

## REVIEW ARTICLE

# Trismus

<sup>1</sup>G Poornima, <sup>2</sup>C Poornima**ABSTRACT**

Trismus or jaw hypomobility refers to a sustained, tonic spasm of the masticatory muscles. There are various causes for this common symptom where the patient seeks medical intervention immediately, as it impairs speech and eating; causes social injunction leading to fear, anxiety and anger. Successful treatment of trismus depends on prompt recognition of its cause and immediate initiation of appropriate treatment. A thorough knowledge of this hypomobility is essential for successful treatment and to avoid permanent functional disability. This article gives an insight into etiology, differential diagnosis and treatment of trismus.

**Keywords:** Jaw hypomobility, Masticatory muscles, Spasm, Trismus.

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**INTRODUCTION**

Trismus refers to a sustained, tonic spasm of the masticatory muscles, particularly the masseter and temporalis, which results in forced jaw closure.<sup>1</sup> The word trismus is derived from the greek 'trismos' meaning gnashing and is defined as 'a prolonged, tetanic spasm of the jaw muscles by which normal opening of the mouth is restricted (lock jaw)'.<sup>2,3</sup> Trismus is a common problem that most people experience at least once in lifetime and dental practitioners need to tackle this efficiently.

The normal range of mouth opening varies in individuals within a range of 40 to 60 mm, although some authors place the lower limit at 35 mm.<sup>4</sup>

The width of the index finger at the nail bed is between 17 and 19 mm. Thus, two fingers 'breadth (40 mm) up to three fingers breadths (54–57 mm) is the usual width of opening. In general, males display greater mouth opening than females. Lateral movement is 8 to 12 mm.<sup>5</sup>

Mouth opening is dependent on the coordinated function of an intact sensory and motor neural activity and also a normal muscular and temporomandibular joint apparatus. Knowledge of the anatomy of the muscles of mastication and movements of temporomandibular joint aids in the understanding of trismus. The muscles primarily responsible for closing the mouth are the temporalis, masseter and medial pterygoid. The lateral pterygoid inserts into the articular disc as well as the neck of the condyle and, therefore, is primarily responsible for opening the jaw and for coordination of the disk-condyle relationship during function. Opening is assisted by the mylohyoid, anterior belly of digastric, geniohyoid and infrahyoid muscles and possibly the posterior belly of digastric. All the muscles of mastication have motor and afferent sensory supply from mandibular division of the 5th cranial nerve except infrahyoid muscles being supplied by branches of the ansacervicalis. The muscles of closure are approximately 10 times more powerful than the opening muscles.<sup>2</sup>

Trismus has a number of potential causes which are single and ranges from simple to complex.<sup>6</sup> Trismus could give rise to many constraints including social injunctions that can cause anxiety and anger.<sup>7</sup> This condition impairs eating, interferes with oral hygiene, restricts access for dental procedures, and also may adversely affect speech and facial appearance.<sup>7</sup>

The causes of trismus are congenital disorders, infections, trauma, iatrogenic, neoplasia, radiotherapy, temporomandibular disorders, drugs, psychogenic, oral submucous fibrosis and miscellaneous causes.

**CONGENITAL DISORDERS****Trismus Pseudocamptodactyly Syndrome**

This is an inherited autosomal dominant condition. The most significant features are trismus with a mouth opening between 3 and 8 mm; hand deformities with a shortening of the profundus muscle-tendon unit and to a lesser extent the sublimis unit, foot deformities, including quinovarus, metatarsus varus and hammer toes; and shortening of gastocnemius and hamstring muscles. This syndrome also manifests with prognathism, blepharochalasis, quilted appearance of the cheeks, ptosis and micrognathia.<sup>2</sup>

<sup>1,2</sup>Reader

<sup>1,2</sup>Department of Oral Medicine and Radiology, Rajarajeswari Dental College and Hospital, Bengaluru, Karnataka, India

**Corresponding Author:** G Poornima, Reader, Department of Oral Medicine and Radiology, Rajarajeswari Dental College and Hospital, Bengaluru-560074, Karnataka, India, Phone: 9449747494, e-mail: drpoornimag@gmail.com

## Arthrogryposismultiplex Congenital

Arthrogryposismultiplex congenital (AMC) is a rare congenital disorder characterized by multiple fixed joint deformities. Arthrogryposismultiplex congenital is defined as a congenital nonprogressive limitation of movement in two or more joints in different body areas. The features of this include micrognathia, limited jaw opening, high vault palate, cleft palate and weakness of masticatory muscles.<sup>2</sup>

Hypertrophy of the coronoid process causes interference of the coronoid against the anteromedial margin of the zygomatic arch causing trismus.<sup>8</sup>

## INFECTIONS

### Tetanus

Tetanus is an infectious disease that results from wound contamination with clostridium tetani, an anerobic Gram-positive motile, spore forming rod that is ubiquitous in nature. Once the organism is introduced into a wound, it produces two exotoxins tetanospasm and tetanolysin. Tetanospasm is a neurotoxin that is responsible for all the clinical symptoms of tetanus. It acts by interfering with the release of acetylcholine. Inhibitory neuromuscular influences of the central nervous system are reduced allowing simultaneous contraction of agonist and antagonist muscles. This action gives rise to muscle stiffness and rigidity.<sup>9</sup>

Trismus is the commonest presenting symptom.<sup>10</sup> Dysphagia, pain and stiffness of the neck, marked increase in the tone of the central muscles (face, neck, chest, back and abdomen) with superimposed generalized spasms and relative spacing of the hands and feet strongly suggests tetanus. Sustained contractions of the facial musculature causes 'risussardonicus' the so called 'sneering grin' expression. Rigidity progresses in a descending manner, with the short cranial nerves being affected first. With severe trismus, there is opisthotonus caused by generalized spasm and resulting in the flexion of arms, extension of the legs and rigidity of the abdominal wall followed by rigidity of trunk and limbs. The spatula test is a simple bedside test to diagnose tetanus. The posterior pharyngeal wall is touched with spatula and reflex spasm of the masseter occurs (positive) instead of the normal gag reflex (negative).<sup>9,10</sup>

### Peritonsillar Abscess

It is the most common deep infection of the head and neck that occurs in adults and is typically caused by a combination of aerobic and anerobic bacteria. Fever, throat pain and trismus are the presenting symptoms. Trismus is mainly because of inflammation of the pharyngomaxillary space and pterygoid muscle. A distinguishing

feature of this abscess is the inferior medial displacement of the infected tonsil with a contralateral deviation of the uvula. In addition, many patients will have a thickened, muffled voice often described as having a 'hot potato' quality. The collection of pus from the abscess through needle aspiration is the gold standard for diagnosis.<sup>11</sup>

## ODONTOGENIC INFECTION

Infection of the masticatory space occurs most frequently from odontogenic infection of molars. Clinically, the hallmark of masticator space infection is trismus. Abscess involving the spaces surrounding the muscles of mastication are a common source of trismus.<sup>12</sup> Trismus associated with facial cellulitis usually indicates an infection of dental origin, however, occasionally other sources, such as acute parotitis, acute temporomandibular arthritis or otitis externa may be the initial site of infection. There is often a previous history of toothache, recent restoration, endodontic therapy, recent extraction or recurrent bouts of pericoronitis and dysphagia is often an associated factor. Clinical examination may reveal swelling, redness, pain and trismus.<sup>2</sup>

### Trauma

Fractures involving the mandible usually give rise to trismus because of protection of the injured part by the patient. With adequate local or general anesthesia most of this trismus will disappear. Occasionally, a fracture dislocation of the condylar head can result in a mechanical obstruction and limited jaw function. Fractures of the zygomaticomaxillary complex can cause trismus by a direct impingement of the complex on the coronoid process of the mandible.<sup>13</sup>

Trismus has also been reported due to the accidental incorporation of foreign bodies because of external traumatic injury.<sup>14</sup>

### Iatrogenic

Trismus following injections of a local anesthetic solution is common that occurs 2 to 5 days after inferior alveolar nerve block and posterior maxillary infiltration. This is usually attributed to inaccurate positioning of the needle when giving the block. Occasionally, the medial pterygoid muscle is accidentally penetrated or a vessel is punctured followed by hematoma and fibrosis which leads to trismus.<sup>15</sup> Good injection technique by penetrating lateral to pterygomandibular raphe avoiding the medial pterygoid muscle will prevent trismus.<sup>16</sup>

Trismus, pain and swelling are also seen after the surgical extraction of third molars. Cyclo-oxygenase and prostaglandins play a crucial role in the development of postoperative pain and swelling.<sup>17,18</sup>

Trismus can occur subsequent to trauma or following prolonged and extreme stretching of the masticatory musculature during surgery or following a period of maxillomandibular fixation.<sup>6</sup>

### Neoplasia

Trismus is a well known complication of head and neck oncology.<sup>19,20</sup> All malignant tumors involving the jaws, muscles of mastication and associated structures can cause limitation of mandibular movement.<sup>2</sup> A tumor of the buccal mucosa or cancer of the anterior floor of the mouth may not lead to trismus at all, whereas a tumor of the retromolar region may have a high risk for inducing trismus.<sup>20</sup>

In about 5% of patients suffering from a tumor of the nasopharynx, trismus may be the first sign. Trismus may be induced by the surgical treatment or radiotherapy in about 8% of patients with malignant tumors of the head and neck.<sup>21</sup> Primary tumors or neoplastic diseases occurring in many parts of the body could metastasize to the epipharyngeal region, parotid gland, jaws or temporomandibular joint whose clinical sign may be trismus.<sup>22</sup>

### Radiotherapy

Trismus may be a significant side effect of radiotherapy especially in combination with muscular tumor invasion and surgery. The most decisive factor whether trismus develops or not is probably the inclusion of the medial pterygoid muscles in the treatment portals.<sup>23</sup>

Osteoradionecrosis may occur due to radiotherapy resulting in pain, trismus, suppuration and occasionally a foul smelling wound. When the muscles of mastication are within field of radiation, fibrosis may result and lead to trismus reducing the range of movement. Fibrosis and trismus have been attributed to the ischemia caused by endarteritis obliterans.<sup>5</sup>

Trismus may also complicate post radiation dental care; the patients at risk of trismus should be put on home exercises to maintain maximum opening and jaw mobility as soon as radiotherapy begins. Tongue blades or rubber tops are used in these exercises to increase the size of mandibular opening.<sup>23</sup> Hyperbaric oxygen is used to increase neovascularization along with protective stents and exercises will minimize the effects of radiation on the facial and masticatory muscles.<sup>5</sup>

### TEMPOROMANDIBULAR JOINT DISORDERS

Temporomandibular joint (TMJ) disorders may be either intra articular or extra articular. Intra articular etiologies include fibrous ankylosis, anchored disk phenomenon, bilateral anterior disc displacement without reduction.

Fibrous ankylosis is most often caused by trauma which could produce intracapsular injury leading to hematoma formation and/or severe inflammation with scarring. This may lead to painless severe trismus. Magnetic resonance imaging and TMJ arthroscopy can be used to confirm fibrous ankylosis.<sup>24</sup>

Anchored disk phenomenon is one of the proposed etiologic factors of severe and persistent closed lock of the TMJ. The main purported functional disturbance in this phenomenon is inability of the disk to translate secondary to the formation of adhesions or a 'suction cup effect' because the condylar head is still able to translate, the maximum mouth opening which is usually between 15 and 20 mm.<sup>25</sup>

Anterior disk displacement without reduction is typically preceded by a history of clicking and intermittent locking. This usually results in trismus followed by gradual improvement of jaw mobility as the posterior discal tissue is stretched.

Extra articular etiologies include infection, foreign body reaction and musculoskeletal injury.<sup>24</sup>

### Drugs

Some drugs are capable of causing trismus as a secondary effect, succinylcholine, phenothiazines and tricyclic antidepressants being the most common. Trismus can be seen as an extrapyramidal side effect of metaclopramide, phenothiazines and other medications.<sup>5</sup> Strychnine poisoning is a possible cause of trismus. It acts mainly on the central nervous system, where it facilitates the transmission through the synapses indiscriminately.<sup>2</sup>

### Psychogenic

Hysteria is a cause of trismus. The presentations are varied and include paralysis, blindness, anesthesia, anorexia and vomiting. In fact, this condition may mimic practically any disease.<sup>26</sup> The diagnosis of this condition is by the exclusion of other forms of trismus followed by psychiatric assessment. Most patients with hysterical trismus can open their mouth under intravenous sedation or general anesthesia; however, long standing trismus can result in fibrosis. A further useful test in the diagnosis of hysterical trismus is electromyography. In these cases, there is little or no activity of inframandibular muscles when the patient tries to open the mouth but there is increased activity of the jaw closing muscles. This pattern of muscular activity is similar to normal biting patterns as opposed to cases of physical trismus where there should be increased activity of the inframandibular muscles.<sup>2</sup>

## Miscellaneous

Trismus has also been described in association with multiple sclerosis, pseudobulbar palsy and lupus erythematoses.<sup>1,5,27</sup>

## Consequences of Trismus

Limited mouth opening may result in the following:

- Reduced nutrition causing weight loss and nutritional deficits.
- Compromised air way clearance because of compromised mastication, poor bolus organization and increased residue leading to aspiration of part or all of the bolus.
- Compromised oral hygiene leading to dental caries and infection. Infection of mandible may get complicated leading to osteomyelitis.
- Difficulty in speech and swallowing.
- Degenerative changes in the TMJ may occur because of joint immobilization (disuse atrophy).<sup>28</sup>

## MANAGEMENT

While causes are many that can bring about trismus, it does not necessarily follow that all trismus patients require the same treatment. Therapy should not be started until a differential diagnosis has been made and the cause of the trismus is clearly understood.

When a patient reports mild pain dysfunction, difficulty in opening the jaw, the initial phase of muscle spasm can be treated by the following methods:

### Heat Therapy

It consists of placing moist hot towels on the affected area for 15 to 20 minutes every hour. Heat increases the extensibility of collagen tissue decreases joint stiffness, relieves pain and muscle spasm, increases blood flow and helps to resolve inflammatory infiltrate and edema.<sup>6</sup>

### Medical Management

Aspirin is usually adequate in managing the pain associated with trismus. A narcotic analgesics may be required if the pain is more intense along with muscle relaxants. Diazepam (2.5 to 5 mg three times daily) or other benzodiazepine may be prescribed for muscle relaxation.<sup>5</sup> If the trismus is suspected to be associated with the infection, appropriate antibiotics should be prescribed. One of the latest treatment modalities for trismus is the use of botulinum treatment injections. Its site of action is predominantly the synaptic terminal of the cholinergic lower motor neuron. This toxin causes flaccid paralysis due to neuroexocytosis block, i.e. acetylcholine

release, specifically at the lower motor neuron terminal presynaptically. The dose recommended is 25 IU injected into each masseter muscle and 10 IU into the temporalis muscle. The onset of action is somewhat delayed, hence it is desirable to start the therapy early.<sup>29</sup>

### Physiotherapy

When the acute phase is over, the patient should be advised to initiate physiotherapy for opening and closing the jaws and to perform lateral excursions of the mandible for 5 minutes every 3 to 4 hours. Soft diet is advised if necessary.

### Surgery

Cases involving intracapsular (TMJ) pathosis, bony interferences from styloid or coronoid processes, the presence of a foreign body or restrictive maxillomandibular bands of dense scar tissue may require surgical intervention while cases of muscle fibrosis or relatively immature scar tissue may not. Treatment should be directed toward the cause or etiology.

### Trismus Appliances

Various types of appliances have been described for treating trismus. Ideally, they are used in combination with physical therapies mentioned above. According to their design, they act either externally or internally.

#### *Externally Activated Appliances*

These appliances employ some mechanical means of forces stretching the elevator muscles by depressing the mandible. They impart forces that can be continuous or intermittent, light or heavy and elastic or inelastic. Such appliances include the following:

- Dynamic bite opener—this provides continuous elastic force to depress the mandible, thereby the amount and direction of the force can be controlled.
- Threaded tapered screw—this appliance is constructed of acrylic resin and is placed by the patient between the posterior teeth. With gradual turns of screw, the mandible is depressed and both maxillary and mandibular teeth are forced apart.
- Screw type mouth gag—it employs a screw type component similar to the type incorporated into orthodontic palatal expansion appliances. It provides a continuous unilateral and inelastic force.
- Fingers—patient should use the fingers to depress the mandible, stretch the musculature to the maximum, and then maintain the position for a slow count of 10. This exercise is repeated by patient throughout the day.

- Tongue blades—tongue blades have been used as a wedge or as a mouth prop to sustain maximal opening.
- Continuous dynamic jaw extension apparatus—this appliance consists of a contra rotating extending screw attached to the maxillary and mandibular arches by two resilient stainless steel wire arms that are connected to acrylic resin splints. The apparatus distributes the forces generated by the screw over the entire dental arch covered by the splints. The force provided is continuous, bilateral and elastic.

### *Internally Activated Appliances*

These appliances rely on the patient's depressor muscles to stretch the elevator muscles, since the elevator muscles can generate forces that are 10 times greater than those generated by the depressor muscles. The amount of force delivered depends on the strength and motivation of the patient, as do the frequency and duration of stretching.

- Tongue blades—tongue blades can be employed so that the force delivered is imparted by the depressor muscle alone and thus the tongue blade are not used as a wedge.
- Plastic tapered cylinder—it is a simple carrot shaped appliance which allows the patient to easily identify the maximal maxillomandibular distance on initial stretching by noting which ring on the taper is reached when both the maxillary and mandibular teeth come into contact with the tapered cylinder. This appliance relies on the patient's depressor muscles to depress the mandible.<sup>6</sup>

Various mechanical aids have been used for the treatment of trismus, like therabite and patient bite or pat bite.<sup>28,30</sup>

### **CONCLUSION**

Trismus is usually a secondary and an only presenting sign of a rich clinical picture but may be of diagnostic value in some cases. So, successful treatment depends on prompt recognition of its cause and initiation of appropriate management, otherwise trismus may lead to permanent functional impairment. It is the clinician's priority to make sure that all the patients with this condition receive an adequate examination for correct diagnosis. Despite the numerous papers written, the knowledge about trismus remains scarce. Research into criteria for trismus, functional consequences, risk factors and interventions studies for trismus are needed in future.

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