REVIEW ARTICLE

TEMPOROMANDIBULAR DISORDER (TMD) AND CERVICAL SPINAL DISORDER(CSD) : A MERE COINCIDENCE OR A TRUE ASSOCIATION-A REVIEW

Dr. Swagata Das [1] , Dr. Dibyatanu Majumdar [1], Dr. Surjargha Mukherjee [1], Dr. Ranjan Ghosh [2], Dr. T. K .Giri [3], Dr. Sugata Mukherjee [4]

ABSTRACT

A plethora of confusions and queries lies regarding the association of TMD and CSD due to the fact that there is a frequent overlapping of the symptoms associated. It is although unknown whether a true association exists between TMD and CSD. Many studies have been conducted to search for the existence of a causal relationship between these two disorders or whether any one of them acts as a predisposing or a precipitating factor for the other, whether there is any specific mechanism that can be attributed to the concurrent development of clinical symptoms of TMD in Cervical spinal disorder patients and vice versa. A systematic search was executed through the open web and articles relevant were reviewed.

The purpose of this systematic review is to evaluate whether there is any true association present between TMD and CSD and whether the presence of CSD in patients predisposes to the development of TMD.

KEY WORDS

Cervical spondylosis, Temporomandibular disorder (TMD), Cervical spinal Disorder(CSD), Myofascial Pain Disorder.

ABOUT THE AUTHORS

1.Post Graduate Student, 2. Associate Professor
3.Professor and Principal, 4. Head of the Department
Department of Prosthodontics and Crown & Bridge,
Dr. R. Ahmed Dental College and Hospital, Kolkata

Corresponding Author
Dr. Surjargha Mukherjee
Post Graduate Student, Department of Prosthodontics and Crown & Bridge, Dr. R.Ahmed Dental College and Hospital, Kolkata, e-mail: bazzo.mukherjee@gmail.com
Mobile: 9051988452

INTRODUCTION

Temporomandibular disorder or TMD as defined by the American Academy of Orofacial Pain is a collective term that comprises of a group of musculoskeletal disorder involving the masticatory muscles, temporomandibular joint and associated structure[1]

It is the most common cause of pain of non-dental origin[2] .There has been a significant increase in the number of people suffering from TMD in recent years. Almost 75% of the population suffers from fromTMD[3]. TMD is a multifactorial disorder which can arise from the loss of structural (occlusal or anatomical), functional (bruxism, neuromuscular) and psychosocial (stress, anxiety) integrity. There is no one specific cause which can lead to the development of TMD. Various factors like occlusal discrepancies, trauma, parafunctional habits, and stress can result in the development of TMD. Individual adaptability plays a major role in protecting one against this disorder. The commonest complaint of the patients suffering from TMD is pain which may radiate to the head and neck region. The other signs and symptoms that are observed are alteration and restriction of range and path of jaw movements, joint noises like clicking and crepitations. The patient commonly complains of headache, earache neck pain, limitations of mandibular movement during function and functional movements like chewing, clenching or yawning eliciting pain in the orofacial musculature.

Cervical spinal disorder (CSD) on the other hand is a chronic condition which affects the cervical region and associated structures with or without the pain radiating to the shoulders, arms, intrascapular region and head[4]. It has been postulated that 67% of the population will suffer from neck pain at certain stages in their lives[5].

The most common symptoms that both these disorders have is that pain originated from the musculoskeletal system that is aggravated by movement of the jaw during mastication or other jaw movements[6] and during certain head movements or adopting a certain neck posture[7].

There has been a significant interest among clinicians to find out whether any possible

correlation exists between these two disorders. This interest has originated from the various clinical reports that documented the presence of pain in and around the cervical and craniofacial region simultaneously [8,9].

Few studies support the correlation between the head and cervical posture[10-12] and TMD while many others do not support[13].

Animal studies have already demonstrated a close connection between trigeminal and cervical neuromuscular system[14,15].

It was also observed that mechanical, thermal, and electrical stimulation of trigeminal nerve and ganglion elicited neck motor neurone activity. Manni et al[16] in 1985 reported the existence of a trigemino neck reflex which established the common clinical findings observed between TMD and CSD.

Clark et al in their case-control study had found that 22.5% of the patient population in a temporomandibular dysfunction clinic had suffered from craniocervical problems in addition to TMD which was significantly less with only 5% in patients who didn't have TMD[17].

It was observed in a few other studies that TMD patients more often showed sign and symptoms of CSD than non-TMD patients[18-20]. But these studies were not very relevant as different signs and symptoms were used to find out the prevalence of TMD or CSD. Moreover different examination methods like questionnaire and clinical tests were used to determine the presence of TMD and CSD.

Since it is established that there is a definite relationship between neurosensory modulation of the trigeminal and cervical neural circuit the concurrent clinical presentation of craniofacial and craniocervical pain is not a surprising fact anymore. The confusion that exists is due to the cause and effect relationship between TMD and CSD.

The questions that this review would attempt to answer is whether the pain/ dysfunction of TMD origin initiates the pain and or dysfunction of the cervical region and vice versa? Or whether an external event simultaneously generate both the disorders?

Method:

Procedure:

The articles were selected by the authors based on the inclusion and exclusion criteria. Titles and Abstracts of all the searched items were read by the authors for possible inclusion in the studies.

All such articles then were retrieved as a full text articles and were reviewed thoroughly before including in the study. No author was contacted for any missing data in the articles. Disagreements regarding selection of articles were resolved among the authors through discussion.

Database search:

The search included the articles that were indexed in Pubmed, Google Scholar and Open web. Articles published in English language were only included in this review. Articles published from 1868 till date were included in this review.

The terms that were used in search were cervical spinal disorder (MeSH) and temporomandibular joint disorder (MeSH), correlation, Review and Systematic Review. References from original articles and review articles were searched for acquiring additional articles.

Inclusion criteria :

The articles selected must be a review or a systematic review or a clinical trial. The articles selected concentrated on correlation between TMD and CSD.

Exclusion Criteria:

1.Articles with dual publication

2. Updates on systematic review by the same author

RESULTS

Fifteen full text articles were read and included in this review.

DISCUSSION

The lower jaw bone or mandible articulates with the upper jaw or skull by forming a unique joint known as Temporomandibular joint. TMJ provides mobility to the whole face and aids in performing basic functions like mastication, speech, swallowing and deglutition. Mandibular movements are performed by masseter, temporalis, medial and lateral pterygoid and digastric muscles which in turn are well coordinated with supra and infrahyoid muscles. During function, mandible moves in a rhythmic movement controlled by neural inputs to the appropriate muscle. This neural circuitry mechanism is located in the brainstem and known as Central Pattern Generator (CGP) which gets inputs from the peripheral exteroreceptors and proprioreceptors for smooth functioning[21-22].

The neck comprises of seven upper cervical vertebrae and associated muscles which supports the head. It is a complex network of muscles that join vertebrae, lower jaw, clavicles and the upper ribs to perform necessary neck movements to maintain an optimal position of the head. Optimal positioning of the head is important for the maintenance of visual gaze, stability and acuity[23].

Movements of jaw motor activity are observed in the 12th week of foetal life as suckling and

swallowing[24]. The muscular response is first developed in the perioral region which indicates that trigeminal nerve is the first to be activated. Even the first reflex that is noticed in a foetus is the trigemino-neck reflex where trigeminal stimulus affects neck movements[25].

It has been seen in all species that a connection exists between the trigeminal nerve and the neck motor neurons which plays an important role in head withdrawal reaction when an unexpected sudden stimulus around orofacial region causes head aversion[26].

In a normal sitting position when a person is sitting upright the centre of gravity of head usually lies ahead of the Atlanto-occipital joint. The extensors muscles of joint counteract this gravity and prevent forward tilting of the head.

Such connections also exist during jaw opening and closing movements which coordinate head-neck movement during normal functions like mastication and speech[27].

Free neck movement is very essential for maximal mouth opening as compromised neck movement may cause a reduction of space for adequate mandibular movement causing impingement on the supra hyoid structures and airway obstruction[28].

In a study conducted by Di Lazzaro et al, it was observed that stimulation of trigeminal nerve evoked responses in sternocleidomastoid and trapezius muscles in humans[29].

The location of the trigeminal nucleus in the upper cervical region also points out the intimate neurophysiological and neuroanatomical relationship between the trigeminal and craniocervical region[27].

Now since it is established that communication exists between these two systems the next question that needs to be answered is how the pain is referred from one region to the other.

The easiest explanation for this concurrent association between TMD and CSD could be of either 1. The pain originating in the orofacial region initiates the pain in the craniocervical region or vice versa or 2. The pain of craniofacial and orofacial region shares a common origin.

To establish these facts existence of any physiological, anatomical or neurosensory mechanism that may act as a common link between the masticatory system and cervical spinal system has to be established.

The theories that are available for a possible explanation of pain referral mechanisms are

1.Convergence referral theory 2. Wide dynamic range recruitment theory 3. Interneuron connectivity theory and 4. Combination of any of these three.

The convergence referral theory states that due to pathological changes in the craniocervical region a mechanical compression takes place in the neurovascular system, cervical vertebral joints and even within upper cervical vertebrae[30-34].The pain due to this compression is referred to the craniofacial region by the help of a central convergence referral process.

This pain referral pathway was first described by Ruch[35] in 1949. The rationale for this pain referral from the neck to the orofacial region is the close functional communication between the trigeminal spinal nucleus and cervical spinal tract nucleus.

Simons suggested the possibility of interneuron

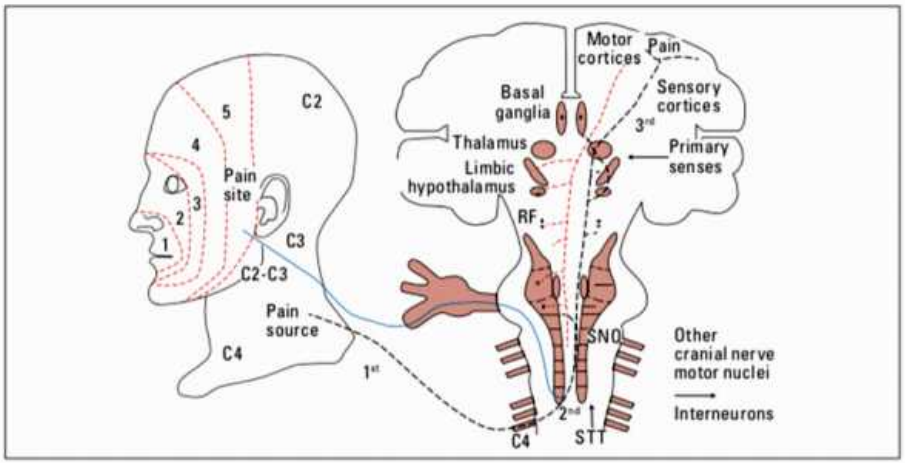

Fig: 1 Sensory Pathways and motor response for referred pain. First order neurons from pain site at C5 lamina and pain source from C4 both converge at Lamina 5 of the subnucleus caudalis and excite the same secondary order neurons. These second order neurons ascends and branches with subnucleus oralis (SNO) and subnucleus interpolis (not shown in picture) and with reticular formation stuctures before synapsing with third order neurons situated in thalamus. RF-reticular formation, STT (spinothalamic tract), SNO- subnucleus oralis, RF- reticular formation

connectivity (Fig.1)

Between afferent nociceptors in the spinal cord which causes C fibre discharge and release of neurokinins and substance P which stimulates the wide dynamic range neurons in the trigeminal subnucleus caudalis[36].

In several clinical works, it has been observed that cervicovertebral pain is referred to forehead and temple regions. Following which the term cervicogenic headache is proposed to describe this syndrome[37-39].

Sternocleidomastoid muscle which is supplied by the cervical part of spinal accessory nerve (11th nerve) and C2, C3 and C4 has been found to be associated with many pathological conditions affecting distant areas including headache[40], myofascial pain dysfunction syndrome[41], vertigo[42] and torticollis[43].

In another clinical trial by Carlson et al[44], it was even observed that injection of lidocaine solution into trigger points of upper trapezius muscle reduced the pain of masseter muscle pain.

Travell and Rinzler[45] also observed referred pain pattern from cervical trigger points to the orofacial region.

There are several arguments as well against the concept of pain referral from neck to orofacial region. Cyrix[46] proposed that since there is no evident neuronal pathway between the neck and head and facial region, this pain referral concept is invalid. But when the convergence referral theory was explained, Cyrix[47] accepted that pain referral was really a possibility.

De Wijer[48] also didn't support this concept of pain referral. She had not found enough evidence to support that cervical spinal disorder (CSD) gives rise to TMD. Though in her study she observed that there was a possible correlation between TMD and CSD, a definite relationship between these two disorders could not be established. She emphasised on a thorough examination of the masticatory system in patients with cervical pain disorder to exclude the involvement of the masticatory system.

All these studies so far mentioned concentrated on establishing pain referral relationship from neck to head region, but not in a caudal relation or from head to the neck region. Tilscher and Eder[49] tried to highlight this in their study. They conducted a study on 682 patients with rheumatic disease, in which there was a group with cervical disease. They found that in 35% of the patients with the cervical problem had a dental- maxillary focal area of stress causing the cervical pain. They proposed that the involvement of the trigeminal region may lead to cervical disease pathology. They also suggested that pressure sensitivity above the transverse process of C2 indicates a pathosis of the upper jaw and above C3 is indicative of lower jaw pathosis. They suggested that importance should be given to diagnose this non-specific focal event of dental origin while considering vertebral pain pathology.

Norris and Eakins[50] observed that when lidocaine injection was given in TMJ, most of their 25 patients with TMD had relief of pain in the neck, while some of them had complete relief of pain.

Block[51] also reported that acute pain from masseter (trigeminal nerve) and posterior digastric (facial nerve) muscle may refer pain to the mastoid region and sternocleidomastoid muscle. He suggested that this could be due to recruitment or guarding action on cervical muscles due to activation of the muscles of mastication. But he did not support this hypothesis that cervical pain was referred from trigeminal nerve stimulation by noxious stimuli.

De Leeuw et al[52] also observed patients with TMD also having cervical pain disorder.

Debora Bevilaqua Grossi et al[53] conducted a study among 100 women of age range between 18-26 years who were clinically diagnosed to have TMD. They observed that an increase in severity signs and symptoms of TMD were accompanied by increased severity of CSD. They tried to find out whether CSD could be considered as a predisposing or a perpetuating factor for the TMD. They concluded that though there was a definite increase in signs and symptoms of CSD when associated with TMD, the inverse of this could not be proved.

Another explanation for this referred pain was given by Browne et al[54]. They expressed that the presence of pain in two different region simultaneously doesn't mean one causing the other but it can also be due to the presence of an extrinsic factor that causing these two distinct disorders simultaneously. They had given an example of pain in both the neck and mandible simultaneously due to anginal attacks. They also explained that another reason for concurrent neck and jaw muscle pain could be due to motor dysfunction that involves both the cervical and masticatory muscles like in bruxism and activation of craniocervical motor neurons.

It has already been mentioned previously about the kinesiologic influence of head and neck posture and jaw movement. Cervical muscles and joint plays a crucial role in positioning and stabilising unsupported head. Cranium is supported by the cervical muscles and thus maxilla is also made steady during the mandibular movements. Foster et al[55] found that EMG activity of masseter muscle increased during cervical extension.

Thompson and Brodie[56] and Brodie[57] suggested that isometric clenching is balanced by the activation of cervical muscles at an erect posture. Halbert [58] also reported activities of neck extensors and an infrahyoid group of muscles during clenching. It was the first documentation of the EMG activity of cervical muscles during jaw movements.

EMG activity of Sternocleidomastoid(SCM) muscle during clenching was also observed by Davies[59]. Yet the amount of neurophysiological coupling between the masseter and other cervical muscles like trapezius and sternocleidomastoid muscle in dynamic movements needs to be explored. Also, cervical muscle activities during nocturnal bruxism yet to be studied.

Another aspect that needs more attention is the co-inhibition phenomenon, considering that trigeminal stimulation can not only excite but may also inhibit cervical motor neurone activity. Meier Ewert et al[60] in 1974 observed that both SCM and masseter muscle activity was inhibited by an acoustic stimulus. Many other investigators also reported that an appropriate amount of electrical and mechanical stimulation of the trigeminal area may produce an interruption of masseter activity[61-63]. Browne et al[64] demonstrated that a muscle inhibition in SCM was elicited after stimulation of trigeminal area with sufficient strength to produce a masseter inhibition. They proposed that dynamic movements of the head like fully flexed, extended or rotated induces such co-inhibition more readily. From this study, it could be speculated that such a coupling may cause a referral of pain between areas supplied by the cervical and trigeminal nervous system.

SUMMARY

This review article attempts to find out whether a correlation exists between cervical spinal disorder(CSDs) and temporomandibular disorder(TMDs). A physiological and anatomical connection between the craniocervical and craniofacial region exists along with a close neurosensory coupling between trigeminal and cervical nervous system. Pathological changes in the cervical spinal region and orofacial region may influence one another. From few clinical reports, it was observed that signs and symptoms of TMD were increased in the presence of cervical spinal disorder, whereas few other studies failed to establish any correlation. So further researches are needed to establish a definite relationship between these two systems and to predict a possible mechanism of referral of pain from one region to another.

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