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MUSCLES OF MASTICATION-A CLINICAL SCENARIO

**Dilip Sudele¹, Pankaj Singh^{2*}, Mridul Tripathi³, Fatima Begum⁴, Archana Rajput⁵,
Naem Ahmad⁶**

¹BHMS, MSc. Anatomy Integral Institute of Medical Sciences, Lucknow, Uttar Pradesh, India.

²BDS, MSc., Anatomy Integral Institute of Medical Sciences, Lucknow, Uttar Pradesh, India.

³BHMS, MSc., Anatomy Integral Institute of Medical Sciences, Lucknow, Uttar Pradesh, India.

⁴BUMS, MSc., Anatomy Integral Institute of Medical Sciences, Lucknow, Uttar Pradesh, India.

⁵BDS, Babu Banarasi Das-Cods, Lucknow, Uttar Pradesh, India.

⁶Senior Lecturer, Department of Prosthodontics, CPGIDS, Lucknow, Uttar Pradesh, India.

ABSTRACT

Although many muscles in head and neck are involved in mastication, the term “Muscles of Mastication” is usually reserved for the four pairs of muscles (Masseter, Temporalis, Lateral and Medial Pterygoid) that are primarily responsible for moving the mandible during the communication and processing of food before swallowing. Accessory muscles include Buccinator, Digastric, Mylohyoid, and Geniohyoid. Masseter and Temporalis lie relatively superficial in the face. The pterygoid muscles are situated deep to the ramus of the mandible.

Key words: Masseter, Pterygoids, Temporalis.

INTRODUCTION

Cutting the food substances into small particle and grinding them into a soft bolus is called Mastication. Mastication or chewing is the 1st mechanical process to which food is subjected. This process helps in breakdown of food stuff into small particles, mixing of saliva with food substances thoroughly, lubrication and moistening of dry food by saliva so that the bolus formed can be easily swallowed & appreciation of taste of food [1].

Nervous control of mastication

Mostly a reflex process, it can be carried out voluntarily also. Centre of mastication – situated in medulla and cerebral cortex. All four muscles of mastication develop from mesenchyme of 1st branchial arch. They therefore derive their innervation from the Mandibular branch of the Trigeminal nerve. Movements of mandible can be classified as Masticatory & non-masticatory.

The masticatory movements are necessary for the introduction, grasping, crushing & grinding as well as the swallowing of the triturated mass. The non-masticatory movements include all of the other normal mandibular movements, such as those used in speech & wetting the

lips & also habitual or abnormal movements such as bruxism, clenching or tapping the teeth together.-It is important to note that the time spent each day for non-

masticatory movements exceeds the time used for masticatory movements. In the mastication of food the . movements are closest to “hinge-like” during opening & closing the mouth for introduction of food & to a lesser degree for the crushing the certain type of food. Protrusive movements are used in grasping & incision of food while Rt. & Lt. Lateral excursion are used for reduction of fibrous as well as other types of bulky food. A combination of all these movements appears to be the most effective in trituration of food [2].

MASSETER MUSCLE

Innervation: By Masseteric nerve – from ant. Division of mandibular nerve.

Vasculature: arterial supply – Superficial Temporal (Transverse Facial branch), maxillary (masseteric branch) and Facial arteries.

Actions: Elevates the mandible to close mouth and Clenches teeth. Small effect in side-to-side movements & protraction and retraction [3].

Corresponding Author :- **Pankaj Singh** Email:- pankiyadav707@gmail.com

TEMPORALIS MUSCLE

Extends like a fan.

Origin: Temporal fossa (excluding zygomatic bone) and Deep surface of temporal fascia.

Insertion: Fibres converge and descend into a tendon that passes between Zygomatic arch and cranial wall and inserted into margins and deep surface of coronoid process & anterior border of ramus. Ant. Fibres descend vertically, post.-oblique, most post- horizontal

Innervation: Deep Temporal branch from anterior division of Mandibular nerve.

Vasculature: Superficial Temporal artery (Middle Temp.br.). Maxillary artery (Deep Temp.br.)

Actions: Ant. Fibres (vertical) – elevates mandible, post. Fibres (horizontal) – retract mandible. The muscle is also concerned in lateral grinding movements.

LATERAL PTERYGOID MUSCLE

Innervation: br. from Ant.division of Mandibular nerve.

Vasculature: Maxillary artery (Pterygoid branch)

Actions: assist in opening the jaws by protracting the condyle & articular disc of TMJ while Mandibular head rotates on disc

Acting together - involved in protrusion & depress chin.

Acting alone & alternately- lateral movements of mandible.

MEDIAL PTERYGOID MUSCLE

thick quadrilateral muscle (deepest). It consists of 2 heads superficial – small & Deep – large, forms bulk of muscle.

Origin: Superficial head: – from maxillary tuberosity & Adjoining bone. The Deep head: – from medial surface of lateral Pterygoid plate & adjoining part of Palatine bone.

Insertion: descends postero-laterally to medial surface of ramus & angle as far as Mandibular Foramen & almost to Mylohyoid groove.

Innervation: nerve to Medial Pterygoid, a branch of main trunk of Mandibular nerve.

Vasculature: Maxillary artery.

Actions: assist in elevating mandible, closing jaws.

Acting together - protrude mandible

Acting alone – protrudes sides of jaws

Acting alternately - grinding motion

Accessory muscles include Buccinator, Digastric, Mylohyoid and Geniohyoid [4].

BUCCINATOR MUSCLE

Important muscle of cheek. Name derived from Latin word meaning “Trumpeter”. Consists of a flat, thin, but strong set of fibres in contact with mucous membrane of oral vestibule. Functions principally during mastication. An imp. Relationship is with parotid duct. This pierces the muscle opposite mx. 3rd molar & then runs forward to open into oral cavity opposite mx. 2nd molar.

Innervation: Buccal br. of Facial nerve

Vasculature: Buccal br. of Facial & Maxillary artery.

Actions: main function is to aid in mastication by maintaining Bolus of food between molar teeth. Involved in sucking & in expelling air forcibly. (In whistling or playing a wind instrument).

DIGASTRIC MUSCLE

So called because it has 2 bellies- united by an intermediate tendon.

Origin: Ant. Belly- Digastric fossa of mandible. (develop from 1st branchial arch)

Post. Belly- Mastoid notch of temporal bone. (develop from 2nd branchial arch)

Insertion: Anterior Belly runs downwards & backwards & Post. Belly runs downwards & forwards to meet at intermediate tendon. The tendon is held by a fibrous pulley attached to hyoid bone. The tendon of Digastric passes between 2 slips of tendon of Stylohyoid muscle.

Innervation: Ant. Belly – Mylohyoid nerve & Post. Belly – Facial nerve

Actions: Accessory muscle of mastication. Parts acting together depress the chin & assist in opening mouth when hyoid bone is fixed by Infrahyoid group of muscle. Elevate the hyoid bone when mandible is fixed in position by primary muscles of mastication as during swallowing [5].

GENIOHYOID MUSCLE

Short & narrow muscle which lies above the medial part of the mylohyoid.

Origin: from Genial tubercle of mandible.

Insertion: Fibres runs backwards & downwards to be inserted into anterior surface of body of Hyoid bone.

Innervation: 1st & 2nd cervical nerve through a branch of Hypoglossal nerve.

Actions: It draws hyoid bone forwards & upward. When acting from assist in opening the mouth. A fixed hyoid

MYLOHYOID MUSCLE

Flat, triangular muscle lying deep to Ant. Belly of Digastric. Rt. & Lt. Mylohyoid muscles together form the floor of mouth or diaphragm.

Origin: Mylohyoid line of mandible.

Insertion: Fibres run medially & slightly downwards. Post. Fibres inserted into body of hyoid bone. Middle & ant. Fibres inserted into a median raphe that unites Rt. & Lt. Muscles.

Innervation: Mylohyoid bone.

Actions: helps in depression of mandible & in elevation of Hyoid bone. Elevates floor of mouth during 1st stage of Deglutition.

Mandibular movements during normal function & during parafunction (bruxism) involve a complex neuromuscular pattern originating from higher centers (cerebral cortex & basal ganglion) & from peripheral influences (periodontium & muscle). The muscle activity as seen in the E.M.G. for jaw opening, closing. Protrusion, retrusion & lateral movements are:

Mandibular Opening (Depression)

Digastric, mylohyoid & geniohyoid are active during jaw opening. No activity of Temporalis & Masseter. Some activity of Medial pterygoid, Lateral pterygoid shows initial & sustained activity [6].

Mandibular Closing (Elevation)

Elevation without contact or resistance is brought about by contraction of the masseter & medial pterygoid. Elevation against resistance is affected by temporalis, masseter & medial pterygoid. Closure to maximum intercuspation i.e. centric occlusion may involve contraction of facial & neck muscles.

Retraction

Voluntary retrusion with mouth closed is brought about by contraction of posterior fibers of temporalis & by inframandibular muscles. Retraction of mandible from protrusion without occlusal contacts by contraction of post. & middle fibers of temporalis muscle. Slight suprahyoid muscle is seen to allow the teeth to glide from centric occlusion to centric relation [7].

Protrusion

Protrusion without occlusal contacts is brought about by contraction of lateral pterygoid & medial pterygoid with masseter & against resistance is by lateral pterygoid, medial pterygoid & suprahyoid muscles. Protrusion with teeth in occlusion is by medial pterygoid, lat. Pterygoid & masseter. Protrusion along with jaw opening all the muscles of mastication are involved.

Lateral movements

Both lateral pterygoid muscles initiates depression & contralateral lateral pterygoid muscles initiates the lateral transversion. Movement of mandible with or without occlusal contact & with or without resistance is brought about by ipsilateral contraction of post. Fibers of temporalis & contralateral contraction of medial pterygoid & masseter.

Chewing: chewing is highly complex & oral motor behaviours usually seen in the frontal plane is simplest form.

PALPATION OF MUSCLES OF MASTICATION**Extra oral approach**

Masseter- palpated by placing finger over the lateral surfaces of the ramus of Mandible.

Temporalis - palpated by placing finger over the patient's temples.

Intraoral approach

Medial pterygoid- Index finger is used to touch the medial pterygoid muscle on the inner surfaces of the ramus.

Lateral pterygoid: Little finger is inserted facial to the maxillary teeth & around distal to the hamular notch to palpate the muscle.

The patient may demonstrate limited opening due to spasm of the masseter &/or temporalis muscle. This can be noted by asking the patient to open wide. If it appears that the opening is limited, ask the patient to use finger to indicate the area that hurts. The patient touches a muscle area as opposed to TMJ. There is probably some dysfunction of the neuromuscular system. MPDS & Lock-jaw – evidence of pain or dysfunction in either the TMJ or the muscles of mastication is an indication for further evaluation prior to starting any Prosthodontic procedure & all prosthetic treatments are post-poned until full evaluation & treatment is given to the basic problem [8].

Atrophy of masticatory muscles

It is essential that the oral function in denture wearers be maintained throughout the life. The maximum bite force tends to decrease with age. Muscle tone decreases as much as 20-25% in old age. Furthermore E.M.G. analysis showed that masseter & medial pterygoid muscles have greater atrophy in C.D. wearers, particularly in women. This indicates that reduced bite force & chewing efficiency are sequelae of wearing C.D. resulting in impaired masticatory function. The preventive measure & management includes retention of small no. of teeth if possible in denture i.e. planning over denture or magnetic denture or use of implants in complete denture.

In the pterygomandibular space the medial pterygoid muscle forms space the medial wall & the roof is formed by the lateral pterygoid, during inferior alveolar nerve injection in this space one should avoid injuring the medial pterygoid. Otherwise there may be trismus & jaw opening may be restricted. The Para functional habit of clenching the muscles of mastication causes bruxism. It can be diagnosed in a patient by noting wear facets on teeth, fractured restorations soreness of the masticatory muscles when the patient wakes up early in the morning.

Masticatory Muscle Dysfunction

This is the subdivision of TM disorders. It is associated with limitation of normal Mandibular movements due to muscle pain & stiffness. Masticatory muscle dysfunctions usually develop without a history of significant injury. Quite often the onset of symptoms is associated with an increase in bruxism or clenching due to personal stress & anxiety. Patients frequently refer to increased job tension, marital difficulty or other stressful life events.

COMMON DISORDERS OF MASTICATORY MUSCLES**Myalgia**

Described as a dull aching continuous pain, increasing with function. The muscles are sensitive to palpation & often, but not always, the jaw has a painful restriction of movement, a mild tremor, & inco-ordination with attempted movement.

Myalgia usually results from hyperactivity such as bruxism or clenching, but may occur secondary to arthritis or an internal derangement.

Muscle Splinting or Trismus

It is restriction of jaw movement due to an abnormal excitation & inhibition of muscle activity with attempted opening movements. Acute myalgia is always present when a splinting trismus problem exists. Jaw tremor & in coordination of movement usually occur when movement is attempted. The etiology is considered to be a protective response to local injury, or secondary to a myalgia, myositis, arthritis, or an internal derangement. It is usually self-limiting when the etiology is no longer present. Abnormal muscle function is not evident when the jaw is in rest posture.

Muscle Spasm

Is an involuntary continuous contraction of the muscle with continuous activity even at rest. True jaw muscle spasm is rare. It may occur secondary to local injury or from CNS hyperactivity.

Myositis

Is an inflammatory non-infectious condition. The muscles typically have pain (myalgia). Swelling is thought

to be secondary to severe spasm or prolonged trismus. This condition is often associated with protracted myalgia.

Dyskinesia

Is clinically evident in coordination of movement, tremor, or both. It occurs with myalgia but may be seen without any pain at all. The cause varies from a severe neurological dysfunction to a single pain associated with loss of proprioceptive ability of the jaw muscles.

Muscle Contracture

Is a progressive painless shortening of muscles due to presumed fibrotic adhesion or scars in the muscle fascia or muscle body. It is commonly associated with significant muscle enlargement or hypertrophy but can also occur with a chronic ankylosis.

Muscle hypertrophy

Can occur in association with severe bruxism habit or for unknown (idiopathic) reasons. The enlargement (hypertrophy) of normal muscle tissue is usually benign. It is self-limiting & may occur unilaterally or bilaterally. It is usually not painful but almost always produces an associated contracture or loss of muscle length.

Table 1. A quadrilateral muscle, which covers the lateral surface of ramus of mandible. It consists of three overlapping layers, Superficial, Middle, Deep

	Superficial	Middle	Deep
<i>Origin</i>	Ant. 2/3 of lower border of zygomatic arch and from zygomatic process of maxilla	Ant. 2/3 of deep surface and post. 1/3 of lower border of zygomatic arch	Deep surface of zygomatic arch
<i>Insertion</i>	Angle of mandible and lower post. Half of lateral surface of ramus of mandible	Middle part of ramus	Upper part of ramus and into coronoid process

Table 2. Lateral Pterygoid Muscle, Short thick muscle with 2 heads

	Origin	Insertion
Superior head	Infratemporal surface & crest of greater wing of sphenoid	Capsule & articular disc of TMJ
Inferior head	Lateral surface of lateral pterygoid plate	Pterygoid fovea

Table 3. Buccinator Muscle Origin

	Origin	Insertion
Upper fibres	From maxilla opposite molar teeth	Straight to upper lip
Middle fibres	From pterygomandibular raphe	Decussate before passing to lips
Lower fibres	From mandible opposite molar teeth	Straight to lower lip

Table 4. Mandibular Movements Caused By Muscles of Mastication

Muscles	Mandibular Movements
Masseter	Elevation of mandible (during jaw closing)
Temporalis	Elevation of mandible (during jaw closing) Retraction of mandible (lower jaw backward)
Medial pterygoid	Elevation of mandible (during jaw closing)
Lateral pterygoid	Inferior heads: slight depression of mandible (during jaw opening) One muscle: lateral deviation of mandible (shift lower jaw to opposite) Both muscles: Protrusion of mandible (lower jaw forward)

CONCLUSION

Although many muscles in head and neck are involved in mastication, the term “Muscles of Mastication” is usually reserved for the four pairs of muscles (Masseter, Temporalis, Lateral and Medial Pterygoid) that are primarily responsible for moving the mandible during the

communication and processing of food before swallowing. Accessory muscles include Buccinator, Digastric, Mylohyoid, and Geniohyoid. A clinician must reaffirm the importance of physiology of muscles of mastication and consider the practical application of this physiological concept to dental practice.

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