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PROSTHODONTIC MANAGEMENT OF PATIENTS WITH TRIGEMINAL NEURALGIA: A NARRATIVE REVIEW

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ABSTRACT:

The element of the human body responsible for coordinating behaviour and sending messages between various bodily parts is the nervous system. The trigeminal (V) nerve, which supplies facial expressions and aids in mastication, swallowing, and breathing, ispart of the extensive sensory and motor nerve network that supplies the orofacial region. Trigeminal nerves' sensory and motor distributions are closely related to each other anatomically and functionally. Before creating a prosthesis for a patient, a complete understanding of these nerves, their lesions, and their therapy is necessary. Neurological lesions or injuries to these nerves impact natural expressions.

Keywords: Denture, Trigeminal Neuralgia,

1. INTRODUCTION

The nervous system is an intricate system of body that empowers an organism to maintain harmony with its environmental factors. In order to force appropriate motor responses to the impulse or tactile responses that have been gathered, stored, and prepared, sensory segments that detect surrounding impulses and motor segments that control glandular secretion, which also supplies control over the heart, skeleton, and smooth muscles, are assembled into a framework.[1]

The maxillary and mandibular divisions of the trigeminal nerve are the primary source of the specific sensory innervation of the buccal cavity. The facial nerve supplies motor innervation

to the muscles of facial appearance, while the mandibular branch of the trigeminal nerve supplies motor innervation to the muscles of mastication. It also supplies sensory information to the front two thirds of the tongue and parasympathetic function to the lacrimal and salivary glands.[2]

Trigeminal neuralgia (TN) is a debilitating neuropathic pain condition affecting the branches of the trigeminal nerve, characterized by excruciating, paroxysmal facial pain episodes.[3] The prevalence of TN is estimated at 12-15 per 100,000 individuals, significantly impacting quality of life and posing a therapeutic challenge.[4]

While pharmacological and surgical interventions remain the primary lines of treatment, the role of prosthodontics in managing TN patients cannot be overlooked. This intricate neural network innervates various facial structures, including the jaw, teeth, and gums, making patients with TN particularly susceptible to challenges during prosthodontic treatment.

Prosthodontists play a crucial role in restoring orofacial function and aesthetics in patients with diverse needs, including those experiencing TN. However, managing this patient population requires a nuanced understanding of the complex interplay between neural pain, prosthodontic interventions, and potential iatrogenic complications. This review aims to comprehensively explore the current understanding of prosthodontic management strategies for TN, analysing their efficacy, limitations, and future directions.

Trigeminal Nerve

It is the fifth and largest cranial nerve that provide sensory innervation to scalp, face, oral and nasal cavities and motor innervation to muscles of mastication.[5] The central component of the trigeminal nerve is within the brain stem. It is comprised of 4 nuclei:[6]

The Spinal trigeminal nucleus,
The Major sensory nucleus,
The Mesencephalic nucleus
The Motor nucleus

The various branches of trigeminal nerve along with innervations have been summarized in Table.[7]

Table: Innervations of branches of Trigeminal Nerve

TRIGEMINAL NERVE BRANCHES	INNERVATIONS
Ophthalmic nerve	Sensory innervation to dura, forehead, iris, ciliary body, sphenoidal, ethmoidal air sinuses and lacrimalgland.
Maxillary nerve	Sensory supply to dura of middle cranial fossa nasal cavity, hard andsoft palate, posterior cheek and maxillary teeth and its periodontium, and skin of nose & upper lip
Mandibular nerve	Motor supply to muscle of mastication mylohyoid and anterior bellyof digastric muscles. Sensory innervation to lower 3rd of face, mandibular teeth and its periodontium, anterior two third of tongue, TMJ, external auditorymeatus and tympanic membrane.

Pathophysiology and Diagnosis of TN

It is essential to comprehend the underlying pathophysiology of TN in order to customize prosthodontic treatment. The majority of instances (classical TN) are caused by vascular compression at the brainstem of the trigeminal nerve root; demyelinating disorders, tumours,

and trauma are other possible causes. To accurately diagnose TN and distinguish it from other face pain syndromes, a thorough history, a clinical examination, and occasionally imaging scans are required.[8]

Clinical significance Trigeminal neuralgia

Rapid onset of repeated unilateral electric shock-like, stabbing, or shooting pain that lasts anywhere from a fraction of a second to two minutes is the hallmark of trigeminal neuralgia (tic douloureux). It mostly affects the trigeminal nerve's maxillary and mandibular divisions, and it has a trigger zone or point that, in response to minor stimuli, causes excruciating agony. Many times, patients endure sporadic intervals without pain, followed by abrupt bouts of discomfort.[9]

Peripheral trigeminal neuropathic pain

Traumatic nerve injury leads to peripheral neuropathic pain. It can be diagnosed by tapping (Tinel's sign) or pressing the suspicious site of nerve injury. Pain can be relieved by applying topical anesthetic agent (benzocaine) followed by nerve block by lidocaine.[10]

Herpes zoster opthalmaticus

It is an infection caused by varicella zoster involving ophthalmic nerve commonly. It manifests as rashes, vesicles, and ocular lesion. The drug of choice is antiviral drugs like acyclovir (800mg/5 times), analgesics and antibiotic ointments.[11]

Mandibular nerve paralysis

Motor dysfunction and atrophy of the muscles supplied by the mandibular nerve are also caused by some central and peripheral lesions of the trigeminal nerve. Due to normal lateral pterygoid muscles on the contralateral side, the jaw deviates towards the ipsilateral side during mouth opening in cases of unilateral paralysis. When there is bilateral paralysis, the mandible will drop.[12]

Prosthodontics difficulty in patients with trigeminal neuralgia

Problems

1. When dentures are being fabricated, trigger zones are activated during the impression-takingprocess, jaw relationship, and occlusion establishment.
2. Older patients with overclosure dentures and those who have worn dentures for a long timewithout correcting ridge resorption also have stimulated trigger zones.

Management

1. Carbamazepine (100mg) is the first drug of choice in trigeminal neuralgic attack during any procedure. Local anesthetic agents in acrylic stent/tray is given for immediate pain relief to the patient.[13]
2. Some studies have shown modification in complete denture fabrication methods such as

a. Temporary complete dentures with sliding plates are fabricated to re-establish the vertical dimension at occlusion and also provide deprogramming of neuromuscular process and jaw closures in physiologic postures.
b. By increasing jaw separation with an acrylic bite plane in lower denture provides flat surfaces against upper denture so that muscles are in normal physiological position. After pain is relieved, new dentures with same jaw relation can be fabricated.
c. Laser therapy increases blood flow, oxygenation and has analgesic effects. It is followed by interocclusal splint to re-establish occlusion and then removable dentures are fabricated with properly mechanical and functional support.[14]

Prosthodontic Considerations for TN Patients:
Prosthodontic interventions for TN focus on minimizing iatrogenic trauma and optimizing oral function while considering the patient's pain sensitivity. Key considerations include:

Material selection: Biocompatible, hypoallergenic materials such as Elastomeric Impression materials are preferred to avoid potential allergic reactions and trigger points. Soft liners may be incorporated into dentures to reduce mucosal irritation and pressure.
Treatment procedures: Minimally invasive techniques and atraumatic anaesthetic administration are crucial to prevent nerve damage and exacerbate pain. Digital workflows and cone-beam computed tomography (CBCT) can optimize diagnosis and treatment planning, minimizing invasive procedures.
Occlusal factors: Establishing a balanced and stable occlusion reduces muscle hyperactivity and potential trigger points that might contribute to pain. Bite splints or occlusal adjustments can be employed to achieve this.
Psychological factors: Chronic pain often manifests with anxiety and depression, impacting treatment adherence and outcomes. A collaborative, empathetic approach from the prosthodontist is essential to address these concerns and optimize treatment success.
Specific Prosthodontic Interventions
Removable dentures: Careful denture design and fabrication ensure proper fit and support, avoiding excessive pressure on sensitive areas. Soft liners, adjustable clasps, and customized borders can further optimize comfort and minimize trigger points.
Fixed prostheses: Minimally invasive techniques like adhesive dentistry or conservative crown preparations are preferred to minimize nerve injury. Implant- supported restorations should be carefully planned to avoid areas of known neural involvement.
Oral appliances: Bite splints can address occlusal imbalances and bruxism, potentially reducing pain associated with muscle hyperactivity. Maxillary occlusal splints have shown promising results in managing TN symptoms.

Management Removable prosthesis
1. In order to preserve nerves passing through the anatomic structure, removable dentures with adequate relief in the incisive papilla, mental foramen should be given.
2. If nerve injuries occur, then commercially available topical application of anaesthetics are used to relieve pain. The most commonly applied medications for neuropathic pain are local topical anaesthetics (lidocaine and benzocaine) and vanilloid compounds (capsaicin).
3. Other compounds such as topical non-steroidal anti-inflammatory drugs, sympathomimetic agents, anticonvulsants, orally administered ketamine can be given in extreme cases.
4. Studies have shown the use of topical application of 0.025% capsaicin gel (desensitizing the ionic channel leading to reduced P substance) placed along with 10% xylocaine or lidocaine on the painful region five times a day for 30 days. The gel was delivered and kept in place with the help of a custom acrylic tray/stent.

Implantology
1. During the placement of implants, there are chances of unfavourable events and so informed consent from the patient has to be obtained beforehand.
2. The use of acceptable preoperative analgesics/anaesthetics/ both, during the operative procedures reduce the risk of postoperative neuropathic pain.
3. CBCT should also be considered, where a 3D anatomical representation will significantly enhance the information of implant osteotomy/bone augmentation sites.
4. It is recommended that a clearance of at least 3 mm of bone should be left from the top of

the mandibular canal, 5mm from mental foramen and 1mm from nasal cavity and maxillary sinus.

5. To prevent nerve injury during implant placement, drill guards are used.
6. If nerve injury occurs due to implant placement either unscrewing of the implant is done or implantology is carried out under antibiotic cover and intravenous sedation.

Efficacy and Limitations of Prosthodontic Management

Although there is evidence that prosthodontic therapies can help patients with TN, the information is still few and frequently anecdotal. Robust methodology-based randomized controlled trials are required to definitively determine the effectiveness of particular therapies. Standardizing methods is further complicated by individual diversity in pain presentation and response to treatment.

Future perspective

Emerging technologies like 3D printing offer potential for patient-specific, biocompatible prostheses further minimizing iatrogenic trauma. Integration of digital workflows and artificial intelligence can optimize diagnosis, treatment planning, and outcome prediction. Collaborative research involving neurologists, pain specialists, and prosthodontists is crucial to develop evidence-based guidelines and refine treatment strategies.[15]

3. CONCLUSION

Trigeminal nerve is the main nerves that provide sensory and motor innervation to most parts of face and rimaoris. There is close functional and anatomical relationship between distribution of cranial nerve V in both their motor and sensory divisions. The knowledge of the anatomy, physiology and distribution of trigeminal nerves is essential to know its location for the fabrication of dentures since many surgical and non-surgical procedures performed by a prosthodontist may have the possibility of causing injury to peripheral branches of the cranial nerve.

Prosthodontic management plays a valuable role in improving the quality of life for TN patients by minimizing iatrogenic trauma, optimizing oral function, and supporting psychological well-being. While current evidence is promising, further research is needed to establish standardized protocols and assess the long-term efficacy of specific interventions. Collaboration between various healthcare professionals and the integration of emerging technologies hold promise for advancing the care of TN patients in the future.

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