IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 19, Issue 12 Ser.2 (December. 2020), PP 01-10
www.iosrjournals.org

"Relationship between Temporomandibular Joint Dysfunction, Forward Head Posture and Severity of Neck Pain in Subjects with Neck Pain and Temporomandibular Joint Dysfunction

Monalisa Pattnaik, MPT, *Assistant Professor (Physiotherapy)*
Dr. Patitapaban Mohanty, Ph. D., *Associate Professor (Physiotherapy*
Meeta Agarwal, MPT
Department of Physiotherapy Swami Vivekananda National Institute Of Rehabilitation Training and Research Olatpur, Cuttack -754010, Orissa, India

Abstract: *Aim of the study was to find out relationship of temporomandibular joint dysfunction with forward head posture and severity in neck pain in patients with neck pain, temporomandibular joint dysfunction. Methodology: non experimental correlation study, Sample Size- 71 subjects with neck pain, forward head posture and symptoms of temporomandibular dysfunction. Temporomandibular dysfuction was recorded using Modified Clinical Dysfunction Index, Modify Clinical Dysfunction Index (DI) was used for measuring dysfunction associated with temporomandibular joint, Postural assessment grid and goniometer was used to take all mandibular measurements and Visual Analog Scale (VAS) was used to measure subjective neck pain intensity. Data Analysis: Pearson's correlation coefficient analysis was used to find the correlations of neck inclination angle (NIA) with age and VAS.Kendall's tau correlation analysis was done to find relationship of Temporomandibular dysfunction index (DI score) with NIA and VAS. Multiple comparisons were done for neck inclination angle (NIA) for three different age groups 21-30, 31-40, and 41-50. Results: Results of the present study show that in patients having TMJ dysfunction with FHP and neck pain, as the score of Temporomandibular dysfunction index (DI) increases, the value for NIA (neck inclination angle) reduces (r= -.807; p= .000) and VAS for neck pain increases (r= -.734; p= .000). Results also establish that with gradual reduction in NIA, intensity of neck pain also increases (r= -.884; p= .000) in same group of patient. Results also showed correlation between AGE and NIA (r= -.846; p= .000) which conclude that there is a progressive decline in neck inclination angle (NIA) at C7 with increasing age i.e. 20-30, 30-40, and 40-50 years. On the basis of findings of present study, we can conclude significant relationships between temporomandibular dysfunction, forward head posture and self reported severity of neck pain in patients with neck pain and TMJ dysfunction.*

Key words: *Temporomandibular Joint (TMJ), Temporomandibular Joint Dysfunction (TMD), Neck Inclination Angle (NIA), Visual Analog Scale (VAS), Modify Clinical Dysfunction Index (DI), Forward Head Posture (HFP)*

Date of Submission: 20-11-2020 Date of Acceptance: 06-12-2020

I. Introduction

Neck pain is defined as 'pain, ache or discomfort in the area between the occiput and the third thoracic vertebra and between the medial border of the scapula.[1] The anatomical and biomechanical nature of the cervical spine encourages mobility at the expense of stability and strength that is why cervical pain and dysfunction are common, particularly as a result of and poor spinal posture**.**[2] Neck pain has been reported to be increased with age and to be more prevalent in woman than man.[3]

Cervical pain and dysfunction appear to affect many people representing 60%-75% population due to poor posture**.**[4,5,6] Poor posture is widespread in the asymptomatic population and appears to be an adaptive, self perpetuating trait as most people lack the cognitive ability or desire to correct by themselves**.**[7] The biomechanical complexity of body posture derives from the functional integration of several body segments, when there is a change in any biomechanical subunit, a refinement of the postural control systems will necessarily occur.[8,9] The muscle groups of the stomatognathic system belong to the cervical muscular chain**.**[10]

According to the American Academy of Orofacial Pain**,** temporomandibular disorders (TMD) are defined as "a collective term embracing a number of clinical problems that involve the masticatory muscles, the temporomandibular joint and associated structures, or both". They are considered to be a subclassification of musculoskeletal disorders and typically run a recurrent or chronic course, with a substantial fluctuation of TMD signs and symptoms over time. [11]

A group of temporomandibular disorders are characterized by pain in the pre-auricular area, TMJ, and/or muscles of mastication**,** limitations/deviations in mandibular range of motion, TMJ sounds during jaw function**.**[12] The clinical sign and symptoms of TMDs can be grouped into 3 categories according to the structure affected, the muscles, the TMJs, the dentition**.**[13] TMJ disorder is commonly associated with headache, ear-related symptoms, and cervical spine disorders.[14]

A forward head posture is one in which the head is positioned anteriorly at an increased distance from the LOG and the normal anterior cervical convexity is also increased with the apex of the lordotic curve at a considerable distance from the LOG compared to optimal posture. [15, 16, 17] Precise and complex balance of the head and neck muscle must exist to maintain proper head position and muscle function. If one elastic band breaks, the balance of the entire system is disrupted and the head position is altered**.**[18]

Many practitioners[19] have done extensive conceptual analysis to establish the primary role a forward head posture in the appearance of some craniomandibular dysfunctions and internal derangements of the temporomandibular joints. The loss of the normal cervical spinal curve has been found to result in negative effects on TMJ (jaw joint) related muscle tension. [20]

As the head moves forward, the capital extensors (suboccipitals, semispinalis, splenius, longissimus and trapezius) must fight gravity to keep the head from dropping. Soon, the entire nervous system goes into a heightened state of alert. In a forward head posture, passive tensile forces begin to shorten and tighten the hyoid and digastric muscles creating a strong tug on the mandible which translates the jaw posteriorly and inferiorly**.**[21] Law of Righting will always cock the head back to level the eyes against the horizon even if it means ravaging the neck**.** [22] Smaller CV angle (craniovertebral angle) in TMD patients than in control subjects has been seen in studies, suggesting that TMD patients have a more forward head position than non TMD patients**.**[23]

To make matters worse, the temporalis and masseter muscles are forced to co-contract against the hyoids so the mouth can be kept closed. Prolonged temporalis and masseter contraction promotes abnormal mandibular positioning and disc compression at the temporomandibular joint (TMJ) [24, 25, 26] Studies have independently demonstrated that when the head is positioned forward, the upper trapezius muscle's EMG, activity is significantly higher than it is when the head is in normal alignment and also the greater the EMG activity the more likely the patient is to have pain from overusing the muscles. In clinical studies it is well established that head-neck backward bending increases the EMG activity of the masticatory elevator muscles, especially the temporalis muscle. [27] The etiology of TMD has been attributed to a number of factors, including bruxism, trauma, and occupational stressors, postural abnormality. Although it is speculated that approximately 70% of the general population will exhibit signs of temporomandibular disorder, only 5% will seek medical or dental treatment**.**[28]

The modified clinical mandibular dysfunction index[29] is appropriately used for estimating the degree of mandibular dysfunction in epidemiological studies independent of the specific TMD being studied. These indices can also give significant results in the population studies and the clinical outcome studies.

There are many references in the literature that support the relationship between cervical spine muscle imbalance leading to neck pain and postural abnormality, forward head posture and mandibular dysfunction.[30] However there are limited studies that further explore about the clinical correlation of severity of neck pain with forward head posture and Mandibular Dysfunction in patient population with neck pain and temporomandibular joint dysfunction. A clearer quantified understanding of relationship between these physical characteristics will enhance the effectiveness of both therapeutic and educative interventions.

In the presenting study, purpose of the study has been put on finding the relationship between neck pain severity with forward head posture measured by neck inclination angle and the clinical dysfunction index, used for determining the mandibular dysfunction.

AIM OF THE STUDY

- To find out relationship of temporomandibular joint dysfunction with forward head posture and severity in neck pain in patients with neck pain, temporomandibular joint dysfunction.
- To establish relationship of forward head posture with neck pain severity and individual dimension (age) in same patient population.

II. Methodology

- Study Design- non experimental correlation study
- Sample Design- Simple random sampling
- Sample Size- 71 subjects

SUBJECTS- Patients reported to Department of Physiotherapy, SVNIRTAR, Cuttack and Dental OPD, SCB dental college and hospital, Cuttack, with complaint of neck pain or pain associated with temporomandibular joint completed a questionnaire. Further, they were screened for neck pain, forward head posture and symptoms of temporomandibular dysfunction. 71 Subjects, meeting the inclusion criteria, were recruited for the study. All recruited subjects were informed of procedure and an informed consent was obtained.

INCLUSION CRITERIA

- Subjects with neck pain (with or without radiation) for more than 3 months
- Forward head posture (>Grade 1, screened according to Griegel-Morris measurement of FHP)
- Symptoms of temporomandibular dysfunction (Ai I and Ai II according to Helkimo anamnestic dysfunction index (Ai)
- Age group- 21 to 50 years

EXCLUSION CRITERIA

- Diagnosed with traumatic internal derangement of TMJ, any traumatic injury to face, head, neck and jaw, medical co-morbidities such as spinal infection, spinal tumor, inflammation RA or AS, cervical spinal surgery, vascular diseases of extremities, thoracic or lumbar spinal deformity, spasmodic torticollis, neurologic motion disorders, neurological and infective conditions, persistent respiratory difficulties, tooth extraction or denture.

PROCEDURE

To inquire about history related to general and oral health of subjects, a questionnaire was given to the patients. Out of which patient has to mark on the symptomatic part, if any. Questionnaire also provides information on demographic factors, and history of any relevant treatment and surgery. Respondents with neck pain were selected for further screening for FHP and TMD. Respondents with TMJ dysfunction were screened for neck pain and FHP. All patients meeting inclusion & exclusion criteria were assessed using assessment proforma.

Temporomandibular dysfuction was recorded using Modified Clinical Dysfunction Index (DI). During all mandibular measurements, subjects were made to sit comfortably in a relaxed posture on a chair with back rest at 90^0 and both forearms resting on thighs and to look at a point in front at eye level. Distance was measured vertically from eye level to ground using a plumb line and point is marked on the front wall at same height at 2 meter distance horizontally. A plumb line was used to provide an absolute vertical line standard for measuring deviations in head posture.[31] An adhesive skin marker, 5.5 inch length light plastic rod bent at 90^0, was used to position the fulcrum of goniometer at C_7 and one adhesive marker over tragus of right ear. Postural assessment grid was used to take horizontal standard for stationary line of goniometer for measuring NIA. Angle measured between horizontal from C7 and tragus of ear is neck inclination angle, was measured in standing against postural assessment grid in sagittal view, using a plastic transparent 180^0 goniometer. Goniometer stationary arm was aligned parallel to black horizontal line of postural assessment grid which ensures horizontal with the ground, as a plumb line is used to take equal vertical distances from ground at either end of postural grid's horizontal lines. Moving arm of goniometer was placed on visible marker placed at tragus of ear.

Mandibular mobility- Maximal mouth opening was measured in mm using a steel ruler, taking distance between upper incisor midline to lower incisor midline. Cotton Swab with 70% isopropyl alcohol to disinfect steel ruler after every use. 3 measurements are taken subsequently to take average value to reduce the chances for error.

Deflection- Deflection of the mandible was recorded if the mandibular midline deviated at least 2 mm during opening. A deflection 0.5 mm was registered as severe.

TMJ function- Joint clicking was recorded for right and left sides without use of a stethoscope as palpable or evidently audible. Locking and luxation were recorded during mandibular movements.

TMJ pain- The joints were palpated both from the lateral sides and via the auditory meatus. The tenderness was recorded as palpable or as a palpebral reflex (pain causing eyelid reaction).

Muscle tenderness- Muscle tenderness was recorded by palpation of the temporal and masseter muscles (both sides) using the same assessments as for TMJ pain.

Modified Clinical Dysfunction Index (DI) was used for measuring dysfunction associated with temporomandibular joint. There is considerable evidence available to support the reliability of Modified version of Helkimo dysfunction index, which examines clinically, dysfunction of the masticatory system on the basis of five signs of TMD: Mandibular mobility, Deflection, TMJ function, TMJ pain, Muscle tenderness. A total dysfunction score ranges from 0 to 25 points. The higher the score, the more serious is the disorder. The sum of the scores (points) form the basis of grouping by grade of dysfunction, where 0 = no dysfunction; I = mild dysfunction (1–4 points); II = moderate dysfunction (5–9 points); III = severe dysfunction (>9 points).

Visual Analog Scale (VAS) was used to measure subjective neck pain intensity. This is a card with uncaliberated scale ranging from 0 to 10 one side (with 0 representing "no pain" and 10 representing "worst pain") and a corresponding 10 cm ruler on other side (with each cm representing one pain level)**.** Subject was asked to mark score between 0 to 10 according to their severity of neck pain. VAS was used to measure neck pain intensities at 6 different levels - Pain at examination (now), Maximum pain occurred till now, Pain during ADL activity, Pain during leisure activity, Pain during job related activity and Pain at rest. Combined score of VAS i.e. out of 60 was used for determining severity of neck pain.

DATA ANALYSIS

Statistical analysis was performed using SPSS version 16.0.

Pearson's correlation coefficient analysis was used to find the correlations of neck inclination angle (NIA) with age and VAS.

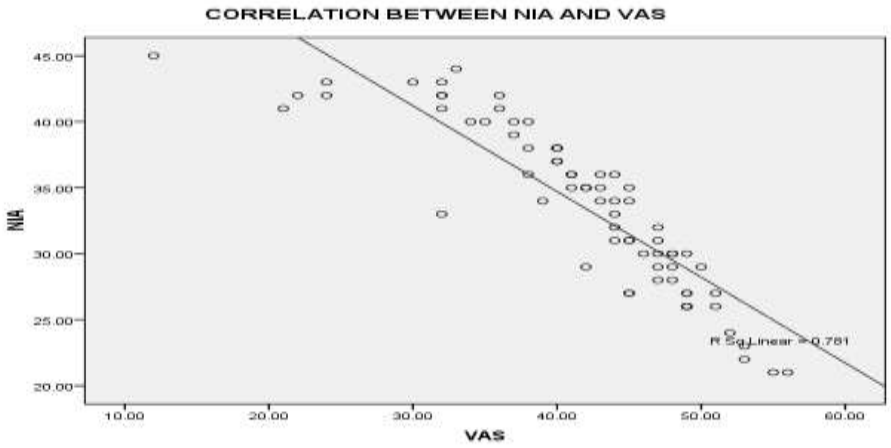
Kendall's tau correlation analysis was done to find relationship of Temporomandibular dysfunction index (DI score) with NIA and VAS.

Multiple comparisons were done for neck inclination angle (NIA) for three different age groups 21-30, 31-40, and 41-50.

III. Results

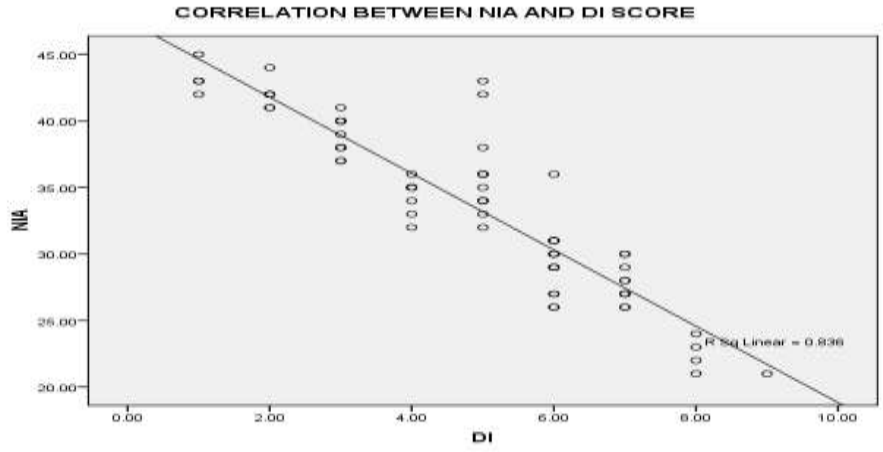
CORRELATIONS

GRAPH 1:



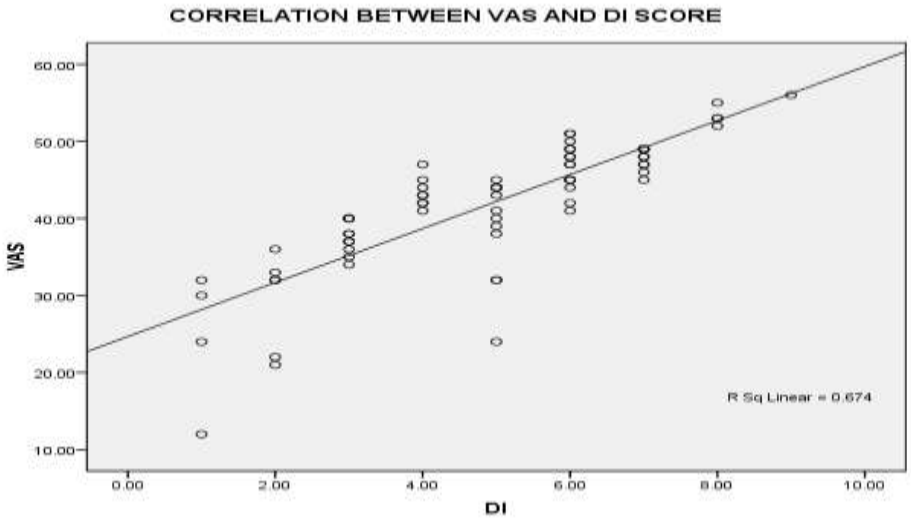
Graph 1 represents the scatter plot diagram with best fit line showing Significant negative high correlation between NIA and VAS with Pearson's correlation coefficient having value r= -.884; p= .000.

GRAPH 2



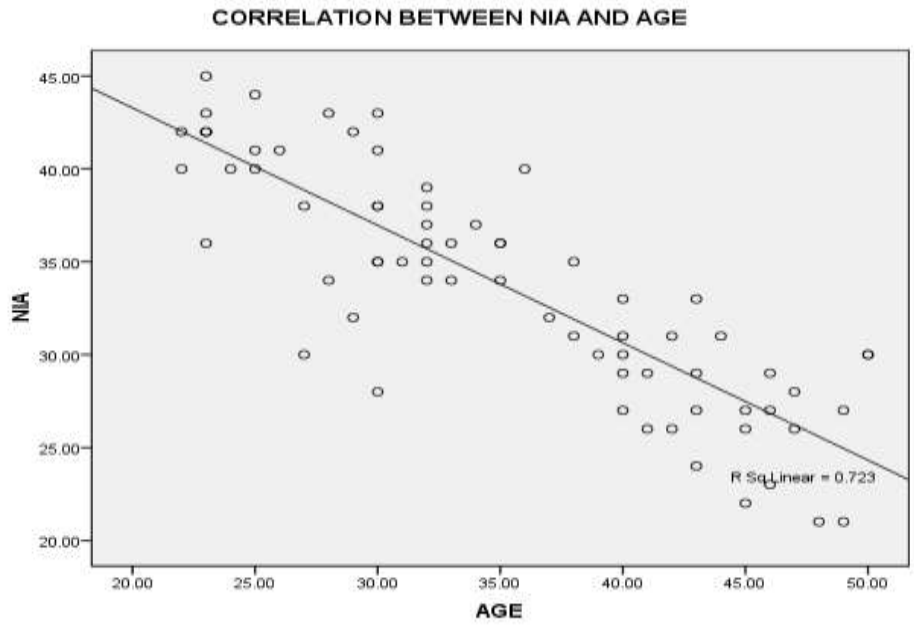
Graph 2 shows the scatter plot diagram with best fit line showing that there is a significant negative high correlation between NIA and Temporomandibular dysfunction index (DI) with Kendall's tau correlation coefficient having value r= -.807; p= .000.

GRAPH 3



Graph 3 illustrates the scatter plot diagram with best fit line showing significant positive correlation between VAS and Temporomandibular dysfunction index (DI) with Kendall's tau correlation coefficient having value r= -.734; p= .000.

GRAPH 4



Graph 4 represents the scatter plot diagram with best fit line showing significant negative high correlation between AGE and NIA with Pearson's correlation coefficient having value r= -.846; p= .000.

NECK INCLINATION ANGLE (NIA) AT C7

Results show that there is a progressive decline in neck inclination angle (NIA) at C7 with increasing age i.e. 21-30, 31-40, and 41-50 years.

Multiple comparisons were used to show that there is a significant difference in CVA between 3 age groups as follows:
Between age group 21-30 and 31-40, p=.002
Between age group 31-40 and 41-50, p=.000
Between age group 41-50 and 21-30, p=.000

IV. Discussion

Results of the present study show that in patients having TMJ dysfunction with FHP and neck pain, as the score of Temporomandibular dysfunction index (DI) increases, the value for NIA (neck inclination angle) reduces (r= -.807; p= .000) and VAS for neck pain increases (r= -.734; p= .000). Results also establish that with gradual reduction in NIA, intensity of neck pain also increases (r= -.884; p= .000) in same group of patient. Results also show correlation between AGE and NIA (r= -.846; p= .000) which also conclude that there is a progressive decline in neck inclination angle (NIA) at C7 with increasing age i.e. 20-30, 30-40, and 40-50 years.

RELATIONSHIP BETWEEN VAS AND FORWARD HEAD POSTURE (NIA)

In our study results there was a significant negative correlation (r= -.884, p= .000) between VAS and NIA angle, which are in similar range of study done by Chiu and Yip et al 2006,[32] The CV angle in subjects with neck pain is significantly smaller than that in normal subjects (r=-.790, p=.015). In this study there was moderate negative correlation between CV angle and neck disability, Thus explaining that patients with small CV angle have a greater forward head posture, and the greater the forward head posture, the greater the disability. Studies by Chiu et al[32], 2002; Haughie et al., [33] 1995; Hickey et al, 2000;[34] Good et al., 2001; present with similar findings.

Johnson (1998) in his study support the findings of present study that forward head posture is one of the common types of poor head posture seen in patients with neck disorders suggested that prolonged forward head posture might increase loading to the non-contractile structures and abnormal stress on the posterior cervical muscular structures and cause myofacial pain.

Forward head posture alignment produces an increased flexion moment arm at the C7-T1 junction; because the moment arm of the weight of the head increases as the head translates anteriorly**.** In the static posture the load on the disc or functional spinal unit (FSU) is due to body posture has two origins, First there is a direct compressive load due to weight of the head and neck above C7-T1 junction, second because the centre of gravity (COG) of the head and neck is anterior to the FSU in front of the tragus**.**[33] The more anterior the COG shifts the greater neck extensors muscle force occurs at the FSU. As a result of new engrams of the CNS, The length/tension relationship of a muscle will adapt to the new resting length. So, it would be reasonable to consider head forward posture associated with adaptation could aggravate neck pain in our subjects. In our study, all subjects were right-handed and they spend the majority of their day sitting in performing occupational tasks or studying. It is possible that the constant use of this work causes shortening of muscles such as the upper trapezius. The significant correlations between the upper trapezius muscle activity and head-neck angles found in studies represent important evidence of a link between muscle activity and postural control.[33] Habitually shortened muscle length, with the individual not moving through a complete range of motion on a daily basis, might cause adaptive changes in muscle length with a habitual forward head posture. [34]

Most of the patients in present study show pain in the region of upper medial scapula, this can be explained as Jull characterizes the levator scapulae as one of the muscle in neck girdle region, acts as a "guy rope" with anterior neck muscles that become overactive with poor posture such as forward head posture, leading into overtime length associated changes and in the short term overuse of muscle could result in pain and discomfort.

Griegel morris et al (1992) observed that the subjects with FHP had increased incidences of cervical, interscapular pain and headache. This observation is similar to our study.[34] Lee**,** Okeson and Lindroth (1995) stated that correct posture is particularly associated with health status and any alteration on this posture could lead to pain and dysfunction of the craniocervical system.[35]

RELATIONSHIP BETWEEN TMJ DYSFUNCTION AND FHP:

Results of present study show that there was a significant negative high correlation between NIA and Temporomandibular dysfunction index ((r= -.807; p= .000). In other words, when evaluating the ear position with respect to the seventh cervical vertebra i.e. taking neck inclination angle into consideration, the head was positioned more forward in the group with temporomandibular dysfunction. Lee et al (1995) supports our findings, in this study the only measurement that revealed a statistically significant difference was angle ear-seventh cervical vertebra-horizontal plane (p<.05). This angle was smaller in the patients with temporomandibular disorders than in the control subjects. [35] Darling et al 2001 investigated the relationship between head posture and rest position of mandible, head angle was assessed in similar way to the present study

(normal 47-49.5 degree). They also indicated there is a strong relationship between head posture and position of mandible (r=-.780).[36]

To understand the mechanisms that are necessary to maintain equilibrium and stability of the cranium and cervical spine, it is necessary to understand the mechanical function of this complex system. [37] At the level of craniocervical joint, a first degree lever exists with the rotation point located in atlanto-occipital joints. Resistance is provided by weight of the head and COG is located anteriorly.

Power for the movement and stabilization is provided by posterior neck muscles (e.g. trapezius, splenius, semispinalis and multifidus up to certain extent).[38] Pauley et al reported continuous EMG activity of semispinalis group of muscles during upright posture to support the head.[39] This tendency is called "the inverted 7 and mark behaviour" (Gillies GT et al 1998), so an equilibrium must be balanced between anterior (masticatory muscles, infrahyoid, suprahyoid, anterior neck muscles) and posterior force, so that of may act in a functional chain.[40]

Hyperextension of the upper cervical and a straightening of the lower cervical in FHP results in suboccipital, posterior cervical, upper trapezius and splenius capitis shortening so that to bring the eyes to gaze forward, which places extra strain on the occipitoatlantal joint (places it in extension). [41]

Part of this association between craniomandibular system and cervical spine can be explained on the basis of sliding cranium theory which suggests that change in head posture are able to produce changes in occlusal contacts by altering the position of maxillary teeth in relation to mandibular teeth.[42] Biomechanically, Kapandji states that when cranium slides backward in extension, as the case in forward head posture, the convex occipital condyle slides anteriorly on the lateral masses of atlas (C1) according to convex-concave rule.[43]

At the same time the maxillary teeth also slide forward (being structurally joined to the cranium through the periodontal membrane system) relative to the mandibular teeth. Consequently the initial teeth contact position shifts posterior to intercuspal position. Therefore, movement in the craniocervical unit causes adaptive movements in the jaw and related structures. Extension of head on cervical spine produces elevation and retrusion of the mandible. The consequences of this abnormal position may lead to an excessive amount of tension on the masticatory muscles, teeth, and supporting structures.[44]

The findings of study by Mclean et al 2007 showed that increased muscle activity during postural changes had the largest impact on the massater muscle, which demonstrated activation levels in the order of 20% maximium voluntary electrical activation.[45] This could be taken into consideration for our subjects in which most of them are present with bilateral masseter muscle tender points on palpation, which could be due to poor functional overloading of mandibular elevators, as a consequence of cervical extension. These observations match the findings of a similar study by Silva et al (2009) that also detected the highest sensitivity (77%) in the anterior masseter muscle, while using a similar palpation in Helkimo clinical dysfunction index as a measuring tool for TMJ dysfunction. Funakoshy et al also showed craniocervical extension produces greater activity in temporalis and activity in masseter group of muscles using palpation method than in the controls.[46]

TMJ DYSFUNCTION AND NECK PAIN (VAS)

A strong relation has been found between neck pain and temporomandibular symptomatology (r= -.734; p= .000). Comorbidity of TMD and cervical spine disorders is quite common and consists of a composite of functional limitation, pain, tender points, and hyperalgesia indigenous to the upper quarter. **[47]**

The relations of the muscles of mastication, hyoid bone, and posterior cervical musculature during head posture are important when considering the effects of head posture on the rest position of the mandible explains the basis for establishing high negative correlation in our subjects with forward head having neck pain and varying degree of TMJ dysfunction.[36]

A muscle that functions inefficiently over a prolong period to maintain equilibrium, is susceptible to strain and spasm, and can produce poor postural and pain relationships. Postural abnormalities which occur due to repetitive cumulative micro-trauma (misuse or overuse), which compromise the normal propriceptive, vascular and neural interplay of sub occipital region can thus cause cervico-craniofacial pain and can also contribute to TMD**.[48]**

In present study patients with more intensity of neck pain on VAS demonstrated markedly increase in clinically detectable temporomandibular sign (pain on palpation). The anatomic basis for this phenomenon is that, pain is referred from one region to another by sensory nerves that share a common segment within the gray matter of the spinal cord. The region surrounding the TMJ is supplied by cranial nerve V and two cervical nerves (C1, C2). Trigeminal pain is referred to the region anterior to the tragus by way of the auriculotemporal branch of the third division. Pain involving the cervical region is also referred to the posterior aspect of the mastoid region through the greater auricular nerve and lesser occipital nerve, both of which are branches of C2, C3.

Study was performed to assess the prevalence of signs and symptoms of temporomandibular disorders (TMD) in patients with cervical spine disorders (CSD). Joint sounds on active movements, pain on palpation of the TMJ, and masticatory muscles correctly classified 82% (n=113). In spite of the biomechanical and

anatomical relationship between the neck and the stomatognathic system, the findings of present study are lying in range with this study as this study is directed to the neck pain population.[49]

Tsai et al (2002) investigated masticatory muscle activity and jaw positions, as the subjects were placed under the stress of mental arithmetic and noted increased EMG activity of right masseter, right posterior temporalis and suprahyoid muscles under a continuous stress conditions. [50]

RELATIONSHIP BETWEEN AGE AND FORWARD HEAD POSTURE (NIA)

In the present study age is negatively correlated (r = -.846) with neck inclination angle (NIA).i.e. the older the subject, smaller the NIA. The results of present study are consistent with the findings by Yi-Liang Kuo; 2009[51], Yip et al; 2008[52] and Raine and Twomey 1997[53]. It may be attributed to the fact that the severity of postural abnormalities would be greater in an older population as compared with a younger population. M. Dalton (2004) studied the effects of increasing age on cervical posture and anterior-posterior range of motion of spine in normal males (24-60 years) and females (23-63 years) subjects, grouped into 10 years age categories and found that natural head posture was significantly affected by age and there is tendency for a forward head posture to occur with increasing age with the decline on the craniovertebral angle occurring greatly in fourth and sixth decade.[54]

Habits of "falling into gravity" are proposed to become exacerbated with advancing age**.**[55] Studies have shown a reduction in proprioception for neck movements of persons over the age of 45 years, regardless of neck pain. Therefore, age related changes may well contribute to a more forward head posture even in the absence of pain. An additional potential influence the change in natural posture with advancing age is the mechanoreceptor activity in the upper cervical articulation.[56] This mechanoreceptor activity significantly attribute to the postural and kinaesthetic awareness of the head and neck. Therefore, the degenerative changes in the underlying upper cervical joints associated with age may interfere with this activity and consequently contribute to the change in natural head posture with increasing age, which is also revealed by present study results that in age group 40-50 years, there is significant decline in NIA is observed.

According to findings of present study, among the sample (n=71), 2.8% lie in group 0 of no dysfunction, 46.47% lie in group 1 of mild dysfunction, 38.02% lie in group 2 of moderate dysfunction and 12.67% are in group 3 of severe dysfunction, using the modified Helkimo clinical dysfunction index.

In a study by Dr. O. D. Otuyemi (2000) done on Nigerian population (n=308), our findings fall in range with grade 1 dysfunction and mildly with grade 2 dysfunction category as 2.1% showed no dysfunction, 46 % showed mild dysfunction signs (Di I), whilst 16•5% and 0•3% exhibited moderate (Di II) and severe (Di III) signs of TMD, respectively. Similarities in findings may occur due to age group of subjects i.e. 20- 45 years, selected in this study.[57]

These findings are dissimilar with study of Birgit Thilander et al (2002) reported prevalence of temporomandibular dysfunction using the similar index as in the present study. In this study score points above zero were observed in 25.5%, However, a score of 1–4 points (mild dysfunction) was registered in most of these subjects, while 16.6% had a score of 5–9 points (moderate dysfunction) and only a few subjects had a severe dysfunction (a score above 9 points). This discrepancy may be due to the large sample size (n=4724) and target population was children adolescents (5-17 years old).[58]

Pain is known as an important feature of TMD because it is the most important reason for seeking treatment**,** [26] the results of present investigation revealed that less than 76% of the subjects showed clinically detectable pain from the temporomandibular joint. Our findings are inconsistent with those of Lundeen *et al*. (1988) where pain was reported as the commonest sign. This is significant as it is either that the pain is not severe enough to bother them or they have gradually adapted to it or they may be totally ignorant of where to seek for treatment. For example, we observed that many of the patients did not realise that TMD could be managed by the physiotherapist or dentist.[59]

Other findings including the postural assessments in our study confirmed the findings of previous studies [23, 60] which revealed that TM joint is related to changes in body posture, particularly in the cervical spine, head and mandibles. These deviations seem to confirm the relationship between the position of the TMJ and head and associated neck pain.

V. Conclusion

On the basis of findings of present study, we can conclude significant relationships between temporomandibular dysfunction, forward head posture and self reported severity of neck pain in patients with neck pain and TMJ dysfunction.

Limitations

- Factors such as psychosocial, emotional background, activity level of patients in different age groups are not explored in detail, which can influence the pain and disability perception among the patients, Sample size was small.

References:

[1]. Cagnie B, danneels L, Van tiggelen D, De loose V, cambier D. Individual and work related risk factor for neck pain among office workers: a cross sectional study. Eur spine J 2007; 16(5):679-86.
[2]. Calliete R. Degenerative disc disease .2nd ed. F.A.Davis. Philadelphia 1989: 94-105.
[3]. Ariens GA, Van mechelen W, Bongers PM, Physical risk factor for neck pain. Second journal of work environment health 2000; 26:7-19.
[4]. Bovine G, Scharder H., Sand. T. Neck pain in general population. Spine 1994; 19:1307-1310.
[5]. Bryden L eds. craniofacial dysfunction and pain. Manual Therapy assessment and management 8th edn. Butterworth Heinemann, oxford (2001).
[6]. Cote P, Vander Velde G, Cassidy JD, The burden and determinants of neck pain in workers: results of bone and joints decade 2000-2010. Task force on neck pain and its associated disorders. Spine 2008; 33(4s): 60-74
[7]. Braun B.L. Postural differences between symptomatic men and women and craniofacial pain patients. Arch phys med rehabilitation, (1991); 72 (9): 653-6.
[8]. Braun B.L. and Amundson, LR. Quantitative assessment of the head and shoulder posture. Arch of physical medicine and rehabilitation 1989; 70:322-329.
[9]. Jull G, Trot. P, Potter H. A randomized control trial of exercise and manipulative therapy for cervicogenic headache .spine 2002; 27; 1835-1995
[10]. Phil Page, Clark C Frank; assessment and treatment of muscle imbalance- The Janda Approach; Human Kinetics; 2010.
[11]. Okeson JP, Orofacial pain: guidelines for assessment, diagnosis, and management. Chicago: Quintessence; 1996.
[12]. Okeson JP: management of tempormandibular disorders and cclusion, 3rd edt, st. Louis, mosby year book 1993,
[13]. Bell WE: clinical management of temporomandibular disorders, Chicago, 1982, year book medical publisher p 500.
[14]. Griffith RH: report of the president's conference on examination, diagnosis and management of temporomandibular disorders, II version, 2002.
[15]. Armijo-Olivo S, Rappoport K, Fuentes J, Gadotti IC, Major PW; Head and cervical posture in patients with temporomandibular disorders. Journal Orofacial Pain. 2011, Summer; 25(3):199-209.
[16]. Racabado M. Advanced upper quarter manual, Tacoma Wa Racabado Institute, 1981.
[17]. Pamela K. Levangie Cynthia C. Norkin, Joint Structure and Function: A Comprehensive Analysis, C A Davis
[18]. Kendall FP, Maceary Ek. Testing and function, 1982. Williams and Willkins , Baltimore.
[19]. Okeson JP: management of tempormandibular disorders and cclusion, 3rd edt, st. Louis, mosby year book 1993,
[20]. Gonzalez HE, Manns A, Forward head posture: its structural and functional influence on the stomatognathic system, a conceptual study. The journal of Craniomandibular practice.1996 Jan; 14(1):71-80.
[21]. Donald A Newmann, PT, Phd. Kinesiology of musculoskeletal system, foundation for physical rehabilitation, edition III.
[22]. Howard w. Makofsky P.T: the effect of head posture on muscle contact position the sliding cranium theory:the journal of craniomandibular theory, oct 1989, vol 7, no. 4
[23]. Lee WY, Okeson JP; The relationship between forward head posture and temporomandibular disorders; Journal of Orofacial Pain, 2005
[24]. Darlene Hurtlingties- The temporomandibular joint in Hall and Broody - "Therapeutic exercise- moving towards function"-, 3rd edition, and chapter 23 page no. 555.
[25]. Enwemeka CS, Bonet IM, Ingle JA. Postural correction in persons with neck pain. Part ii. Integrated electromyography of the upper trapezius in three simulated neck positions. J orthopedic sports phys therapy 1986; 8:240–2.
[26]. Schuldt k, Ekholm J, Harms-Ringdahl K, Nemeth G; Effects of changes in sitting work posture on static neck and shoulder muscle activity. Journal of Ergonomics 1986; 29:1525–37.
[27]. Bratz lavsky M, VanderEEcken N et al, postural reflexes in cranial muscles in man, Acta. Neurol. Bel. 77.5-11, 1977).
[28]. Joshua Cleland, DPT; Effectiveness of manual physical therapy,therapeutic exercise, and patient education on bilateral disc displacement without reduction of the temporomandibular joint: a single-case design; , JOSPT; volume 34; number 9, September 2004
[29]. Helkimo M. Studies on function and dysfunction of the masticatory system index for anamnestic and clinical dysfunction and occlusal state. *Swed Dent J.* 1994
[30]. Deniz Evcik, Orkun Eksoy; correlation of Temporomandibular joint pathologies, neck pain and postural differences, journal of physical therapy science, 12, 97-100, 2000
[31]. Kendall Florence P. , Elizabeth Kendall McCreary,2005, Muscles: Testing and Function, with Posture and Pain.
[32]. Chiu TW, Ku WY, Lee MH, Sum WK, Wan MP, Wong CY, et al. A study on the prevalence of and risk factors for neck pain among university academic staff in Hong Kong. Journal of Occupational Rehabilitation 2002;12(2):77–91.
[33]. Haughie LJ, Fiebert IM, Roach KE. Relationship of forward head posture and cervical backward bending to neck pain. The Journal of Manual and Manipulative Therapy 1995;3(3):91–7.
[34]. Edward R. Hickey,Mark J. Rondeau,James R. Corrente,Jason Abysalh &Connie J. Seymour, Reliability of the Cervical Range of Motion (CROM) Device and Plumb-Line Techniques in Measuring Resting Head Posture (RHP), Journal of Manual & Manipulative Therapy Volume 8, 2000 - Issue 1
[35]. Lee WY, Okeson JP, Lindroth J: The relationship between forward head posture and temporomandibular disorders. J Orofac Pain, 1995, 9: 161–167.
[36]. D. W. DARLING, M B Glasheen-Wray, Relationship of head posture and the rest position of the mandible, The Journal of Prosthetic Dentistry, vol. 52, issue 1, july 1984, P 111-115
[37]. M Dena Gardiner The Principles of Exercise Therapy M Dena Gardiner Delhi, India CBS Publishers & Distributor, 2004 4th edn
[38]. Oatis CA K*inesiology: The Mechanics and Pathomechanics of Human Movement*,Philadelphia, Pa:Lippincott Williams & Wilkins, 2004
[39]. Pauly JE (1966) An electromyographic analysis of certain movements and exercises of some deep muscles of back. Anat rec 155: 223-234
[40]. Gillies GT, Broaddus WC, Stenger JM, Taylor AG- A biomechanicalmodel of craniomandibular complex and cervical spine based on the inverted pendulum. J Med Eng Technol 1998, 22: 263 - 269

[41]. Leon chaitow Muscle Energy Techniques, 4th Edition, Churchill Livingstone
[42]. Howard W. Makofsky The effect of head postore on muscle contact position: the sliding cranium Theory, The journal of Craniomandibular & sleep Practice, Vol 7,1989-issue 4
[43]. Kapandji, Physiology of joint, vol 3 , Handspring publishing
[44]. OkesonJP. Management of temporomandibular disorders and occlusion. 3rd ed. Saint Louis: Mosby year Book , 1998
[45]. McLean LF, Brenman HS, Friedman MGF: Effects of changing body position on dental occlusion. J Dent Pros 1973
[46]. Funakoshi R. Fujita N, Takehana S. Relations between occlusal interference and jaw muscle activities in response to changes in head posture. J Dent Res 1976;55: 684-690.
[47]. Therapeutic Exercise: Moving Toward Function 3rd Edition, by Lori Thein Brody, Carrie M. Hall, Wolters Kluwer
[48]. Mannheimer J, Attanasio R, CinottiWR, et al (1989) Cervical strain and mandibular whiplash: effects upon the craniomandibular apparatus. Clinical preventive dentistry 11:29-32
[49]. A de Wijer et al. Symptoms of the cervical spine in temporomandibular and cervical spine disorders, J Oral Rehabil. 1996 Nov.
[50]. C. M. Tsai, s. L. Chou, E. N. Gale, W. D. Mccall, Human masticatory muscle activity and jaw position under experimental stress, Journal of Oral Rehabilitation, Vol 29, issue 1
[51]. Yi- Lian Kuo, E;lizabeth A. Tully, Mary P. Galea, Video Analysis of sagittal spinal posture in healthy young and older adults, J of Manipulative and Physiological Therapeutics, Mar 2009, Vol 32, issue 3, P 210- 215
[52]. Yip C. H., Chiu TT, Poon A.T, The relationship between head posture and severity and disability of patients with neck pain, Man. Ther. 200813, 148-154
[53]. S Raine, L T Twomey, Head and shoulder posture variations in 160 asymptomatic women and men , Arch Phys Med Rehabil. 1997 Nov. 78 (!!): 1215 - 23
[54]. Dalton M.Coutts A. The effects of age on cervical posture in a normal population. In: boyling JD, Palastanga N, editors. Grieve'smodern manual therapy: the vertebral column. New York: Churchill Livingstone; 1994
[55]. Griegel-Morris P, Larson K, Mueller-Klaus K, Oatis CA. Incidence of common postural abnormalities in the cervical, shoulder and thoracic regions and their association with pain in two age groups of healthy subjects. Phys Ther 1992;72:425–31
[56]. Wyke B.D.The neurology of joints: a review of general principles, Clin Rheum Dis. 1981; 7: 223-239
[57]. O. D.Otuyemi, J. Owotade Prevalence of Signs and Symptoms of Temporomandibular disorders in young nigerian adults, british orthodontic society 2000.
[58]. Birgit Thilander, LDS, Odont Dr; Guillermo Rubio, DDS; Lucia Pena, DDS, MSc; Clara de Mayorga, BSc, Prevalence of Temporomandibular Dysfunction and Its Association With Malocclusion in Children and Adolescents: An Epidemiologic Study Related to Specified Stages of Dental Development , *Angle Orthod* (2002) 72 (2): 146–154.
[59]. Lundeen *et al*. (1988), evaluation of temporomandibular joint disorders by clinical rating, journal of prosthetic dentistry, vol.59,issue 2, p 202-211
[60]. Marzola FT ,Marques AP,Marzola C. Contribution of physiotherapy to dentistry in temporomandibular joint disorders. Revista Odonto Cincia,2002:17(36):119-33.

Meeta Agarwal, MPT, et. al. "Relationship between Temporomandibular Joint Dysfunction, Forward Head Posture and Severity of Neck Pain in Subjects with Neck Pain and Temporomandibular Joint Dysfunction." *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, 19(12), 2020, pp. 01-10.