inferior alveolar and mental nerves is crucial to avoid nerve-related complications in ORIF (Bagheri et al., 2017).

Classification of Mandibular Fractures

The fractures of the mandible are categorized based on the location, pattern, displacement and relationship between the fracture segments. Mandibular fractures are classified in terms of their location, namely: condyle fracture, ramus fracture, angle fracture, body fracture, symphysis fracture, parasymphysis fracture, and alveolar process fracture.

Fractures can also be simple, compound, comminuted, greenstick, pathological or complicated depending on how severe they are and on involvement of surrounding structures. A simple fracture is characterized by a single fracture line and is not communicating with the oral cavity or the external tissues, a compound fracture is communicating with the oral cavity or external tissue.

Parasymphysis Fractures: Causes and Clinical Features

Parasymphysis fractures are located in the front part of the jaw on both sides, from the middle line of the jaw to the area next to the mental foramen. These fractures are a common type of mandibular fracture and are frequently seen in young adults as a result of trauma of high energy. The most common causes of parasymphysis fractures are road traffic accidents, falls, sporting injuries and interpersonal violence. The direction and force of trauma determines the fracture pattern, displacement and other injuries.

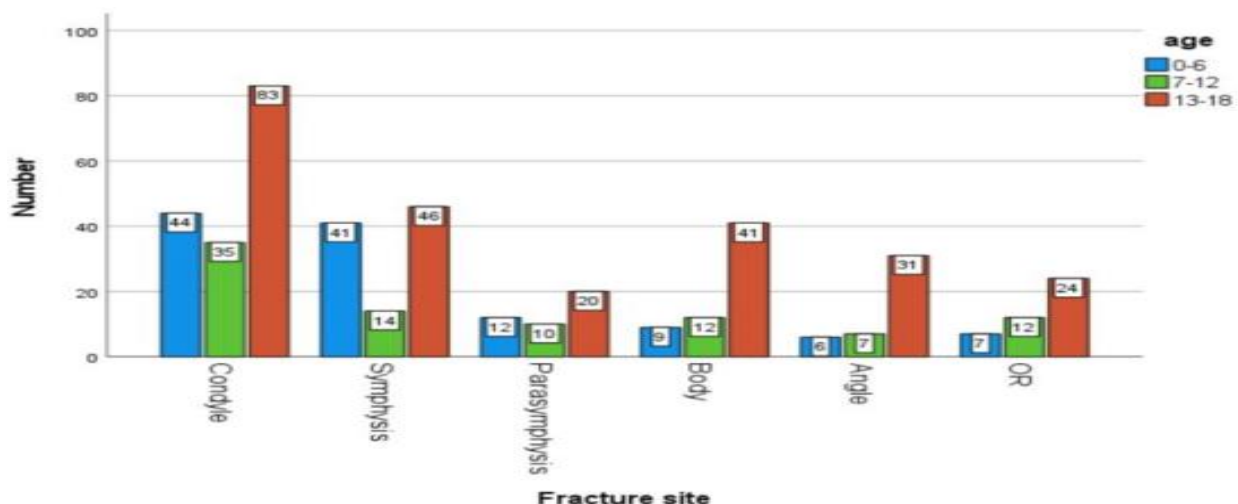


Fig 2.2 Parasymphysis Fractures: Causes and Clinical Features

The clinical symptoms of a parasymphysis fracture are pain, swelling, inability to move the jaw, malocclusion, mobility of the fracture fragments, and tenderness over the fracture. Occasionally the mental nerve is involved, causing changes in sensation of the lower lip and chin.

Radiographic assessment, such as panoramic radiography and computed tomography, is crucial for assessing fracture morphology and surgical management. Diagnosis helps minimize complications and treatment effectiveness (Sharma et al., 2020).

Management Approaches for Parasymphysis Fractures

Treatment for parasymphysis fractures will vary depending on several factors, such as the degree of fracture displacement, occlusion, patient's age, and health status, as well as any other injuries. Conservative management, closed reduction, and

For mandibular fractures, rigid fixation enables functional loading and minimized prolonged immobilization. When properly fixed, it will enhance the patient comfort, allow early jaw movement and ensure predictable healing.

Surgical Approaches for Parasymphysis Fractures

There are several surgical procedures which can be used for access to the parasymphysis, such as intraoral and extraoral techniques. The intraoral route is the more usual choice as it avoids any visible facial scars and will allow good access to the anterior mandible.

When exposed intraorally, special care must be taken to avoid complications to the mental nerve and adjacent structures. It is important for the surgeon to be aware of the position of the mental foramen and not apply too much traction on the nerve.

Extraoral: Can offer a better visualization in complex fractures, but there are risks of scarring the face and damage to adjacent structures. Surgical approach depends on the complexity of the fracture, the surgeon's preference and patient-related factors.

open reduction with internal fixation are all methods of treatment.

If a fracture is not displaced and is stable, it may be treated conservatively; in cases of displaced fractures, however, surgical treatment is usually necessary for anatomical restoration of the mandible. ORIF has emerged as the treatment of choice for many para-symphysis fractures as it offers both stable fixation and early functional recovery.

Principles of Open Reduction and Internal Fixation (ORIF)

Open reduction and internal fixation include surgical exposure of fracture site, anatomical repositioning of fracture segments and stabilization by fixation devices, like plates and screws. The key to ORIF is to ensure bone reduction is achieved and that stability is maintained while the bone is healing.

Complications Following ORIF of Mandibular Fractures

While ORIF is a good option for fracture stabilization, there are some complications that can follow the operation of the fracture in the mandible. The most frequent complications are infection, malocclusion, hardware failure, delayed healing, non-union and sensory disturbances.

One of these complications is nerve injury which can impact patients' quality of life. The mental nerve can be damaged at the time of fracture exposure, fixation or compression from trauma.

Numerous factors influence the incidence and severity of complications such as fracture type, surgical technique, postoperative care and patient compliance. Surgical planning and follow-up are important aspects of minimizing adverse outcomes.

Mental nerve injury after Mandibular fracture surgery

The incidence of Mental Nerve Injury was 1.5%. Mental Nerve Injury incidence was 1.5%.

A common side-effect reported after the treatment of mandibular fractures is injury to the mental nerve, especially in fractures involving the area of the parasymphysis. Incidence reported

differ across studies as a result of differences in patient populations, evaluation methods and

follow-up times.

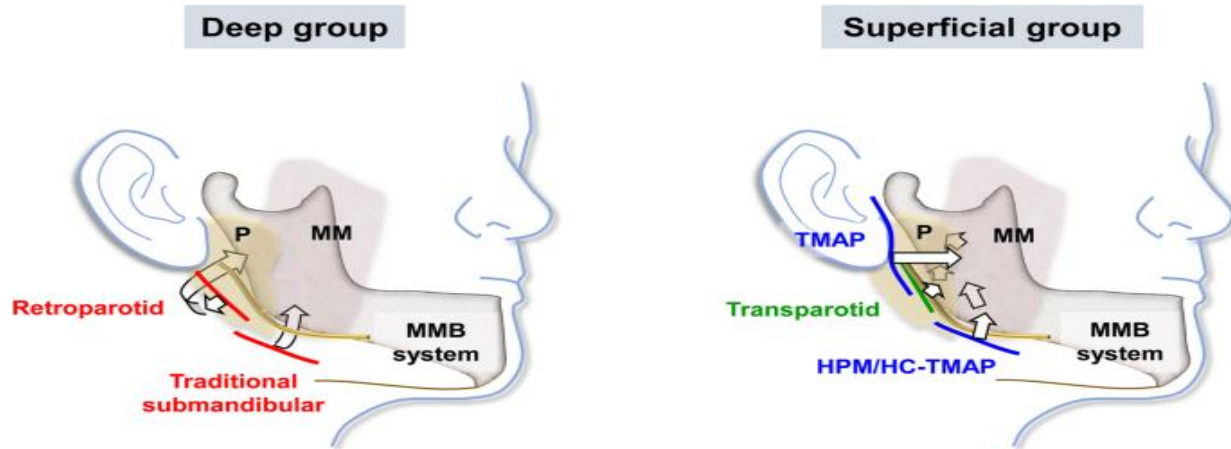


Fig 2.3 Mental nerve injury after Mandibular fracture surgery

Research has shown that disturbance of the senses can happen following traumatic injury and/or surgical fixation. The close relationship between the mental nerve and fracture site contributes to its increased vulnerability (Furr et al., 2019).

Many people are affected by nerve damage. Nerve damage affects many people.

Damage to the mental nerve can happen in a number of different ways, such as: direct trauma, compression from displaced fracture fragments, stretching, surgical manipulation, drilling, or penetration with screws. The degree of the injury is based on either temporary compression or damage to the nerve.

Temporary Nerve Injuries vs Permanent Nerve Injuries

Mental nerve injuries can be temporary or permanent. Weariness injuries are usually caused by nerve compression or minor trauma, and can often go away over time as the nerves heal. Severe nerve disruption can lead to permanent injuries, and produce long-term sensory impairment.

Mental nerve damage that presents with sensory disturbances

Patients with mental nerve injury may have numbness, tingling, burning sensations, decreased sense of sensation or changes in how they feel touch and temperature. These symptoms

can hamper patient's normal life and hence decrease patient satisfaction post surgery (Kumar et al., 2022).

Neurosensory Examination

After mandibular surgery, the functional status of the mental nerve is assessed by neuro-sensory examination. It aids to identify sensory impairment and its impact.

Two-Point Discrimination Test

Two-point discrimination is a test to determine how well the patient can tell the difference between two points that are touched on the skin. A decrease in discrimination means there is poor sensory function.

Light Touch Testing

Light touch testing determines the ability of the nerve to respond to light pressure. It is usually carried out with cotton or soft instrument to test sensory perception.

Pin-Prick Test

Pin-prick test is a mild sharp stimulus that assesses pain sensation in the test person. Useful in assessing the integrity of protective sensory pathways.

Thermal Testing

Thermal testing measures how well one can feel warm and cool. It gives more details about the ability of sensory nerves to work and get better.

Factors Influencing Mental Nerve Injury

Fracture Displacement

Severely displaced fractures are at risk of compressing the nerve and injuring it by the fracture fragments moving towards the mental nerve.

Surgical Technique

A good surgical technique is required to avoid damage to the nerves. Tissue handling, improper exposure and failure to identify the proper anatomy could lead to injury.

Plate Placement

If the fixation plates are placed too near the foramen or the mandibular canal, it can also cause irritation or compression of the nerve.

Screw Positioning

If the screw is not long enough or is turned the wrong way, it can cause damage to the inferior alveolar canal or mental nerve pathway, causing postoperative sensory disturbances.

Duration of Surgery

Longer surgeries could lead to more inflammation and tissue movements, which might complicate problems with nerves.

Severity of Trauma

The risk of postoperative sensory impairment is greater when there is more extensive fracture displacement at high energy trauma.

Research Methodology

The descriptive observational study design is used to find the frequency and pattern of presentation of mental nerve injuries after open reduction and internal fixation (ORIF) of parasymphysis fractures. This study aims to assess sensory disturbances after surgery, types of mental nerve injury and factors involved with nerve injury after surgical fixation.

The study is carried out in the Department of Oral and Maxillofacial surgery of a tertiary care hospital where the management of trauma cases of maxillofacial region is done routinely. The study population is patients with mandibular parasymphysis fractures that are treated with surgery (open reduction and internal fixation). Those who meet the eligibility criteria become part of the study and their mental nerve function is evaluated following surgery.

The number of patients depends on the research objectives, size of the patient population and statistical needs. Patient selection is done using a non-probability consecutive sampling technique. During the study period all patients with parasymphysis fractures who underwent ORIF are assessed using specific inclusion/exclusion criteria.

The patients who are included in the study are those who have been diagnosed with parasymphysis fracture of the mandible, were treated by open reduction and internal fixation with plates and screws, were of both sexes and had follow-up after the operation. The patients who had mental nerve dysfunction, pathological fractures, history of surgery on the mandible, neurological disorder affecting sensory assessment, and those who had incomplete follow up were excluded from the study.

Assessment of data is carried out during clinical examination, patient interviews, medical records and radiologic and follow-up evaluations after surgery. Demographic data (age and gender) are collected as well as trauma data (type of trauma, fracture pattern, fracture displacement, and any associated mandibular fractures). Other surgical notes are also recorded such as surgical approach, fixation, location of plates and screws, and the length of surgery.

Postoperative assessment is carried out to determine the function of the mental nerves and to check for the presence of a sensory disturbance in the lower lip and chin area. Patients have symptoms which are evaluated for numbness, tingling sensation, altered sensation, pain, sensory loss. Clinical neurosensory examination involves various techniques such as two-point discrimination, light touch, pin-prick and

thermal testing to assess the extent and severity of nerve injury.

Study Design

The data analysis of this study is descriptive observational studies. The study compares and contrasts patients with a parasymphysis fracture and open reduction and internal fixation with the incidence, clinical, and radiographic findings of mental nerve injuries after surgical management.

Study Setting

The study is carried out in the Department of Oral and Maxillofacial Surgery of tertiary care health care center. The department treats patients with maxillofacial trauma and the diagnosis and treatment of mandibular fractures that require surgery.

Study Population

Patients with fractures of the mandibular parasymphysis treated with open reduction and internal fixation with internal plates and screws. Patients who met the inclusion criteria were evaluated for mental nerve function and sensory changes after surgery.

Sample Size

Sample size depends on the purpose of the study, the anticipated rate of mental nerve injuries in patients, patient population available and statistical needs. Patients who met the inclusion criteria within the period of study are assessed for the study.

Sampling Technique

Participant selection is by a non-probability consecutive sampling. To achieve the required number of patients in the study, all patients eligible for ORIF who presented with parasymphysis fractures during the study period are included.

Inclusion Criteria

The study will include patients who meet the following criteria

Patients who sustained parasymphysis fractures and underwent open surgery and fixation.

Patients being surgically fixed with internal plates and screws.

Patients who could be clinically assessed and followed up after surgery.

Patients who are willing to participate and informed consent is given.

Exclusion Criteria

The following are excluded from the study

Those patients who have had injury to the mandibular nerve in the past.

Patients who have associated pathological fractures.

In the absence of completed follow-up.

Patients who have a disorder of the sensory system in the facial area.

Data Collection Procedure

The evaluation of data is conducted by clinical examination, patient interview, medical records, radiographic assessment, and postoperative evaluation. Information is collected on the patients' demographic information, trauma-related information, fracture characteristics, and surgical information for each patient.

History and physical findings are reviewed preoperatively and intraoperatively, such as fracture location, fracture displacement, surgical approach, fixation method, type of plate used, and the placement of screws. Postoperative follow-up examinations are performed to detect and determine type of mental nerve injury.

Patients are screened for sensory changes such as numbness, tingling, loss of sensation, altered sensation, and pain in the area of the lower lip and lower chin. Symptom duration and symptom evolution is recorded to assess the recovery pattern.

Assessment of Mental Nerve Injury

Clinical neurosensory examination after surgery of injury to the mental nerve is used to evaluate its injury. Evaluation is conducted to determine changes in sensation that occur in the lower lip, chin and surrounding soft tissues.

Assessment involves sensory objective testing and patient-reported symptoms. Patients have their numbness, tingling sensation, altered sensation, pain, and sensory function assessed.

Neurosensory testing can be done using two-point discrimination, light touch, pin prick and thermal testing. These methods will assist in determining the level of sensory impairment and measuring changes during subsequent visits. The length of time that symptoms exist and the pattern of nerve function recovery is noted to evaluate nerve function over time.

Data Analysis Plan

Appropriate statistical methods are used to analyse the collected data. Demographic characteristics, fracture-related findings, and surgical details were summarized using descriptive statistics, and the frequency of mental nerve injury was summarized.

Categorical variables are reported by frequencies and percentages; Continuous variables are reported by appropriate statistical measures. The correlation between mental nerve injury and the possible contributing factors such as fracture displacement, surgical technique, positioning of the plate and positioning of the screw is analyzed with appropriate statistical tests. The results are analysed to evaluate the prevalence, distribution and factors of mental nerve injuries after open reduction and internal fixation (ORIF) of parasymphysis fractures.

Results Analysis

To assess the incidence and distribution of mental nerve injuries in open reduction and internal fixation of parasymphysis fracture. The results can be based on demographic characteristics, trauma-related factors, surgical variables and postoperative neurosensory assessment.

The demographic analysis shows the distribution of patients by age and gender. Most patients are in the younger adult age group, which is related to the increased incidence of traumatic injuries to the mandible among people who suffered road traffic accidents and other traumatic injuries with high impact. More males than females are affected, as with other injuries to the face.

Trauma-related variables in assessment reveal that road traffic accidents are the most frequent cause of parasymphysis fracture, followed by falls, interpersonal violence and other causes of

trauma. Fracture pattern is different in each patient and bilateral and unilateral parasymphysis fractures were both observed. In many cases fracture displacement is observed, and fractures which are displaced have a higher association with postoperative sensory disturbances.

Surgical analyses demonstrate variations of surgical approach, fixation techniques, types of plates, and screw placement procedures among patients. Parasymphysis fracture fixation is often performed intraorally. The distance from the mental nerve region is evaluated and fixation hardware closer to the nerve pathway shows more sensory changes.

Postoperative neurosensory evaluation detects mental nerve injuries after ORIF of parasymphysis fracture. Patients experience various forms of sensory symptoms such as numbness, tingling sensation, altered sensation, reduced sensitivity and pain in the lower lip and chin area. Transient (temporary) sensory dysfunction occurs more commonly than permanent nerve dysfunction.

Affected patients may experience symptoms for a different period of time. In some patients, there is progressive improvement of sensory function during follow-up, and in others, sensory disturbance lasts longer. The recovery pattern suggests that most nerve injuries improve over time, with a smaller number of patients having ongoing sensory changes.

The associated factors analysis shows that the level of fracture displacement, the severity of the trauma, the surgical manipulation and the fixation-related factors play a role in the incidence of mental nerve injury. The postoperative sensory impairment has a higher risk in more complex fractures, larger displacement.

Demographic Characteristics of Study Participants

Study participants' demographics are assessed to see how the patients are distributed by age and sex. The results indicate that the majority of the patients with parasymphysis fractures, which needed an open reduction and internal fixation, were young and middle-aged adults. This age group has greater exposure to traumatic events

(road traffic accidents and physical injuries) and

the higher incidence of cases reflects this.

Table 4.1: Demographic Characteristics of Study Participants

Variables	Frequency (n=100)	Percentage (%)
Age Group		
18–30 years	45	45%
31–45 years	35	35%
>45 years	20	20%
Gender		
Male	78	78%
Female	22	22%

There are more male patients than female patients in the study population. This is due to the greater participation of males in activities that have a higher risk of facial trauma. Demographic distribution gives an overall picture of the population with parasymphysis fractures and enables evaluation of associations of patient factors with mental nerve injury post-operatively.

Clinical Characteristics of Parasymphysis Fractures

This clinical assessment of parasymphysis fracture shows some differences in fracture patterns, fracture displacement and associated injuries among the participants of the study. The most common presentation is with a traumatic mandibular fracture that involves the displacement or instability of the fracture segments, requiring surgical intervention.

Table 4.2: Clinical Characteristics of Parasymphysis Fractures

Clinical Characteristics	Frequency (n=100)	Percentage (%)
Type of Parasymphysis Fracture		
Unilateral fracture	72	72%
Bilateral fracture	28	28%
Fracture Displacement		
Displaced fracture	68	68%
Non-displaced fracture	32	32%
Associated Mandibular Fracture		
Present	40	40%
Absent	60	60%

Road traffic accidents are the most common cause of parasymphysis fractures followed by falls, interpersonal violence and trauma in general. Unilateral and bilateral parasymphysis fractures

are seen in participants. The involvement of neighbouring anatomic structures, such as the mental nerve area, is related to the degree of fracture displacement.

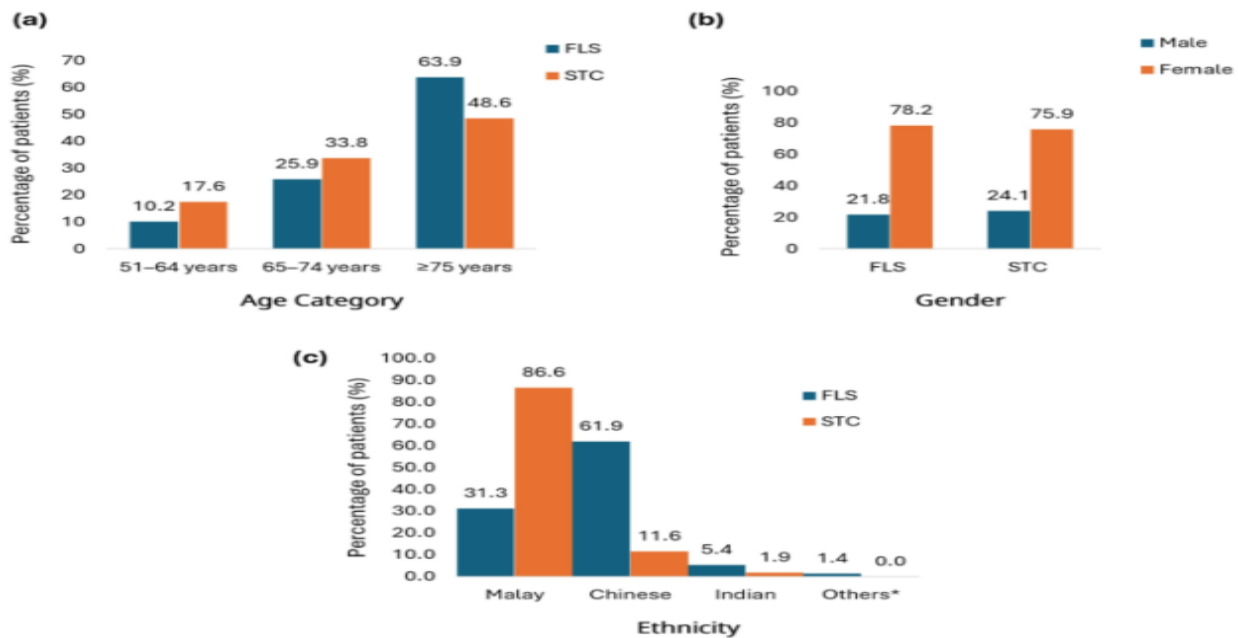


Fig 4.1 Clinical Characteristics of Parasymphysis Fractures

Patients show clinical signs such as pain, swelling, jaw movement impairment, malocclusion, and lower lip and chin area sensation changes. These results suggest possible role of the mental nerve in the initial trauma or surgical intervention.

Frequency of Mental Nerve Injuries After ORIF

Postoperative assessment determines that mental nerve injuries occur after open reduction and internal fixation of parasymphysis fractures. The occurrence of sensory disturbances after surgical treatment is seen in a proportion of patients, suggesting that mental nerve injury is an important complication of ORIF procedures.

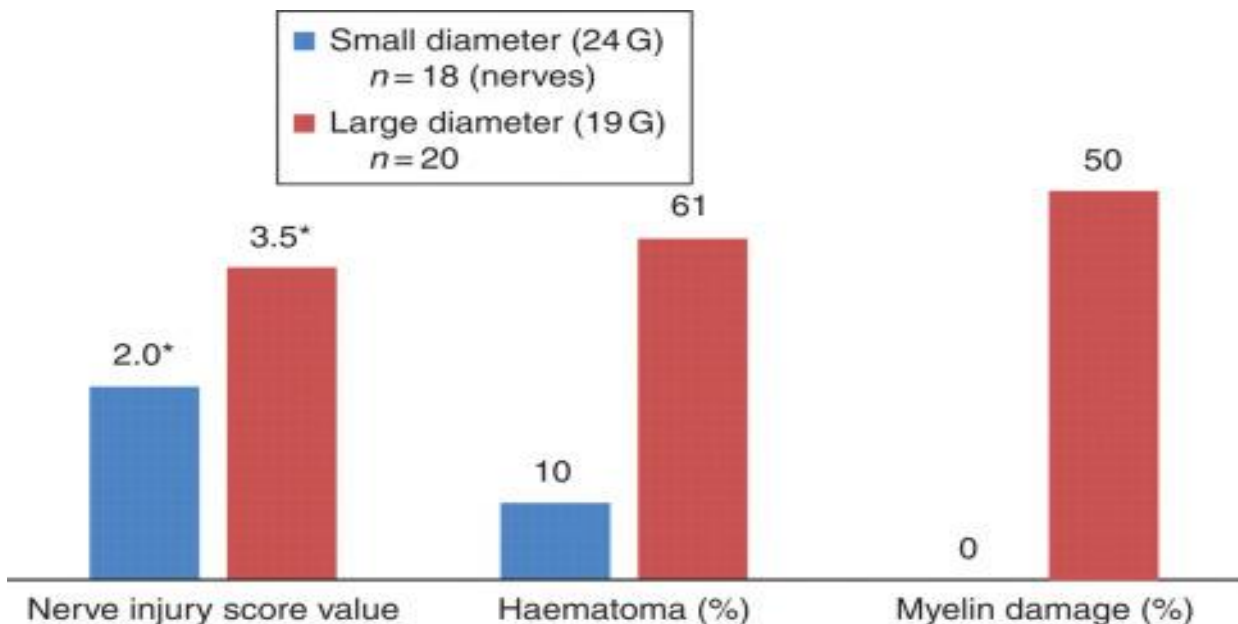


Fig 4.2 Frequency of Mental Nerve Injuries After ORIF

Table 4.3: Cause of Trauma Among Study Participants

Cause of Trauma	Frequency (n=100)	Percentage (%)
Road traffic accidents	55	55%
Fall injuries	20	20%
Interpersonal violence	18	18%
Sports-related injuries	7	7%

The frequency of nerve injury is dependent on fracture type, degree of trauma and surgical factors. Patients with more complex fracture patterns and/or more displaced fractures have a higher risk of postoperative sensory deficits. These results emphasize the need for careful surgical planning and precise fixation methods to

minimize the possibility of nerve-related complications.

Pattern of Mental Nerve Injury Presentation

Mental nerve injuries present differently in each patient that is injured. On postoperative assessment, various patterns of sensory disturbances are recognized, from minimal sensory changes to greater impairment.

Table 4.4: Frequency of Mental Nerve Injuries After ORIF

Mental Nerve Status	Frequency (n=100)	Percentage (%)
Mental nerve injury present	38	38%
No mental nerve injury	62	62%

Numbness

Among the many reported sensory abnormalities in mental nerve injury patients, numbness occurs most frequently. These patients report decreased or loss of sensation in the lower lip and chin areas after surgery for fixation. The degree of numbness also depends on how much the nerves are involved and many patients improve their numbness over follow-up time.

may not be able to detect normal stimulation after surgery.

Pain or Dysesthesia

In a small number of patients, the pain is sensory, involving a burning sensation or discomfort with normal stimulation. Dysesthesia can impact the patient's overall function and satisfaction after fracture treatment.

Tingling Sensation

One of the most common symptoms of nerve dysfunction is a tingling feeling. Patients have unusual feelings like pins or slight electrical sensations in the area. This symptom is common during nerve healing and can reduce with the improvement of sensation.

Complete Sensory Loss

Complete sensory loss is a more serious injury to the mental nerve. Patients affected have marked loss of sensation in the lower lip and under the chin. This kind of injury is less frequent, but can be more prolonged.

Altered Sensation

Altered sensation refers to an abnormal sensation, for example increased or decreased sensation of touch. In certain patients, nerves

Distribution of Mental Nerve Injuries According to Patient Factors

The mental nerve injuries are analyzed according to patient related factors such as age, gender and cause trauma.

Table 4.5: Pattern of Mental Nerve Injury Presentation

Type of Sensory Disturbance	Frequency (n=38)	Percentage (%)
Numbness	18	47.4%
Tingling sensation	8	21.1%
Altered sensation	6	15.8%
Pain or dysesthesia	4	10.5%
Complete sensory loss	2	5.2%
Total	38	100%

Although mental nerve injuries occur in people of all ages, younger adults are more likely to have them, as they are more likely to have suffered traumatic mandibular fractures. The age may affect recovery patterns; younger patients have a better nerve healing potential.

Male patients are more likely to have mental nerve injury than female patients, possibly because there are more men in the study sample and more of them are at a higher risk of high

energy trauma. But, gender does not seem to directly influence the severity of nerve injury.

The incidence of mental nerve injury is dependent on the cause and severity of trauma. High impact trauma patients, such as those suffering from road traffic accidents, are more likely to suffer nerve damage because their fractures are more displaced and will have more soft tissue trauma.

Association Between Surgical Factors and Mental Nerve Injury

Surgical factors are analysed to see if there are potential causes of sensory disturbances following

surgery. The views of the surgical approach, fixation method, placement of plates, and location of screws are evaluated.

Table 4.6: Distribution of Mental Nerve Injuries According to Age

Age Group	Total Patients	Patients with Nerve Injury	Percentage (%)
18–30 years	45	20	44.4%
31–45 years	35	12	34.3%
>45 years	20	6	30%

Sensory disturbances are more common when the fixation hardware is located near the mental foramen or mandibular canal. The placement of

the screws or too much surgical manipulation can cause nerve irritation or injury.

Table 4.7: Distribution of Mental Nerve Injuries According to Gender

Gender	Total Patients	Patients with Nerve Injury	Percentage (%)
Male	78	32	41%
Female	22	6	27.2%

The length and difficulty of the surgery also can have an impact on recovery. Longer procedures with extensive tissue exposure and manipulation may have a higher risk for nerve related complications. To reduce mental nerve injury, the correct surgical procedure and identification of anatomical landmarks is important.

Table 4.8: Distribution of Mental Nerve Injuries According to Cause of Trauma

Cause of Trauma	Total Cases	Nerve Injury Cases	Percentage (%)
Road traffic accidents	55	25	45.4%
Fall injuries	20	7	35%
Interpersonal violence	18	5	27.7%
Sports injuries	7	1	14.2%

Recovery Pattern and Follow-up Findings

Patients with mental nerve lesions recover in different ways, as shown by follow-up assessment. Sensory function will improve slowly in many patients, indicating temporary, not permanent, nerve dysfunction.

Table 4.9: Association Between Surgical Factors and Mental Nerve Injury

Surgical Factor	Total Cases	Nerve Injury Cases	Percentage (%)
Plate positioned near mental foramen	30	18	60%
Standard plate positioning	70	20	28.5%
Improper screw positioning	15	10	66.6%
Proper screw positioning	85	28	32.9%

The recovery is judged by the improvement of numbness, tingling sensation and changed sensitivity. Patients with mild sensory abnormalities have quicker recovery while in severe cases of nerve involvement, the recovery takes more time to recover.

Table 4.10: Recovery Pattern and Follow-up Findings

Recovery Pattern	Frequency (n=38)	Percentage (%)
Complete recovery	20	52.6%
Partial recovery	12	31.6%
Persistent sensory disturbance	6	15.8%

A smaller proportion of patients continue to experience persistent sensory changes during follow-up. The recovery pattern shows that timely diagnosis of nerve injury, ongoing monitoring and correct postoperative treatment are crucial to improve the functional results of ORIF of parasymphyseal fractures.

DISCUSSION

The following is a summary of the major findings. The following are the key findings. The aim of the present study is to assess the incidence and mode of presentation of mental nerve injuries after open reduction and fixation of parasymphyseal fracture. The results showed that mental nerve injury is still a postoperative complication of the treatment of mandibular fractures. Among the patients with sensory disturbances, the study finds variations in the type of sensory disturbances, such as: numbness, tingling sensation, altered

sensation, pain or dysesthesia, and complete sensory loss.

The results revealed that there are demographic, trauma-related and surgical factors that affect the incidence of mental nerve damage. Patients are mostly young and middle aged adults, and the incidence is higher in males because of increased exposure to traumatic injuries. Road traffic accidents have been recognized as the most frequent cause of parasymphyseal fracture and displacement fracture had more association with postoperative sensory complications.

Frequency of Mental Nerve Injuries After ORIF

Although advances have been made in surgical techniques and fixation methods for open reduction and internal fixation of a parasymphyseal fracture, mental nerve injury is still a recognized complication following this

surgery. The occurrence of nerve dysfunction is mainly related to the anatomical proximity of the mental nerve to the fracture site and the surgical field.

This study's rate of mental nerve injury is consistent with previous studies reporting a relatively high incidence of sensory disturbances after the treatment of mandibular fractures. The discrepancy in the incidence of the reported studies could be explained by the differences in the severity of fractures, patient characteristics, surgical procedures, assessment techniques, and follow-up duration.

Comparison with Previous Studies

Results of the present study support previous studies, which have indicated that mental nerve dysfunction is one of the significant complications encountered after surgery for a mandibular fracture. Ellis and Price (2016) highlighted the importance of careful surgical management of mandibular fractures in the anterior region due to the intimate relationship between fracture sites and important neurovascular structures.

Both traumatic and surgical causes of injuries involving inferior alveolar and mental nerves are reported by Bagheri et al. 2017. Their results confirm that anatomical knowledge and correct surgical procedures are crucial in decreasing nerve-related complications.

According to the authors from the study by Scolozzi et al. (2018), fracture displacement and surgical manipulation are important factors for postoperative sensory disturbances. Likewise, Furr et al. (2019) showed that standardized assessment of neurosensory function is crucial in determining the severity and recovery of nerve injuries after fixation of mandibular fractures.

With the results of the present study, Sharma et al. (2020) found that greater fracture complexity and fracture displacement were correlated with greater risk of nerve injury. Al-Moraissi and Ellis (2021) also noted that careful fixation planning and correct surgery is required to prevent complications.

Factors Associated with Mental Nerve Damage

The occurrence of mental nerve injuries after ORIF of parasymphysis fractures is a consequence of several factors. Displacement of fracture segments is regarded as one of the major factors because displaced fracture segments can compress or stretch the nerve directly. If the high energy trauma creates severe displacement, there is an increased risk of nerve involvement.

The surgical procedure is also significant in predicting nerve outcomes after surgery. Over manipulation of soft tissues, failure to correctly identify anatomical landmarks and inappropriate handling of the region of the mental nerve may raise the risk of injury.

The location of plates and screws is an important issue in regard to nerve damage. Fixation screws that are near the mental foramen or the mandibular canal may result in mechanical irritation or injury to the nerve. The proper length of screw and accurate positioning of fixation devices is crucial in order to avoid complications.

The amount of trauma to the nerves and the length of surgery may also affect nerve function. There is more risk of postoperative sensory disturbances with more complex fractures that will need more extensive surgical exposure, as there will be more tissue manipulation and inflammation.

Clinical Implications of Findings

This study's results are of clinical significance for oral and maxillofacial surgery. The patient's comfort and quality of life are greatly influenced by injury of the mental nerve and thus it is imperative to prevent and recognize sensory disturbances early as part of the management of mandibular fractures.

The proper imaging technique performed before surgery will provide the surgeon with information about the fracture line, relationship with the mandibular canal and mental foramen. With care and precision in surgery, handling tissues carefully, and positioning the screws and plates carefully during surgery may help minimize the chances of nerve damage.

The assessment of neurosensory function should be a part of the postoperative follow-up

evaluation. When sensory changes occur early in the recovery process, the clinician can keep an eye on recovery, deliver appropriate counseling, and manage patient expectations for healing of the nerves.

The results also highlight the need to educate patients about the risk for temporary or permanent sensory abnormalities prior to surgery for fixation. Effective communication and follow-up boosts patient satisfaction and treatment outcomes.

Limitations of the Study

There are some restrictions in this study that should be taken into account while drawing conclusions from the study. The findings could not be widely applicable to other populations due to the sample size and/or length of the study. A larger sample with several healthcare centers could yield more detailed data on the prevalence and risk factors of mental nerve injury.

Patient reported symptoms and differences in perception can also affect the evaluation of sensory disturbances. The clinical tests designed to assess the neurologic sensory function are useful, but may be evaluated in different ways so they cannot be compared with other studies.

This study was specifically on fractures of the parasymphysis treated with ORIF, so the results may not be applicable to all mandibular fractures or treatment methods. Further, follow-up may be needed for a long period of time to establish the pattern of full recovery for patients with ongoing sensory disturbances. Despite the above-mentioned limitations, the study offers valuable insights regarding the occurrence, pattern of presentation and aetiology of mental nerve injuries after ORIF of parasymphysis fractures. The results help promote a better understanding of postoperative complications and will help guide the strategies to prevent and manage postoperative complications.

Conclusion And Recommendations

One of the important complications of open reduction and internal fixation of parasymphysis fractures is mental nerve injury. This study shows that mental nerve sensory disturbances can be seen after surgical

treatment of the mandible fracture, because of the close anatomic relation of the mental nerve with the parasymphysis area. A number of factors affect the occurrence of these injuries such as fracture characteristics, trauma severity, surgical technique and fixation related factors.

The study describes various patterns of presentation of mental nerve injury such as numbness, tingling sensation, altered sensation, pain or dysesthesia and complete sensory loss. Of these, the transient sensory disturbances are more frequently reported and many patients have a progressive recovery over time. But in some patients, the sensory impairment can be long-lasting or permanent, so it's important to get careful assessments and monitoring.

The authors state that important factors associated with higher risk of mental nerve damage include fracture displacement, complex trauma and surgical manipulation. To avoid nerve-related complications, the surgeon must be well versed in the anatomy of the mandible, his or her plan must be accurate, and the fixation methods must be appropriate. Clinical neurosensory assessment helps in early diagnosis of mental nerve dysfunction, which facilitates better postoperative management and counselling of the patient. Sensory recovery should be assessed continuously in order to help determine prognosis and optimize functional outcome following ORIF of parasymphysis fractures.

Recommendations for Clinical Practice

Preoperative evaluation of parasymphysis fractures is essential and should be assessed by the proper clinical and radiographic evaluation, in order to identify the relationship between the fracture line and the mental nerve.

The surgeon should know the anatomy and course of mental nerve to minimize the risk of accidental injury in surgical exposure and fixation.

The use of proper surgical techniques and care, such as gentle handling of tissues, identification of anatomical landmarks, accurate placement of plates and screws, and the selection of the appropriate type and size

of screws should be employed to reduce nerve damage.

Neurosensory evaluation should be added as a standard component of postoperative follow up evaluation following ORIF of parasymphysis fractures.

Prior to surgery, patients need to be made aware of the fact that there is a possibility of temporary or permanent sensory disturbances to enhance understanding and expectations after surgery.

Any change in sensation should be detected early and then monitored and managed accordingly to help the nerves heal.

Using standardized assessment methods for mental nerve function to improve the documentation and comparison of mental nerve function outcomes.

Recommendations for Future Research

For more precise estimates of the incidence and the recovery course of mental nerve injuries, larger samples and longer follow-up time is recommended.

To assess variations in surgical approaches, patient demographics and outcomes in various healthcare environments, multicenter studies should be performed.

More study is required to develop a uniform assessment and classification of mental nerve injuries after surgery for mandibular fractures.

Research comparing the various fixation methods and plate designs and approaches to surgery may offer more insight into techniques that are less likely to cause nerve issues.

Future studies will be directed at determining predictive factors related to permanent sensory loss, which will aid in the risk assessment of patients.

Investigating the use of advanced imaging systems and surgical navigation in the management of mental nerve injury reducing in mandibular fracture.

The functional consequences of chronic sensory impairments on patients' quality of life and real-life activities need to be evaluated in long-term studies.

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