ASSESSMENT OF CRANIOCERVICAL POSTURE IN TMJ DISORDERS USING LATERAL VIEW: A CROSS SECTIONAL STUDY

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MASTER OF DENTAL SURGERY

BRANCH IX

ORAL MEDICINE AND RADIOLOGY

2016-2019

CERTIFICATE

This is to certify that the dissertation entitled **"Assessment of Craniocervical posture in TMJ disorders using lateral view: A Cross sectional study."** is a bonafide record of the work done by Dr.Tanuja.S under our guidance during her post graduate study period of 2016-2019. This dissertation is submitted in partial fulfilment of the requirements for the award of MASTER OF DENTAL SURGERY IN BRANCH IX (ORAL MEDICINE AND RADIOLOGY) under THE TAMIL NADU Dr. M.G.R MEDICAL UNIVERSITY, GUINDY, CHENNAI. It has not been submitted (partial or full) for the award of any other degree or diploma.

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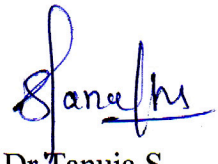

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“Enlightmentis just another word for feeling comfortable with being a completely ordinary person.”

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CONTENTS IN CONCISE

LIST OF ABBREVIATIONS

AP	Anterioposteriorly
AS	Anterior Scalene
CMD	Craniomandibular Disorder
CT	Computed Tomography
CVA	Craniovertebral angle.
CSD	Cervical Spine Disorder
C1	First cervical vertebra
C2	Second cervical vertebra
C3	Third cervical vertebra
C4	Fourth cervical vertebra
C5	Fifth cervical vertebra
C6	Sixth cervical vertebra
C7	Seventh cervical vertebra
EMG	Electromyograph
ML	Mediolaterally
NEMET	Neck Extensor Muscle Endurance Test
OP	Opisthion
SCM	Sternocleidomastoid
T1	First thoracic vertebra
TMD	Temporomandibular Disorders
TMJ	Temporomandibular joint

LIST OF TABLES

LIST OF GRAPHS

LIST OF ANNEXURE	
NO	**TITLE**
APPENDIX - 1	Certificate from Institutional Research Committee Certificate from Institutional Human Ethics Committee
APPENDIX - 2	Patient information sheet ➢ English ➢ Malayalam ➢ Tamil
APPENDIX - 3	Patient consent form ➢ English ➢ Malayalam ➢ Tamil
APPENDIX - 4	Data sheet

ABSTRACT

Background: The temporomandibular joint is which connects the skull to the jaw bone and responsible for jaw bone movements.The etiology of temporomandibular joint disorder is multifactorial. When there is temporomandibular joint disorder it causes pain and restriction in jaw movements.Since the temporomandibular joint is interconnected primarily with musles of mastication like masseter, temporalis, lateral pterygoid muscle, medial pterygoid muscle, and accessory muscles like digastric, stylohyoid, mylohyoid,and geniohyoid, it results in tenderness of the muscles. It also leads to reffered pain in relation to the neck, shoulder and cervical muscles, which in turn resulted changes in head posture. In this study we evaluated postural changes in TMD subjects and comparing the results with healthy subjects.

Aim; To determine the Craniocervical posture in the TMJ disorders from True lateral radiographs in Asymptomatic and symptomatic patients and to compare the changes between the two groups.

Materials and Methods; The study was conducted in department of Oral Medicine and Radiology. The total sample size was 120. The sample was divided in to two groups, Asymptomatic and symptomatic group. And the symptomatic group was further subdivided in to three groups mild, moderate, and severe with 30 subjects in each group.

Healthy volunteers aged between 20-30 years diagnosed without TMD were included in group I and subjects aged between 20-50 yrs diagnosed with TMD

were included in group II and according to Laskin's criteria group II were further subdivided in to mild(Group IIA), moderate (Group IIB) and severe (Group IIC). True lateral view was used as the imaging modality for the study. The angle and linear measurements were done in lateral radiographs with the help of the software Romexis. All the measurements were tabulated and statistical analysis were made using One way ANOVA (Post hoc) followed by Sheffi test.

Results and Discussion: A comparision of angle parameters like craniovertebral angle, cobbs angle, individual vertebral angle, and odontoid plane angle was done in both asymptomatic (Group I) and symptomatic group (Group II). There was a significant difference seen in craniovertebral angle, odontoid plane angle, and individual vertebral angles in group II when compared to that of group I.

Linear measurements like C1-C7 length, Opisthion-C7 length and Opisthion to intersection of CV angle and individual intervertebral spaces were done to cross verify the craniovertebral, odonoid plane angle and individual vertebral angle parameters which totally correlated the linear measurements. TMD had higher percentage in females when compared to males. But mean values of craniovertebral, odontoid plane angle and individual vertebral angles was higher in males when compared to female.

The results of our study revealed changes in craniovertebral, odontoid plane angle and resulted in hyperextension of the head in relation to the cervical spine. In order to cross verify the outcome of these both angles linear

measurements were made. Linear measurements like C1-C7 length, Opisthion-C7 length and Opisthion to intersection of CV angle totally correlated with the individual parameters. Individual vertebral angle showed significance in certain groups and in our opinion hyperextension, leads to greater amount of stress in other cervical vertebrae which causes excessive straining of cervical facets. According to the results of Individual vertebral angle C4 vertebrae was able to withstand greater amount of stress in all groups. Linear measurements of individual intervertebral spaces were measured to cross verify the result which totally correlated with it.

Since this study churned out a few unanticipated results, this can be considered as a forerunner for future studies in this field. We made use of available resources and techniques in our study, but still advanced techniques for assessing the cervical vertebrae and its impact on muscles can provide more insight to the postural changes,which is a very fascinating and prime aspect of health care.

Conclusion; This original study was carried out to assess the postural changes between the temporomandibular joint disorders and healthy individuals through lateral view radiographs. The results showed significant changes of the head in relation to the cervical vertebraes.

This study was a baby step to assess the changes associated with individual cervical vertebrae. The study was precipitous in exposing an important initial change (Dorsoflexion) as a compensatory efforts of the stomatognathic system, unlike what was hither to presumed. The dorsoflexion we understand

is a front runner of the forward head posture which followed,and is anatomically, physiologically explained and logical.

Key words:

Temporomandibular Joint disorders, Tempormandibular Joint, Posture, Skull, Pterygoid Muscles, Masseter Muscles, Radiography, Mastication, Pain, Attitude.

INTRODUCTION

Human craniomandibular system which consists of maxilla, mandible, teeth, temporomandibular joint, and the masticatory muscles, is functionally involved in feeding , speech and also may be of diagnostic value for assessing disorders of stomatognathic system.The temporomandibular joint is a unique feature of the mammalia and no other vertebrates have it.

The area where the mandible articulates with the cranium, is the TMJ. One of the most complex joints in our body is TMJ . It provides hinging movement and also gliding movements, which classifies it as an ginglymoarthrodial joint.[1]

The two bones responsible for formation of TMJ is the mandibular condyle fitting into the mandibular fossa of the temporal bone. The articular disc is which separates these two bones from direct articulation. The TMJ is also otherwise called as a compound joint. By definition, a compound joint requires the presence of at least three bones, yet the TMJ is made up of only two bones. The articular disc which is a nonossified bone that permits funcionally the complex movements of the joint. The craniomandibular articulation is considered as a compound joint since the articular disc functions as a third bone.

The articular disc is composed of dense fibrous connective tissue, avascular,and devoid of nerve fibers. However, slightly innervations are present in periphery of the disc. It can be divided into three regions

according to thickness in the sagittal plane. The intermediate zone is the thinnest and called as central area. Anteriorly and posteriorly to the intermediate zone the disc becomes considerably thicker. The anterior border is generally slightly thinner than the posterior border. In the normal joint the articular surface of the condyle is located on the intermediate zone of the disc, bordered by the thicker anterior and posterior regions.[2]

Unique variations are notable between the structure of the joint of primates and humans, which would help us visualize the image as to how the TMJ had evolved.The TMJ of Homo sapiens, the glenoid fossa of the primates appears shallow, and the articular eminence is poorly developed. Comparatively the primates pre-glenoid plain is larger than humans.

The positional change of the glenoid fossa in the mediolateral part has been noted. In the current period modern man has the fossa medially placed, in our ancestors the fossa was more lateral due to the pneumatization of the tympanic squama,. Since the joint was more functional due to the application of high masticatory forces it led to structural changes of the joint, where it resulted in over all increase in the size of the joint.[3]

By the 10th week of intrauterine life the TMJ begins to develop from two separate blastemas (mesenchymal condensation) – one for the temporal bone component and one for the condylar component.A band of mesenchymal cells present superior to the condylar blastema will

eventually differentiate into the disc. Cartilage develops in the center of the condyle which further differentiates in to secondary cartilage and contributes to the subchondral bone formation. In nature the developing disc is highly cellular and vascular.

It results in development of lateral pterygoid muscle anteriorly and by a ligament with the superior end of the Meckel's cartilage posteriorly, , where this cartilage in future will develop into malleus of the middle ear. At the 14th week of gestation developing TMJ shows all the components of the mature joint. More nerve fibers and blood vessels are found at the peripheries of the fetal disc.

The most prominent feature of the temporal bone's glenoid region is the articular eminence ,a transverse bar of dense bone that forms the anterior boundary of the concave articular fossa. This fossa is the main articulation for the mandibular condyle (via the articular disc), and during occlusion the head of the condyle directly abuts the posterior slope of the articular eminence, rather than lying in the depth of the fossa..

The articular eminence in humans is convex anteroposteriorly (AP) and slightly concave mediolaterally (ML). The lateral temporomandibular and sphenomandibular ligaments are the main extracapsular ligaments that provide stability to the joint. From the anterior process of the malleus, the lips of the petrotympanic fissure, and the spine of the sphenoid , sphenomandibular ligament originates and inserts into the lingual of the

mandibular foramen below. The other accessory ligaments are the pterygomandibular raphae and stylomandibular ligament . The ligament which attaches to the styloid process above and the angle and posterior border of the mandibular ramus below is stylomandibular.

The pterygomandibular raphae attach to the pterygoid hamulus superiorly and to the posterior end of the mylohyoid ridge of the mandible below.[5] Thefunction of the ligament is to safe guard the joint by restricting and limiting border movements. The associated muscles of mastication are masseter, temporalis, medial pterygoid,lateral pterygoid and the digastric.[6] These muscles work closely with the TMJ, thus, helping in the movement of the jaw and mastication.[7]

The temporo mandibular dysfunction is a biomechanical change in the temporomandibular joint that has a multifactorial origin. The body posture has a great relationship with the masticatory muscles through neuromuscular connections .Harmony in muscle mechanism involving the muscles of the head, neck and shoulder girdle plays a essential role in maintaining posture.[8]

Posture is defined as 'the relationship between a segment or part of the body related to other adjacent segments, and the relationship between all the segments to the human body'. It is an indicator of biomechanical efficacy, equilibrium, and neuromuscular coordination.Human beings require a stable and balanced posture for proper movements. The

neuromuscular system is responsible for maintaining the posture of the body and allowing movement to occur.[9]

The cervical vertebrae is intimately related to the cranium and masticatory system through, muscle attachments, joint articulations and neural and vascular innervations.[10] Maintaining the functionality of the system formed by these structures is necessary for postural balance.[11]Therefore postural imbalance occurs mainly due to changes in these structures related to cranio-cervical disorders causing forward head, cervical kyphosis and asymmetric shoulders.

Several studies were carried out to assess the postural balances in the tmj disorders patients.This study investigates the possibility of association between head and cervical posture between TMD(internal derangement and myofascial pain dysfunction syndrome) and non TMD using lateral view anlaysis by Romexis software.

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AIMS AND OBJECTIVES

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- To determine the Cranio cervical posture in the TMJ disorders from lateral radiographs in Asymptomatic and symptomatic patients
- To compare the changes between the two groups.

REVIEW OF LITERATURE

Darling DW, Kraus S, Glasheen-Wray MB in 1984 studied the association of head posture in relation to rest position of mandible. Eight subjects were assessed for the relationship between VDR and head posture. Photographic assessment was done in relation to head position and VDR measurements were taken. Each and every subjects were given physical therapy for 4 weeks to improve their head posture. After 2 and 4 weeks of therapy the photographs were taken again for assessment. And he concluded that increase in the VDR made changes in the angle of the head to the cervical vertebra.[12]

In 1987 Darlow, F studied the postural changes between 30 myofascial pain dysfunction syndrome subjects with 30 healthy individuals. The subjects of myofascial pain dysfunction syndrome associated with pain in the muscles of mastication are only included in the study. He assessed the postural changes with 28 parameters in the both the groups. And he concluded that there are no significant postural changes between the groups.[13]

Clark J et al in 1987 studied the association between craniocervical dysfunction levels in 40 temporomandibular disorder subjects and in 40 healthy individuals.And he concluded that higher significance of changes are seen in temporomandibular disorder subjects and they should always be examined for craniocervical dysfunction.[14]

In 1991 Mannheimer JS, Rossenthal RM studied the relationship between acute and chronic postural abnormalities temporomandibular disorder

subjects. He discussed primarily about the etiology of acute and chronic facial pain in temporomandibular disorder and its associated changes. But he did not make a assessment regarding postural changes pertaining to it.[15]

In 1991 Urbanoicz M studied the alteration of vertical dimension and its effect on postural changes. He studied that change in vertical dimension plays a role in change of head posture. He concluded that increase in the vertical dimension causes changes in posture and causes craniovertebral extension leading to the suboccipital compression which eventually results in postural changes between head and neck.[16]

Braun BL in 1991 studied the postural changes in temporomandibular joint disorder subjects. He also described that women are most commonly affected by neck pain, postural changes when compared to men. In this study he has compared the sagittal head and shoulder posture in healthy individuals with temporomandibular joint disorder subjects . 20 subjects were healthy individuals of both men and women and nine subjects of temporomandibular joint disorder with neck pain were assessed. The parameter used for analyzing the subjects were, computer-assisted slide digitizing system called the Postural Analysis Digitizing System (PADS). He found that sagittal posture does not show any significance to gender related factor in these disorders. But there is significant postural changes in temporomandibular joint disorder subjects with neck pain. Hence he concluded that treatment regarding postural changes should also included in these subjects. [17]

Hackney J Bade D and Clawson A in 1993 studied the association of postural changes in the subjects diagnosed with internal derangement of the temporomandibular joint. The reason of this study was to determine whether internal derangement of the temporomandibular joint had a significantly higher amount of forward head posture than in the healthy individuals. Twenty-two patients of temporomandibular joint with internal derangement were compared with healthy individuals. The angle was measured from four photographs. Two photographs in standing position and two photographs in sitting position. The angle measurements was done by drawing a tangent line from the spinous process of the seventh cervical vertebra to the tragus of the ear and a horizontal line drawn perpendicular to it. The angles were measured from each group. And he concluded that there was no postural changes in the temporomandibular joint subjects with internal derangement when compared with healthy individuals. [18]

In 1994 Baloh RW et al assessed the sway velocity in normal and older individuals during static and dynamic posturography and he also to determined which tests can be best in assessing the changes in "normal" and as well as in older subjects. 30 young individuals and 82 older subjects were assessed. And he concluded that sway velocity was greater in older individuals when compared to the younger group and dynamic posturography was higher in older individuals when compared to younger subjects. [19]

In 1995 Jeffrey P. Okeson, studied the association between forward head posture changes in temporomandibular disorder subjects. Thirty-three

temporomandibular disorder subjects with masticatory muscle tenderness were compared with healthy individuals. The postural changes was measured by angles in photographs. Ear seventh cervical vertebra-horizontal plane and eye-ear-seventh cervical vertebra was also measured. The measurement which showed significant difference was ear-seventh cervical vertebra- horizontal plane. The temporomandibular disorder subjects showed smaller angle when compared to healthy individuals. Therefore he concluded that head was more forwardly positioned in the subjects with temporomandibular disorders than in the healthy individuals. [20]

In a study done by Ciancaglini. R in 1999 The relationship of neck pain with temporomandibular joint dysfunction in the general adult(elderly people) population was evaluated. According to the symptoms pertaining to the TMJ and neck pain 483 subjects were evaluated. Through the questionnaie and clinical evaluation he concluded that there is facial, neck and jaw pain in temporomandibular joint disorders and increases with age and higher prevalence was seen in the women.[21]

Evcik D and Aksoy. O in 2000 studied the association between temporomandibular joint (TMJ) disorders, neck pain and postural changes and healthy controls. Eighteen patients with TMJ and neck pain were included in the study. Cervical X-Ray and Magnetic Resonance Imaging (MRI) of TMJ were taken in both healthy individuals and also for TMJ disorder subjects. Both the groups was assessed by mandibular ROM (active-passive), and head-shoulder angles parameters. The measurement and assessement of angles was

done on patients photographs. And they found a statistical difference in angles between TMJ subjects when compared with healthy individuals. They also concluded postural diiferences are seen in TMJ disorders.[22]

Visscher CM in 2001 assessed the prevalence of cervical spine disorder (CSD) in craniomandibular disorder (CMD) subjects. 250 subjects were included in the study based on oral history, physical examination of masticatory muscles and neck muscles. The CMD subjects were subdivided in three subgroups: 1) subjects with mainly myogenous pain 2) subjects with mainly arthrogenous pain 3) subjects with both myogenous and arthrogenous pain. And he concluded there was no significant difference in craniomandibular subjects in relation to cervical spine.[23]

In 2002 Visscher CM et al studied the relationship of head and postural changes in craniomandibular disorders subjects with and without painful cervical spine and in controls. 250 subjects were included in the study. By the clinical and physical examination of masticatory muscle and neck muscle and from the history of pain , subjects were included in the study. Postural change assessment was done through lateral radiographs of head and cervical spine. Therefore he concluded that there was no postural changes in craniomandibular disorders subjects with and without painful cervical spine when compared to healthy individuals.[24]

Bracco P in 2004 assessed the effects of postural changes in different jaws relations. 95 subjects were included in the study. The posturometric measurements were analyzed through digitalized computer software. The

posturometric measurements were performed in three different mandibular positions such as centric occlusion, rest position and myocentric position. In relation to these position other parameters like teeth engagement, joint position and muscle contraction were included . He found that all the individuals showed difference in body posture in various mandibular positions. It was confirmed by statistical analysis which showed siginificance, when there was a change in jaw position it resulted in postural changes.[25]

Pallegama RW in 2004 et al studied the relationship of electromyographic (EMG) activities of sternocleidomastoid and trapezius muscles in myogenous temporomandibular joint disorder (TMD) subjects with healthy individuals. 8 masticatory muscle pain subjects without disc reduction and 30 subjects with disc reduction was compared with 41 healthy individuals. Portable EMG machine was used to record the activities of sternocleidomastoid and trapezius muscles of all the groups.100 mm visual analogue scale was used to measure the pain intensity. The two groups of patients had significantly higher resting activities when compared with healthy individuals. Subjects in both groups who had pain in both the muscles had higher resting activities when compared to healthy individuals. [26]

In 2005 Munhoz WC, Marques AP, Tesseroli de Siqueira JT studied that postural changes in Temporomandibular dysfunctions (TMD) subjects. He said that temperormandibular joint when affected causes internal dearrangement, which leads to tenderness of the masticatory muscles, and shoulder muscles and have been suggested to be linked to head, neck, and

body posture factors. In this study 30 subjects with temporomandibular dysfunctions were compared with 20 healthy individuals. Analysis was done by photographs. And he concluded that there was no statistically significant differences were found between the subjects. [27]

Olivo SA et al in 2006 assessed the relationship of postural changes in temporomandibular disorders (TMD) through systematic reviews. The reviews were taken from Pubmed, Medline, Lilacs, and Web of Science. Original research articles were evaluated. He found that postural assessment was done in all reviews using poor methodology, the relationship between the head and cervical posture in temporomandibular joint disorders was unclear. And he also concluded postural change assessment in TMD subjects should be assessed by best methodology and should contain greater sample size. [28]

In 2006 Armijo-olivo S. studied the relationship of postural changes in temporomandibular joint disorders. He also described that several studies were done to find the association between head and the cervical spine not only to find the postural changes but also to determine the biomechanical relationship of the head and cervical spine in relation to dentofacial structures. Several methods were there to find the association of postural changes in relation to head and cervical spine. He evaluated the association of head and cervical spine through teleradiographs and cephalometric analysis. Postural changes were evaluated by craniocervical measurements which was done by teleradiographs and comparsion was done with self balanced position where Frankfurt horizontal plane will be parallel to the floor and position of the head

will be according to it.68 subjects were included in the study. Craniocervical angle, Cobb angle, C0–C1 distance, C1–C2 distance and Hyoid Triangle height were measured The software analysis used for craniocervical measurements was Rocabado. He concluded that there was only mild significance of craniocervical angle in the subjects where the cephalostat was used. And there was no changes found in relation to age and the gender. [29]

In 2007 Perinetti.G studied the postural changes and its alteration in body in temporomandibular disorders (TMD) subjects through posturography. Thirty-five healthy controls and 35 TMD patients were assessed respectively. Posturography was performed in both the groups. It was performed by having subjects in various position. Eyes open with mandibular rest position and with dental occlusion, eyes closed with mandibular rest position and with dental occlusion. Static and dynamic posturographic parameters were recorded by sway length, area,velocity through theoretical barycentre respectively. He found that there was no significance in Eyes open with mandibular rest position, Eyes open with dental occlusion for both dynamic and static postures.There was a mild significance in eyes closed with mandibular rest position and with dental occlusion in dynamic posture and no significance in relation to static postures.[30]

In 2009 Matheus RA, studied the postural changes in temporomandibular joint disorders by a systematic review of articles. The reviews were taken from Pubmed, Medline, Lilacs, and Web of Science. Original research articles were evaluated. He found that postural assessment

was done in all reviews using poor methodology, the relationship between the head and cervical posture in temporomandibular joint disorders was unclear. [31]

Armijo-Olivo SL, in 2010 studied the association of maximal cervical flexor muscle strength in individuals with temporomandibular joint disorders. 149 subjects were included in the study. In that 50 subjects were healthy individuals, 54 were myogenous and 45 were both myogenous and arthrogenous TMD subjects. There was no statistically significant differences seen between the groups. And there was no relationship between the maximal cervical flexor muscle strength between the groups. Therefore he concluded that there was no significant association between maximal cervical flexor strength and jaw disability among the groups. [32]

In 2010 Olivo SA,et al studied the relationship between the cervical spine disorders and its impact on temporomandibular joint disorders (TMD) subjects. He also evaluated the level of jaw and neck disability in these subjects through neck disability index and jaw function scale. 154 subjects were included in the study. To analyze the association between the neck and jaw disability spearman rho test was used. There was significant differences seen between jaw and neck disability. This was seen greater in TMD subjects when compared to healthy individuals. Therefore he concluded that TMD subjects have both jaw and neck disability and treatment focus should be given on both for improvement. [33]

In 2010 Armijo-Olivo.S et al studied the capacity of the cervical flexor muscles in subjects with temporomandibular joint disorders and neck

disability. In this study endurance capacity of the cervical muscles in temporomandibular joint disorders subjects was evaluated with healthy individuals. 149 subjects were included in this study. In that 49 subjects were healthy individuals, 54 were myogenous TMD, 46 were both myogenous and arthrogenous TMD subjects. When compared to myogenous TMD and healthy individuals there was a significant difference with mixed TMD. Therefore he concluded that subjects with both myogenous and arthrogenous TMD had less endurance capacity. [34]

In 2011 Armijo-Olivo.S studied the relationship of head and cervical postural changes in temporomandibular joint disorders. He evaluated whether only myogenous or both the myogenous and arthrogeneous subjects with temporomandibular disorders are subjected to postural changes. 154 subjects were included in the study. Of these 50 subjects were controls 55 subjects had myogenous TMD, and 49 subjects had both myogenous and arthrogenous TMD. In these subjects head in the self-balanced position, lateral photographs was taken. The angles were measured in the photographs. The first angle was measured from Eye-Tragus-Horizontal, the second angle was measured from Tragus-C7- Horizontal, the third angle was measured from Pogonion-Tragus-C7, and the fourth angle was measured from Tragus-C7-Shoulder. The software used to measure the angles was Alcimagen.. Among the groups the only angle which showed significance was the Eye-Tragus-Horizontal. Therefore he concluded that significance of Eye-Tragus-Horizontal angle indicates more extended position of the head. [35]

In 2011 Armijo-Olivo. S et al studied the electromyographic activity of the cervical flexor muscles in subjects with temporomandibular joint disorders. The individuals were subjected to craniocervical flexion test . Mostly subjects with temporomandibular joint disorders (TMD) have been shown to have cervical spine dysfunction. Therefore he evaluated electromyographic activity of cervical muscles in temporomandibular joint disorders (TMD) subjects with healthy individuals . 150 subjects were included in this study. In that 47 were healthy individuals,. 54 had myogenous TMD, and 49 myogenous and arthrogenous TMD. All the groups were subjected to perform the Craniocervical flexion test. The electromyographic activity of the sternocleidomastoid (SCM) and anterior scalene (AS) muscles were collected during the CCFT for all the groups. He concluded that there was no statistically significant differences in electromyographic activity of sternocleidomastoid (SCM) and anterior scalene (AS) muscles with mixed and myogenous TMD when compared to healthy individuals but increased activity of the superficial cervical muscles was seen in all TMD subjects.[36]

Armijo-Olivo S, Warren S, Fuentes J, Magee DJ in 2011 studied the clinical relevance and statistical significance of postural changes in temporomandibular joint disorders**..** CranioCervical Flexion Test (CCFT) was done symptomatic individuals to check the endurance of cervical flexor and extensor muscles, maximal muscle strength in cervical muscles and electromyographic activity of the cervical flexor muscles and assess the

postural changes in these individuals. It was concluded that there can be statistical significance without any clinical revelance and vice versa.[37]

In 2012 Armijo-Olivo. S studied the cervical muscle impairments in temporomandibular joint disorders**.** 154 subjects were included in this study. The electromyographic assessment was done in cervical muscles of all the subjects. There was significant difference seen in subjects with myogenous Temporomandibular Disorders when compared to healthy individuals. Maximal cervical flexor extension was not significantly seen in myogenous Temporomandibular Disorders subjects. The electromyographic activity of the sternocleidomastoid or the anterior scalene muscles in subjects with TMD had no significant differences when compared to healthy individuals . He concluded that subjects with TMD presented with reduced cervical flexor as well as extensor when compared to healthy subjects. [38]

Armijo-Olivo S, et al in 2012 studied the relationship of cervical extensor muscles strength in temporomandibular joint disorders (TMD)by neck extensor muscle endurance test (NEMET). 151 subjects were included in the study. In that 47 subjects were healthy individuals, 57 subjects had myogenous TMD, and 47 subjects had both myogenous and arthrogenous TMD. All the groups were subjected to perform the NEMET. This procedure was done when subjects were in lying position in order to reduce the discomfort. Electromyographic activity of the cervical extensor muscles during the NEMET was acquired and evaluated by A 1-way analysis between subjects with TMD and healthy individuals. There was statistically significant

differences seen between the TMD groups when compared to healthy individuals.[39]

In 2013 Rocha C. P studied the relationship of postural changes in relation to head and cervical spine in temporomandibular joint disorders (TMD through systematic review . The original research articles were taken from Medline, ISI Web of Science, EMBASE, PubMed and Lilacs. 22 studies were chosen based on the abstract. These abstract were evaluated and retrieved. 17 studies fulfilled the criteria. Since the selection of methodlogy to assess the head and cervical posture was poor, the relationship of postural changes in temporomandibular joint disorders (TMD subjects remains controversial and unclear.[40]

Durga Okade in 2014 studied craniocervical dysfunction in subjects with temporomandibular joint disorders. The aim is to establish the changes pertaining to cervical dysfunction in myofascial pain dysfunction subjects. 40 subjects were included in the study. 20 subjects had cervical dysfunction with myofascial pain and they were consisdered as group I. 20 subjects only with myofascial pain were consisdered as group II. With the history and physical examination group I was given physiotherapy to the cervical muscles and group II was given physiotherapy to the muscles of mastication. Subjects were assessed postreatment and also for every 3 months. There was significant improvement in the signs and symtoms. And he concluded that cervical dysfunction may one of the etiologies for myofascial pain. [41]

In 2015 Shweta Channavir Saddu et al studied the craniocervical postural changes in subjects with and without temporomandibular joint disorders. Craniocervical posture between individuals with and without TMD is evaluated by both the photographic and radiographic method. 68 subjects were included in the study. 34 subjects were TMD and divided in two groups. Group I subjects with muscle disorder and Group II subjects with disc displacement. 34 subjects were healthy individuals. Head posture angles were measured using lateral view photographs. Angles assessed were Craniocervical Angle, and Suboccipital Space. T-test was used for statistical analysis. There was no statistical significance of head posture changes seen between the groups. The craniocervical angle showed some significance in Group I only. Atlas-Axis Distance was significant in Group II statistically. It was concluded that there was no head postural changes in TMD subjects but cervical lordosis was present in group I subjects. [42]

Silva MP et al in 2016 studied the postural changes in temporomandibular joint disorders by Biofotogrametric and electromyographic analysis. Electromyograph of masticatory and cervical muscles are done in TMD subjects in sitting and standing positions to evaluate the craniocervical postural changes. 21 subjects are included in the study with the mean age group of 28 to 34. Electromyograph of the masseter, anterior temporal and sternocleidomastoid (SCM) and upper trapezius muscles, were taken bilaterally, in both standing and sitting position. The body posture assessment was done by biophotogrammetry in lateral view. The Electromyograph of

masticatory and cervical muscles and photogrammetric values did not show any significance. The electrical activity when done during maximum intercuspation it was significantly lower in the left masseter ,higher in the left anterior temporal muscle and higher in the right and left upper trapezius muscles, in standing position when compared to sitting position. Therefore he concluded that electrical activity of muscles change during sitting and standing position with increase in cervical muscle recruitment than the masticatory muscles which interferes with posture destabilization. [43]

In 2017 Fuentes Fernández R et al studied the postural changes in temporomandibular joint disorders (TMJDs) subjects. He has also described that these can be due to anatomical, neuromuscular and psychological alterations.. An anterior position of the head requires hyperactivity of the posterior neck region and shoulder muscles To prevent the head from falling forward hyperactivity of posterior neck and shoulder muscles is required. In this postural assessment is done in more than one plane(frontal, sagittal) for proper reliability. 78 subjects were included in the study. And the postural assessment was done with the help of acromiopelvimeter, grid panel and Fox plane both qualitatively and quantitatively. And he concluded that there was a significant change in the posture of temporomandibular joint disorders when compared to healthy individuals.[44]

Pacella E, in 2017 done a systematic review in order to assess the relationship between temporomandibular joint disorders and its relation to craniocervical posture. After a review of several studies he concluded that even

though there was, relationship between the posture and temporomandibular joint these studies are not enough to speak the correlation between temporomandibular disorders and its associated postural changes because of its poor design and diagnostic techniques. Hence further studies, are required to establish the association between postural changes and TMD.[45]

In 2017 Greenbaum T, Dvir Z , Reiter S , Winocur E studied the postural changes in myogenic TMD disorders through Cervical flexion-rotation test and physiological range of motion. 20 women with myogenic TMD are measured for the range of motion of neck , FRT and compared with 20 age healthy subjects. When compared to healthy subjects women with myogenic TMD had lower FRT scores. TMD subjects had 90% positive FRT when compared to healthy subjects. In myogenic TMD C1-C2 are potentially involved when compared to other cervical joints. [46]

MATERIALS AND METHODOLOGY

The study was conducted in the department of Oral Medicine and Radiology, Sree Mookambika Institute of Dental Sciences, Kulasekharam, Kanyakumari district to assess the postural changes in TMD subjects versus controls on lateral view images.

METHOD OF SELECTION OF DATA

SAMPLING

Sample size is collected based on the equation **n=** $\frac{Z^2S^2}{d^2}$

Z = Z value associated with confidence = 1.96

S = Standard deviation of mean = 1.42

D = Absolute precision = 1.2

Sample size = 5.3= 6

a. Sampling technique used in the study: Systematic random sampling

1. **Sample Size**

Total number of subjects: 120

Total number of TMD : 90

Total number of Controls: 30

b. Number of groups to be studied: 2 Groups

c. Detailed description of the groups:

1st group consisting of 30 cases of healthy volunteers

2nd group consisting of 90 cases of symptomatic patients with TMJ disorder according to **Laskin's criteria**.

2nd group subdivided in to three groups

- **Mild (30 cases**) : Mild cases are patients with TMJ disorder without any masticatory muscle tenderness and radiating pain to shoulders.

- **Moderate (30 cases**) : Moderate cases are patients with TMJ disorder and with masticatory muscle tenderness without radiating pain to shoulders.

- **Severe (30 cases**) : Severe cases are patients with TMJ disorder with masticatory muscle tenderness and radiating pain to shoulders.

Selection of cases

Inclusion criteria:

- Patients aged above 20 years diagnosed with TMJ disorders.
- Patients with internal disc dearrangement.
- Patients with myofascial pain dysfunction syndrome.
- Patients undergoing/undergone orthodontic treatment.
- Patients with malalignment or malocculsion
- Patients with missing teeth

- Patients with parafunctional habits like bruxism, clenching, and other masochistic habits.

Exclusion criteria:

- Patients with other TMJ disorder like osteoarthritis, osteoarthrosis, polyarthritis, ankylosis, fibromyalgia etc.
- Patients with age below 20 yrs and above 50 yrs.
- Patients with whiplash injuries.

Selection of Control Group:

Inclusion criteria:

- Healthy volunteers aged above 20 years diagnosed without TMJ disorders
- Patients without internal disc dearrangement .
- Patients without myofascial pain dysfunction syndrome.
- Patients who have not undergone orthodontic treatment.
- Patients with proper occlusion.
- Patients without any missing teeth.
- Patients without any parafunctional habits.
- Patients with patent airway.

Exclusion criteria

- Patients with other TMJ disorders like osteoarthriris, osteoarthrosis, polyarthritis, ankylosis, fibromyalgia etc
- Patients with age below 20 yrs and above 30 yrs.

PARAMETERS TO BE STUDIED :

- Craniovertebral angle
- Cobbs angle
- Individual vertebral angles
- Odontoid plane angle.
- Linear measurements.

CRANIOVERTEBRAL ANGLE

This angle is formed by a tangent line drawn from the posterior nasal spine to the opisthion and a tangent line marked to the most posterior surface of the body from the first to seven cervical vertebrae extending to the cranium. The intersecing point of these tangent line forms the craniovertebral angle.This angle measures the position of the head in relation to spine**.** The landmark used to measure the postural changes must be present below the skull because it is the area where the whole weight of the skull rests, hence opisthion was taken to measure the postural changes of head in relation to spine.

COBBS ANGLE

The Cobbs angle is the result of intersection of the two perpendicular lines. One perpendicular to the superior end plate of $C_7$and the other perpendicular to the superior end plate of C_3.It measures the degree of curvature of spine.

INDIVIDUAL VERTEBRAL ANGLES

The Individual vertebral angles is measured by making tangent line drawn from the opisthion to the posterior surface of the spinous process of C_7 and superior surface body of the cervical vertebrae from C_3 to C_7 connecting to the tangent line. Used to assess changes in various vertebral stacking.

ODONTOID PLANE ANGLE

To localize the dimensional relation of the skull to the vertebrae. A tangent line is drawn from menton which passes through gonion to reach opisthion. This line bisects the vertebral tangent line which pass through the most posterior surface bodies of the first to seventh cervical vertebrae extending to the cranium. This is used as it appears to be the most logical relation of the skull to the vertebral stack and also to assess the changes.

LINEAR MEASUREMENTS

- Opisthion to intersecting point of craniovertebral angle.
- Opisthion to spinous process of seventh cervical vertebrae.
- Body of Atlas (first cervical vertebrae) to the lower border of seventh cervical vertebrae.
- These measurements were included to assess and cross verify the changes present in the angle parameters of head in relation to spine.
- Individual inter vertebral spaces measured from C1-C7.

- These measurements were included to assess and cross verify the changes pertaining to individual vertebrae

Method/Technique/instruments/Reagents/Kit:

- Ideal Images from the Planmeca Proline XC Digital Orthopantomograph Machine, "Romexis " software

PROCEDURE

The study was conducted in the Sree Mookambika Instiute of dental sciences, kulasekharam, Kanyakumari district. The study involved two groups asymptomatic (Group I) and symptomatic (Group II) with 30 subjects in each group. The symptomatic group is further subclassified in to three groups Mild (Group IIA), Moderate (Group IIB), and Severe (Group IIC). The total sample size was 120. Based on inclusion and exclusion criteria the samples were selected

The subjects were grouped according to the presence or absence of temporomandibular joint disorder, myofascial pain dysfunction syndrome based on laskin's criteria. The laskin's criteria consists of four cardinal signs such as unilateral pain, muscle tenderness, clicking or popping noise in the tmj,and limitation of jaw movements. Once the subject was confirmed and found to have temporomandibular joint disorder they were subjected to lateral view imaging.

The lateral view image was taken in order to assess the changes pertaining to craniocervical segment. Another advantage of lateral view imaging in

temporomandibular joint disorder subjects was assessment of airway passage can be done. Although some disadvantages like studying a three dimensional object with a two dimensional picture , super imposing strctures and having the patient awake and in upright position lateral cephalograph is a non invasive , inexpensive, universally available, and technically easy to approach for evaluation of skeletal and soft issue abnormalities.[47-52]

The digital lateral view imaging was taken in subjects with natural head position covering till C7 cervical vertebrae. Adoption of natural head position is necessary for representing the relation of craniocervical strctures to changes in head posture.The lateral view imaging was taken til C7 vertebrae for the assessment of individual vertebral angles and its impact pertaining to the changes in the head posture.

The use of higher modalities like CT was not considered because of its cost and radiation. The other advantage with lateral view was its primary requirement in assessment of head posture, patent airway,diagnostic sequence, and hence avoiding ethical concerns.

The postural assessment was done in lateral view images in both symptomatic and asymptomatic group by using four parameters such as craniovertebral angle, odontoid plane angle, cobbs angle, and individual vertebral angles. Linear measurements were taken to cross verify and assess the changes

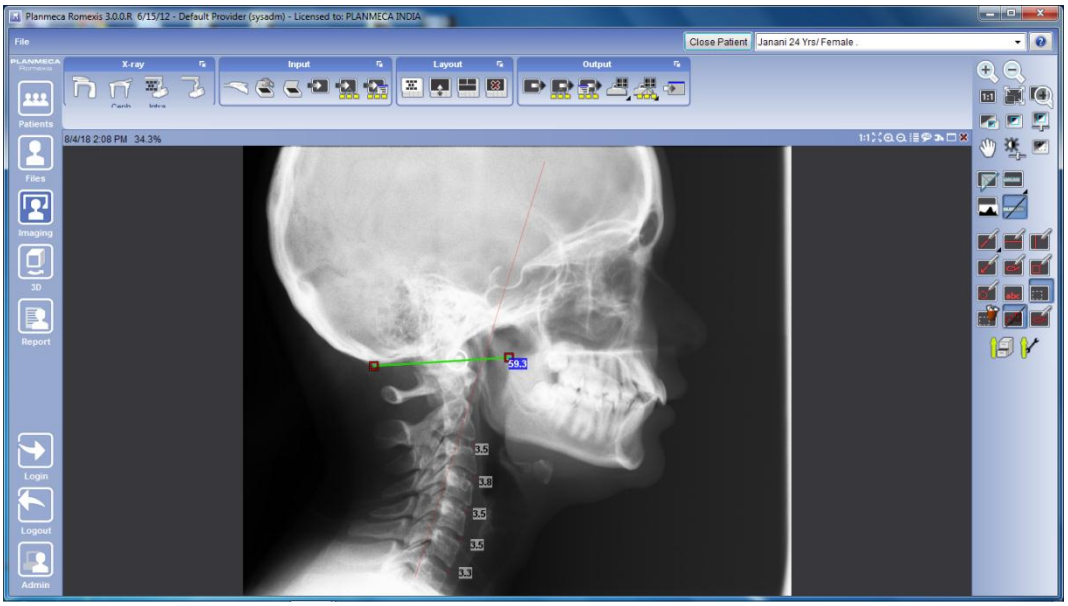
pertaining to angle measurements. The angle and linear measurements was done using Romexis software 4.0. This software is advanced and easy to use and provides a rich set of tools to meet the imaging requirements. It supports both 2D and 3D imaging modalities. It has excellent tools for image viewing, enhancement, measurement, drawing, annotations, and it also improves the diagnostic value of radiographs.

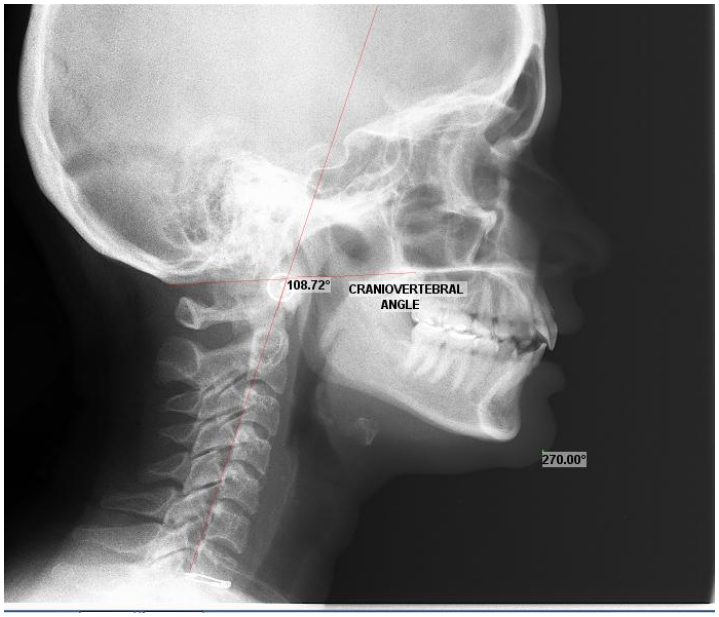
The data of both case and control are entered in to the data sheet. The craniocervical posture of Temperomandibular joint disorder versus controls will be compared. The results will be obtained by the Z-test statistical analysis.

FIGURES

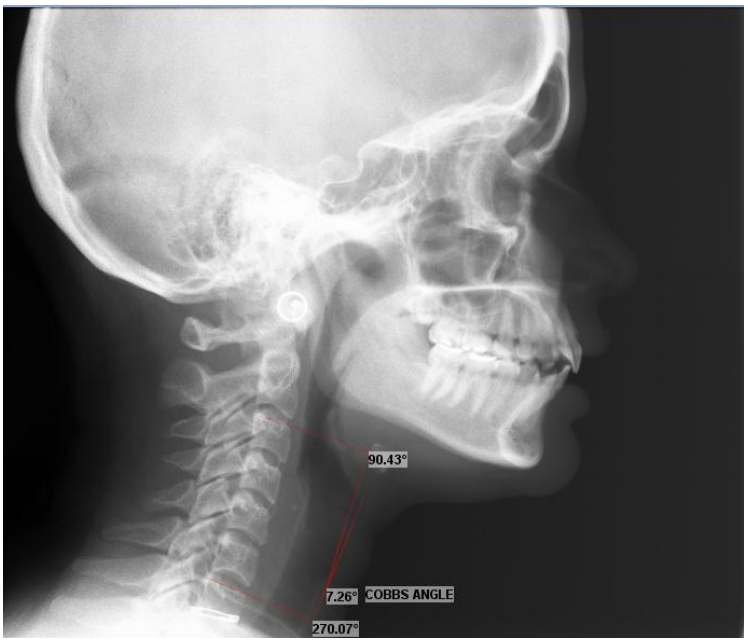
ORTHOPANTOMOGRAPH MACHINE

ROMEXIS SOFTWARE

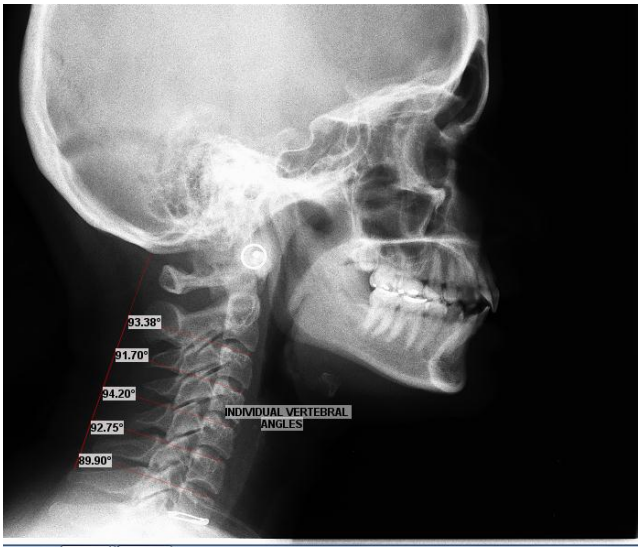




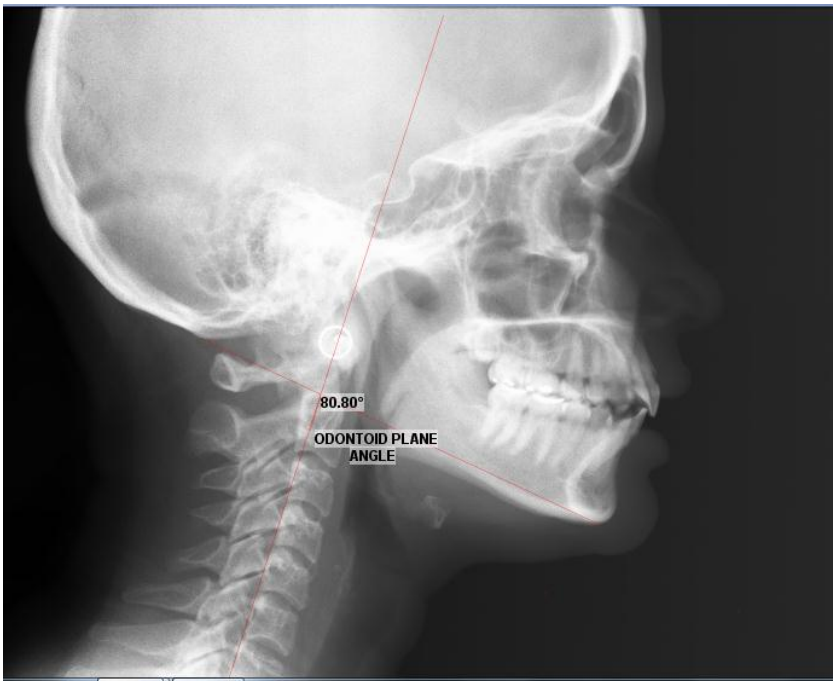
CRANIOVERTEBRAL ANGLE



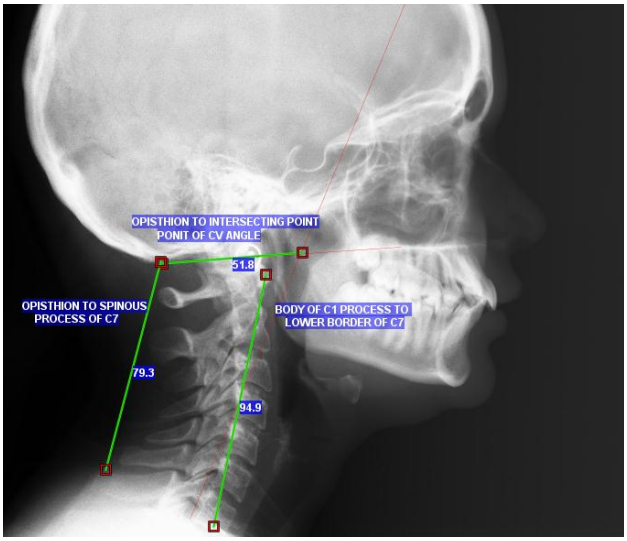
COBBS ANGLE



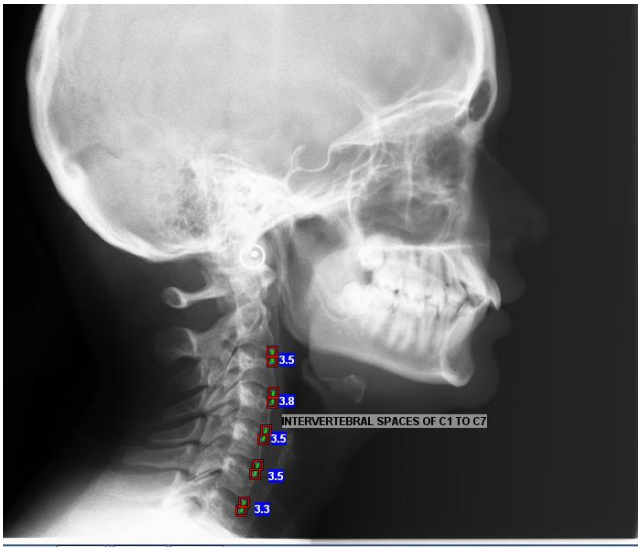
INDIVIDUAL VERTEBRAL ANGLE



ODONTOID PLANE ANGLE



LINEAR MEASUREMENTS



INDIVIDUAL INTERVERTEBRAL SPACES

RESULTS

RESULTS

STATISTICAL ANALYSIS

The data was expressed in mean and standard deviation (MEAN±SD). Statistical Package for Social Sciences (SPSS 16.0) version used for analysis. ANOVA (Post hoc) followed by Sheffi test applied to find the statistical significant between the groups. P value less than 0.05 ($p<0.05$) considered statically significant at 95% confidence interval.

The present study was conducted to assess the postural changes (head posture) in temporomandibular joint disorders (symptomatic) with healthy controls (asymptomatic).It was carried out on a study group comprising of 30 healthy individuals (Group I) in comparision with three different groups (Group IIA,Group IIB, Group IIC) comprising of 90 individuals containing temporomandibular joint disorder. Assessment of postural changes are determined by four angles such as craniovertebral angle, odonoid plane angle, cobbs angle, and individual vertebral angles. P values less than 0.05 considered statically significant at 95% confidence interval.

The mean value of craniovertebral angle are found to be 103.56±6.40 in Group I, 105.65±6.75 in Group IIA, 111.11±6.15 in Group IIB, 111.11±6.16 in Group IIC The mean value of odontoid plane angle are found to be 75.26±5.00 in Group I, 75.58±6.44 in Group IIA**,** 81.23±6.44 in Group IIB**,** 81.42±4.77 in Group IIC**.** The mean value of cobbs angle are found to be 5.07±2.01 in Group I, 6.54±2.10 in Group IIA**,** 7.82±2.86 in Group IIB**,** 6.74±3.36 in Group IIC**.**

The mean value of individual vertebral angle in relation to C3 are found to be 93.27±3.30 in Group I, 94.60±2.94 in Group IIA**,** 93.21±3.36 in Group IIB**,** 95.22±3.09 in Group IIC**.** The mean value in relation to C4 are found to be 92.41±3.06 in Group I, 93.03±2.80 in Group IIA**,** 92.61±2.79 in Group IIB with**,** 93.87±3.89 in Group IIC**.** The mean value in relation to C5 are found to be 92.82±4.20 in Group I, 92.84±2.72 in Group IIA**,** 91.98±3.64 in Group IIB**,** 93.41±2.72 in Group IIC**.**

The mean value in relation to C6 are found to be 91.92±3.32 in Group I**,** 92.31±3.18 in Group IIA**,** 90.66±3.61 in Group IIB**,** 92.42±2.41 in Group IIC**.** The mean value in relation to C7 are found to be 89.73±4.04 in Group I**,** 90.90±3.43 in Group IIA**,** 89.08±4.60 in Group IIB**,** 91.27±3.11 in Group IIC.

A comparision of mean value of craniovertebral angle in relation to Group I with other groups showed significant difference in mean values of Group IIB and Group IIC. A comparision of mean value of odontoid plane angle in relation to Group I with other groups showed significant difference in mean values of Group IIB and Group IIC. A comparision of mean value of cobbs angle in relation to Group I with other groups showed mild significant difference only in mean values of Group IIB.

A comparision of mean value of individual vertebral angle C3,C4,C5,C6,C7, in relation to Group I with other groups showed significant difference of mean value between the groups. A comparision of mean value of

individual vertebral angle C3,C4,C5,C6,C7, in relation to Group IIA with other groups showed significant difference of mean value between the groups.

To verify the significance of craniovertebral, odontoid plane angle linear measurements was done. The linear measurements from The decrease in the length of opisthion to spinous process of C7 and increase in body of odontoid (C1) to C7 cervical vertebrae suggested that length decreases proportionately in severe symptomatic subjects. And there was increase in length of opisthion to the intersecting point of craniovertebral angle in symptomatic groups.

To verify the significance of individual vertebrae linear measurements of individual intervertebral spaces were measured. . In mild subjects the changes were seen in C3, C5, C7. In moderate group changes was seen C5,C6. In severe group changes was seen in C3,C4,C5,and C7.

A comparision of gender distribution between the symptomatic groups(Group IIA, Group IIB, Group IIC) showed higher percentage of female ratio compared to males. A comparision of age distribution between the symptomatic groups (Group IIA, Group IIB, Group IIC) showed higher percentage of ratio in the middle aged group.

TABLES

Table-1: Mean age of the patients of different groups

Groups	Age (MEAN±SD)
Group-I	31.13±9.77
Group-IIA	30.13±1.03
Group-IIB	30.53±8.70
Group-IIC	32.03±9.81

Table-2: Distribution of patients based on the gender

Groups	Male		Female	
	Number	Percentage (%)	Number	Percentage (%)
Group-I	6	20.00	24	80.00
Group-IIA	13	43.33	17	56.57
Group-IIB	10	33.33	20	66.67
Group-IIC	8	26.67	22	73.33

Table-3: Mean values of different angels of TMJ

Groups	Cranio vertebral angle (MEAN±SD)	Odontoid plane angle (MEAN±SD)	Cobbs angle (MEAN±SD)
Group-I	103.56±6.40	75.26±5.00	5.07±2.01
Group-IIA	105.65±6.75	75.58±6.44	6.54±2.10
Group-IIB	111.11±6.15	81.23±6.44	7.82±2.86
Group-IIC	111.11±6.16	81.42±4.77	6.74±3.36

Table-4: Mean vales of individual vertebral angles of TMJ

Groups	C3 (MEAN±SD)	C4 (MEAN±SD)	C5 (MEAN±SD)	C6 (MEAN±SD)	C7 (MEAN±SD)
Group-I	93.27±3.30	92.41±3.06	92.82±4.20	91.92±3.32	89.73±4.04
Group-IIA	94.60±2.94	93.03±2.80	92.84±2.72	92.31±3.18	90.90±3.43
Group-IIB	93.21±3.36	92.61±2.79	91.98±3.64	90.66±3.61	89.08±4.60
Group-IIC	95.22±3.09	93.87±3.89	93.41±2.72	92.42±2.41	91.27±3.11

Table-5: Comparison of mean angles values of Group-I with other groups

Groups	Cranio vertebral angle (MEAN±SD)	p value	Odontoid plane angle (MEAN±SD)	p value	Cobbs angle (MEAN±SD)	p value
Group-I	103.56±6.40		75.26±5.00		5.07±2.01	
Group-IIA	105.65±6.75	0.65	75.58±6.44	0.99	6.54±2.10	0.20
Group-IIB	111.11±6.15*	0.01	81.23±6.44*	0.02	7.82±2.86	0.02
Group-IIC	111.11±6.16*	0.01	81.42±4.77*	0.01	6.74±3.36	0.11

(*p<0.05 significant compared Group-I with other groups)

Table-6: Comparison of mean vales of individual vertebral angles of C3, C4 and C5 of Group-I with other groups

Groups	C3 (MEAN±SD)	p value	C4 (MEAN±SD)	p value	C5 (MEAN±SD)	p value
Group-I	93.27±3.30		92.41±3.06		92.82±4.20	
Group-IIA	94.60±2.94*	**0.04**	93.03±2.80*	**0.40**	92.84±2.72	**1.00**
Group-IIB	93.21±3.36	**1.00**	92.61±2.79	**0.99**	91.98±3.64*	**0.04**
Group-IIC	95.22±3.09*	**0.04**	93.87±3.89*	**0.04**	93.41±2.72*	**0.04**

(*p>0.05 significant compared group-I with other groups)

Table-7: Comparison of mean vales of individual vertebral angles of C6 and C7 of Group-I with other groups

Groups	C6 (MEAN±SD)	p value	C7 (MEAN±SD)	p value
Group-I	**91.92±3.32**		**89.73±4.04**	
Group-IIA	**92.31±3.18***	**0.04**	**90.90±3.43***	**0.04**
Group-IIB	**90.66±3.61***	**0.04**	**89.08±4.60**	**0.83**
Group-IIC	**92.42±2.41**	**0.95**	**91.27±3.11***	**0.04**

(*p>0.05 significant compared group-I with other groups)

Table-8: Mean values of different angels of TMJ of males

Groups	Cranio vertebral angle (MEAN±SD)	Odontoid plane angle (MEAN±SD)	Cobbs angle (MEAN±SD)
Group-I	**101.41±9.78**	**75.75±5.65**	**5.15±2.71**
Group-IIA	**106.59±8.38**	**76.39±7.76**	**6.66±2.82**
Group-IIB	**108.62±4.60**	**80.95±6.94**	**7.94±3.42**
Group-IIC	**114.30±5.78**	**83.69±4.04**	**6.32±2.34**

Table-9: Mean vales of individual vertebral angles of TMJ of males

Groups	C3 (MEAN±SD)	C4 (MEAN±SD)	C5 (MEAN±SD)	C6 (MEAN±SD)	C7 (MEAN±SD)
Group-I	**91.73±4.78**	**91.73±4.64**	**90.26±6.36**	**90.49±4.68**	**86.77±6.06**
Group-IIA	**95.37±2.56**	**93.18±2.51**	**93.28±2.11**	**92.25±3.32**	**91.43±3.73**
Group-IIB	**93.81±3.79**	**93.04±3.60**	**92.78±3.94**	**90.15±4.91**	**88.54±5.72**
Group-IIC	**96.37±3.91**	**96.04±4.61**	**94.64±3.95**	**94.02±2.56**	**92.79±3.67**

Table-10: Mean values of different angels of TMJ of females

Groups	Cranio vertebral angle (MEAN±SD)	Odontoid plane angle (MEAN±SD)	Cobbs angle (MEAN±SD)
Group-I	**104.09±5.43**	**75.14±4.95**	**5.05±1.87**
Group-IIA	**104.93±5.36**	**74.95±5.48**	**6.46±1.41**
Group-IIB	**112.35±6.55**	**81.37±6.35**	**7.76±2.63**
Group-IIC	**110.01±6.03**	**80.58±4.83**	**6.90±3.70**

Table-11: Mean vales of individual vertebral angles of TMJ of females

Groups	C3 (MEAN±SD)	C4 (MEAN±SD)	C5 (MEAN±SD)	C6 (MEAN±SD)	C7 (MEAN±SD)
Group-I	**93.66±2.83**	**92.58±2.64**	**93.47±3.37**	**92.28±2.91**	**90.47±3.12**
Group-IIA	**94.01±3.14**	**92.92±3.08**	**92.51±3.12**	**92.36±3.17**	**90.50±3.24**
Group-IIB	**92.91±3.18**	**92.40±2.37**	**91.58±3.51**	**90.92±2.87**	**89.36±4.08**
Group-IIC	**94.80±2.71**	**93.08±3.37**	**92.96±2.07**	**91.84±2.12**	**90.71±2.77**

Table-12: Comparison of cranio verterbral angle, odontoid plane angle, between males and females

Groups	Cranio verterbral angle (MEAN±SD)		p value	Odontoid plane angle (MEAN±SD)		p value
	Female	Male		Female	Male	
Group-I	104.09±5.42	101.41±9.78	0.03	75.14±4.95	75.74±5.65	0.03
Group-IIA	104.93±5.36	106.59±8.38*		74.95±5.48	76.39±7.67	
Group-IIB	112.35±6.55*	108.62±4.60*		81.37±6.35*	80.95±6.94*	
Group-IIC	110.01±6.03*	114.30±5.73*		80.58±4.83*	83.69±4.03*	

(*p<0.05 significant)

Table-13: Comparison of Cobbs angle, C3 between males and females

Groups	Cobbs angle (MEAN±SD)		p value	C3 (MEAN±SD)		p value
	Female	Male		Female	Male	
Group-I	5.05±1.87	5.15±2.71	0.04	93.66±2.83	91.73±4.78	0.03
Group-IIA	6.46±1.41	6.66±2.82		94.01±3.14	95.37±2.56*	
Group-IIB	7.76±2.63*	7.94±3.42*		92.91±3.18*	93.81±3.79	
Group-IIC	6.90±3.70	6.32±2.33		94.80±2.71	96.37±3.91*	

(*p<0.05 significant)

Table-14: Comparison of C4 and C5 between males and females

Groups	C4 (MEAN±SD)		p value	C5 (MEAN±SD)		p value
	Female	Male		Female	Male	
Group-I	92.58±2.64	91.73±4.64	0.02	93.47±3.37	90.26±6.36	0.02
Group-IIA	92.92±3.08	93.18±2.51		92.51±3.12	93.28±2.11	
Group-IIB	92.40±2.37	93.04±3.60		91.58±3.51	92.78±3.94	
Group-IIC	93.08±3.37	96.04±4.61*		92.96±2.07	94.64±3.95*	

(*p<0.05 significant)

Table-15: Comparison of C6 and C7 between males and females

Groups	C6 (MEAN±SD)		p value	C7 (MEAN±SD)		p value
	Female	Male		Female	Male	
Group-I	92.28±2.91	90.49±4.68	0.04	90.47±3.12	86.77±6.06	0.02
Group-IIA	92.36±3.17	92.25±3.32		90.50±3.24	91.43±3.73*	
Group-IIB	90.92±2.87	90.15±4.91		89.36±4.08	88.54±5.72	
Group-IIC	91.84±2.12	94.02±2.56*		90.71±2.77	92.79±3.67*	

(*p<0.05 significant)

Table-16: Comparison of C1-C7 length, Opesthion-C7 and Opesthion to intersection of CV angle of Group-I with other groups

Groups	C1-C7 length (MEAN±SD)	p value	Opesthion-C7 (MEAN±SD)	p value	Opesthion to intersection of CV angle (MEAN±SD)	p value
Group-I	104.03±7.14		95.32±7.24		37.64±6.08	
Group-IIA	104.48±8.07	0.45	93.76±10.62	0.23	38.86±6.25	0.17
Group-IIB	103.97±9.48*	0.04	90.95±8.76*	0.04	42.67±8.36*	0.03
Group-IIC	102.83±9.02*	0.04	90.05±7.74*	0.04	44.05±6.52*	0.03

(*p<0.05 significant compared Group-I with other groups)

Table-17: Comparison of mean C2-C3, C3-C4, C4-C5 values of Group-I with other groups

Groups	C2-C3 (MEAN±SD)	p value	C3-C4 (MEAN±SD)	p value	C4-C5 (MEAN±SD)	p value
Group-I	3.54±0.85		3.75±0.70		3.84±0.67	
Group-IIA	3.70±0.53	0.56	3.82±0.56	0.32	3.83±0.62	0.53
Group-IIB	3.92±0.72	0.76	3.82±0.80	0.85	4.01±0.69*	0.04
Group-IIC	3.93±0.48*	0.04	3.93±0.47*	0.04	4.08±0.61*	0.04

(*p<0.05 significant compared Group-I with other groups)

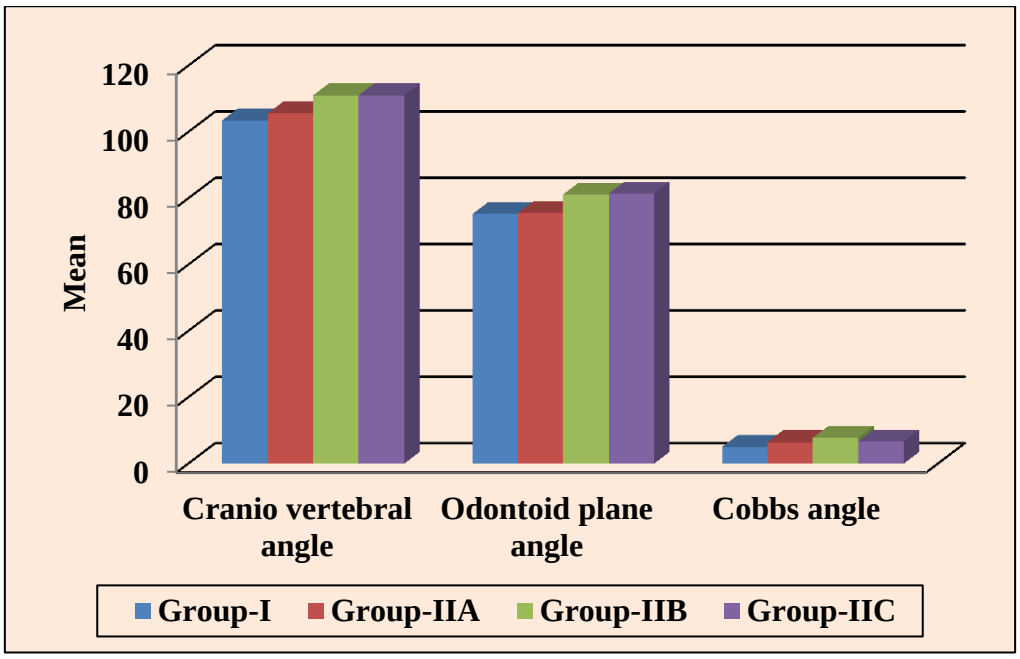
Table-18: Comparison of mean C5-C6, C6-C7 values of Group-I with other groups

Groups	C5-C6 (MEAN±SD)	p value	C6-C7 (MEAN±SD)	p value
Group-I	**3.80±0.60**		**4.07±0.87**	
Group-IIA	**3.75±0.60**	**0.43**	**3.90±0.58***	**0.04**
Group-IIB	**3.88±0.78***	**0.04**	**3.88±0.74***	**0.03**
Group-IIC	**3.79±0.54**	**0.23**	**4.01±0.52***	**0.04**

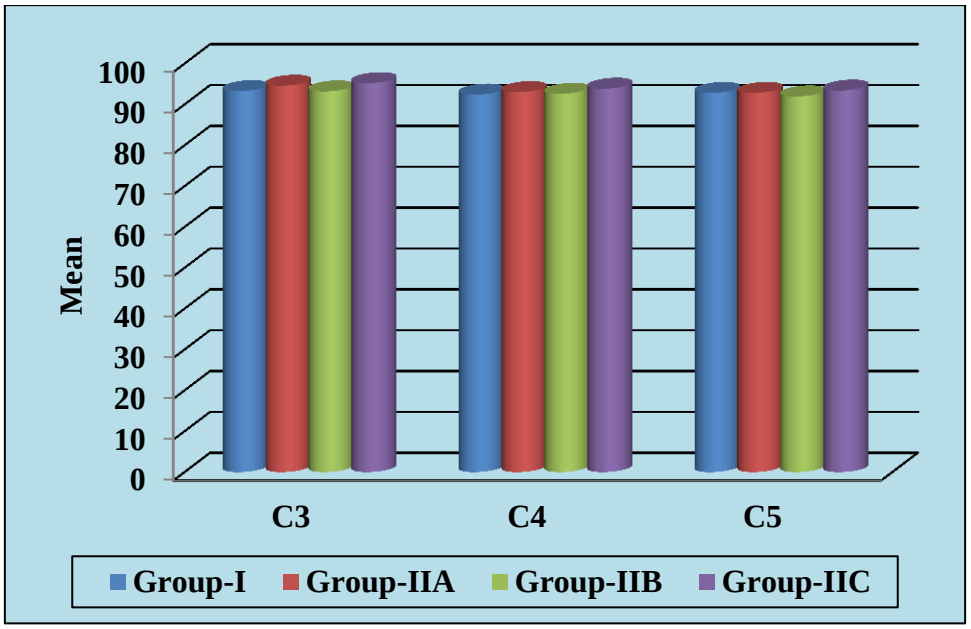
(*p<0.05 significant compared Group-I with other groups)

GRAPHS

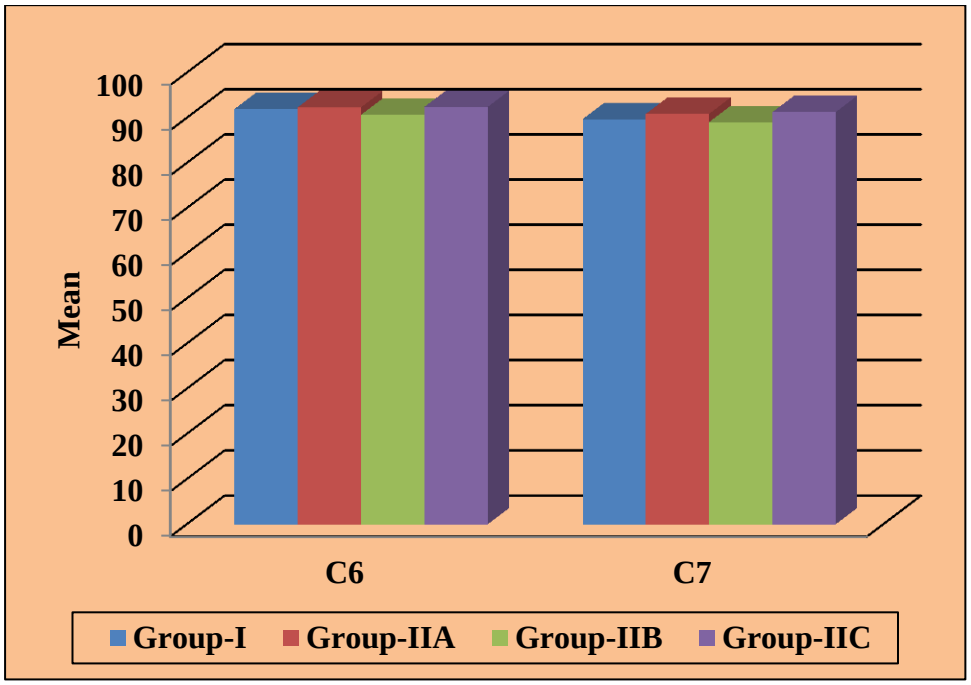
Graph-1: Comparison of mean angles values of Group-I with other groups



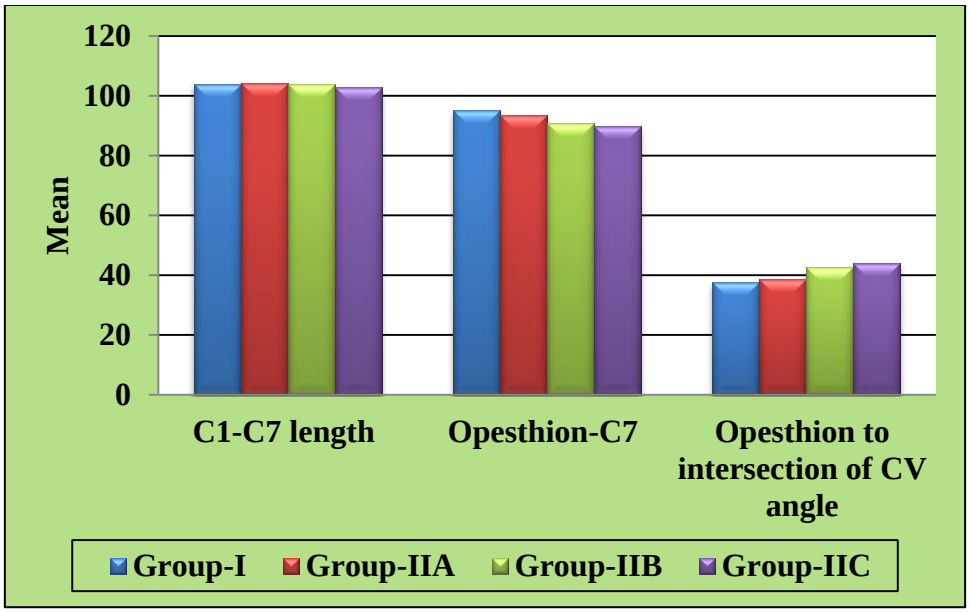
Graph-2: Comparison of mean vales of individual vertebral angles of C3, C4 and C5 of Group-I with other groups



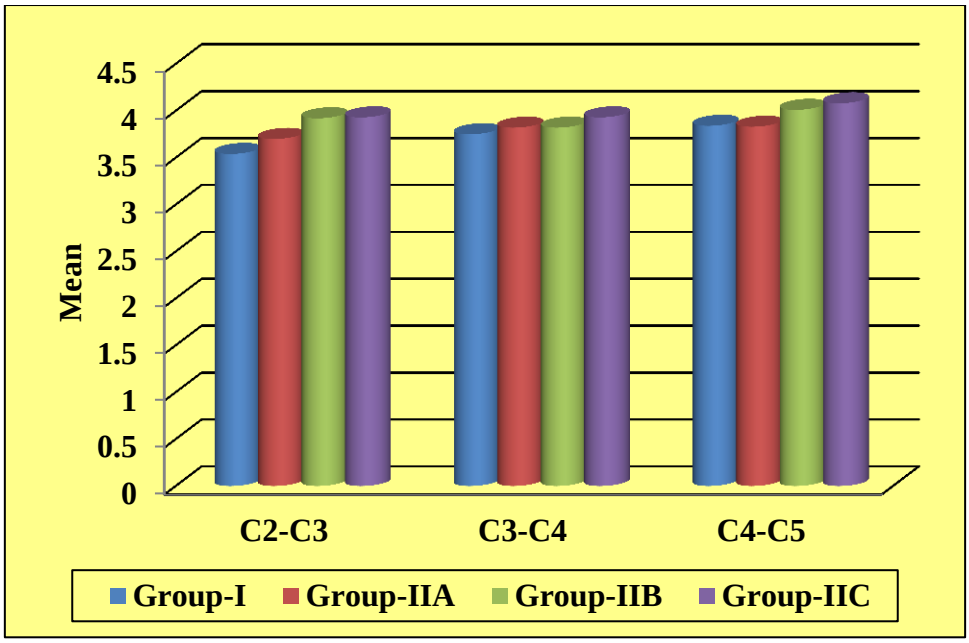
Graph-3: Comparison of mean vales of individual vertebral angles of C6 and C7 of Group-I with other groups



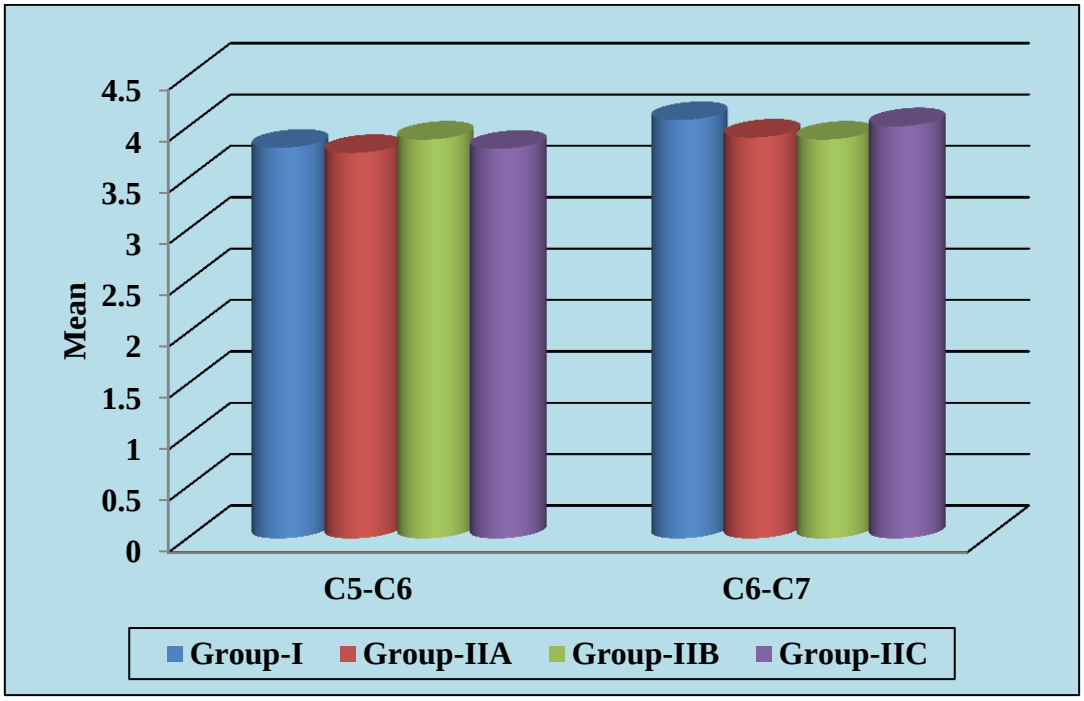
Graph-4: Comparison of C1-C7 length, Opesthion-C7 and Opesthion to intersection of CV angle of Group-I with other groups



Graph-5: Comparison of mean C2-C3, C3-C4, C4-C5 values of Group-I with other groups



Graph-6: Comparison of mean C5-C6, C6-C7 values of Group-I with other groups



DISCUSSION

Several research studies were done in assessing the postural changes in temporomandibular joint disorders. Several authors suggested various findings. Alessandro.N revealed there was significant postural changes in temporomandibular joint disorders .[53]

Gonzalez and Manns postulated that the Forward Head Position (FHD) is characterized by an extension of the head together with the upper cervical spine (C1-C3), accompanied by a flexion of the lower cervical spine (C4-C7), whereby the cervical curvature is increased, a condition called hyperlordosis. However, it was commonly observed in TMD patients that a hyperextension of the upper cervical spine and a straightening of the lower cervical spine through a conceptual study. [54]

Silva MP stated that with increase in cervical muscle recruitment than the masticatory muscles which can interfere with posture destabilization.[44] But still a thought arises whether temporomandibular joint disorder can potentially cause postural changes and to that our study gave an interesting unique insight.

From the outcome of our study it was revealed that temporomandibular joint disorders was seen in middle aged persons (30-33) when compared to other age groups and females are more affected with temporomandibular joint disorders and showed higher percentage ratio when compared to males.

.The results of the study revealed changes in the craniovertebral and odontoid plane angle in temporomandibular joint disorder subjects compared

to healthy controls. These angles play an important role in the assessment of head posture as it relates the head (skull) to the cervical spine. The change in this angle occurs due to impaired proprioception, contraction of cervical flexor and extensor muscles even at rest, inflammation of nuchal ligament, reduced neuromuscular efficiency of muscles due to greater excitability of the motoneuronal pool and accommodating for weakness or inhibition of another muscle due to modification of neural activation pattern.[55]

Increased muscle stiffness results in reduced muscle blood flow, which subsequently results in an accumulation of ions and metabolites. Accretion of metabolites within muscles further excites chemosensitive muscle afferents, which in turn results in additional excitation of the g-muscle spindle system and alpha motoneurons via reflex actions on the g-motoneurons, thereby the vicious cycle of spasticity becomes difficult, to breakout off.[56-59]

Armijo olivo S et al in a study evaluated the association of head and cervical posture using teleradiographs and cephalometric analysis and gave a positive relation that there was siginificant changes in the craniocervical angle of the subjects, where our study is in concurrence.[29]

Weber P et.al in a study evaluated the association of head and cervical posture by photogrammetric and cephalometric analysis and proved that there was a positive correlation with significant changes in the craniocervical angle. In our study there was significant changes in both these angles resulting in hyperextension of the head in relation to the cervical spine.[29]

The cervical muscles (extensor and flexor) are of two types superficial and deep. The literature often refers to the superficial muscles which become overactive in the presence of neck pain and the deep neck flexors which become dysfunctional. The more superficial flexor muscles of the cervical spine include sternocleidomastoid (SCM) and anterior scalene and deep flexor muscles include longus colli and longus capitus.

The more superficial cervical extensor muscles include Levator scapulae and upper trapezius, Splenius capitus and cervicis, Semispinalis capitus, and the deep cervical extensor muscles are Semispinalis cervicis and multifidus.[60]

The more superficial cervical extensor muscle upper trapezius which results in the hyperextension of head. The trapezius muscle, and its close cousin, the sternocleidomastoid or SCM , are unique in their innervation and action in as much as they're the only muscles with direct connection spanning from trunk to head that are innervated by a cranial nerve the spinal Accessory XI .[61]

A potential link between these two muscles is presence of a trigemino-cervical reflex, which has been studied by Milanov et al. (2001). [62]This reflex may link afferent bombardment from nociceptive drives from the TMJ into the trigeminal nucleus, with sensitization of the muscles supplied by the accessory nerve; the trapezius and sternocleidomastoid (Milanov et al. 2001 reported a stronger effect in the SCM than the trapezius upon stimulation of the trigeminal nerve.[62]

The trapezius can facilitate respiration as an accessory muscle. Other accessory respiratory musculature positioned anteriorly on the neck and rib cage (such as SCM and scalenes), work synergistically with the trapezius. Reciprocally, the trapezius, acting on the neck from a stable or loaded shoulder girdle requires counter-balancing force generation from the anterior musculature of the neck to avoid its contraction pitching the head backward into extension.[63]

The optic, otic and occlusal plane reflexes are, which is key to optimal vision, balance and feeding mechanics; essentially core survival functions of the organism.[61]

Chek (1993) suggested, that "higher" reflexes like breathing occlusal, optic and otic plane reflexes are placed high on the hierarchy.[64] Even though SCM tend to lose its endurance in greater measure our brain always tends compensate the lost function. Much like trying to control a falling tree, which is done by the trapezeius muscle which is synergist muscle of SCM..[65-67] Hence it results in hyperextension of head initially to maintain the higher reflexes and also hold patent the airway, thereby ensuring oxygenation of the reduced lung volume.

Mild changes were seen in cobbs angle and showed significance in group IIB(moderately symptomatic) subjects. But there was no significant correlation to cervical loridosis. Armijo olivo S et al in a study evaluated the association of head and cervical posture using teleradiographs and

cephalometric analysis also gave a negative correlation that there was no siginificant changes in the cobbs angle.[29]

Linear measurements were made to verify the veracity of the angle parameters and to assess the result of hyperextension of the head in relation to cervical spine pertaining to angle parameters. The decrease in the length of opisthion to spinous process of C7 and increase in body of odontoid (C1) to C7 cervical vertebrae suggested that length decreases proportionately in severe symptomatic subjects.

Although there was increase in length of opisthion to the intersecting point of craniovertebral angle in moderate to severe cases it did not show any significance in control and mild cases this suggested that there was a an initial dorsoflexion followed, later and ending up in forward head posture. Hence both these criteria provided undisputable evidence of hyperextension of head pertaining to the cervical spine, as one of the primary protective response to a TMD.

Individual vertebral angles showed significance in C3, C4, C5, C6, C7 vertebrae in certain groups. These angles were measured to see changes in relation to each cervical vertebrae. In mild subjects the changes were seen in C3, C5, C7. In moderate group changes was seen C5,C6. In severe group changes was seen in C3,C4,C5,and C7.

Our study indicates that C1,C2, C3 vertebrae bear the intial stress load that occurs due to contraction of sternocleidomastoid and trapezius muscles. It

resulted in hyperextension of head. In our opinion hyperextension, leads to greater amount of stress in other cervical vertebraes which causes excessive straining of the cervical facets.[68]

According to the results of individual vertebral angles in each symptomatic group it is the C4 vertebrae which withstands greater amount of stress in all groups. We propose this akin to Ruth Jackson and Mckenzie who stated that even in hyperextension trauma injury it was the C4 vertebrae which was better positioned to be able to sustain the stress.[69-70]

According to the results obtained from individual vertebral angle parameters our opinion was later in severe groups the C4 vertebrae tends to lose its capacity to withstand the stress and it was transferred to C5,C6, C7 vertebrae. Due to a unique feature of the vertebrae and prominent spinous process present in C7, C7-T1 are able to withstand higher loads of force.

This akin to Waxebaum JA and futter man B who suggested C7 has a unique feature and prominent spinous process present in it.[71] But when its capacity is lost (C7-T1) along with loss of cervical muscles endurance it can end up resulting in forward head posture.

As an afterthoughts, since C4 vertebrae was seen to bear greater amount of stress according to the individual vertebral angle parameters, linear measurements of individual inter vertebral spaces was measured. The linear measurements from C4-C6 had significant changes in the moderate TMD group and all cervical vertebrae except C5-C6 showed significance in severe

TMD groups. These findings are concurrent with our assumption of C4 being a more stable cervical vertebrae.

Since this study churned out a few unanticipated results, this can be considered as a forerunner for future studies in this field. We made use of available resources and techniques in our study, but still advanced techniques for assessing the cervical vertebrae and its impact on muscles can provide more insight to the postural changes, which is very fascinating and prime aspect of health care.

CONCLUSION

This original study was carried out to assess the postural changes between the temporomandibular joint disorders and healthy individuals through lateral view radiographs. The results showed significant changes of the skull in relation to the cervical vertebrae. This study was a baby step to assess the changes associated with individual cervical vertebrae.

The study was precipitous in exposing an important initial change (Dorsoflexion) as a compensatory effort of the stomatognathic system, unlike what was hitherto presumed. The dorsoflexion we understand is a front runner of the forward head posture which followed, and is anatomically and physiologically explained and logical.

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BIBLIOGRAPHY

1. Akhter R, Hassan NM, Nameki H, Nakamura K, Honda O, Morita M. 2004. Association of dietary habits with symptoms of temporomandibular disorders in Bangladeshi adolescents. J Oral Rehabil 31:746-53.
2. Anderson K, Throckmorton GS, Buschang PH, Hayasaki H. 2002. The effects of bolus hardness on masticatory kinematics. J Oral Rehabil 29:689-96.
3. Arsuaga Jl, Martinez I, Gracia A, Lorenzo C. 1997. The Sima de los Huesos crania (Sierra de Atapuerca, Spain). A comparative study. J Hum Evol 33:219-281.
4. Ashton EH, Zuckerman S. 1954. The anatomy of the articular fossa (fossa mandibularis) in man and apes. Am J Phys Anthropol 12:29-61.
5. Barbenel JC. 1972. The biomechanics of the human temporomandibular joint: a theoretical study. J Biomech 5:251-256.
6. Barbenel JC. 1974. The mechanics of the temporomandibular joint: a theoretical and electromyographic study. J Oral Rehabil 1:19-27.
7. Baume LJ, Holz J. 1970. Ontogenesis of the human temporomandibular joint. 2. Development of the temporal components. J Dent Res 49:864-75.
8. Baume LJ. 1962. Ontogenesis of the human temporomandibular joint. I. Development of the condyles. J Dent Res 41:1327-39.
9. Heylings DJ, Nielsen IL, McNeill C: Lateral pterygoid muscle and the temporomandibular disc, J Orofac Pain 9:9-16, 1995.

10. Wilkinson TM: The relationship between the disk and the lateral pterygoid muscle in the human temporomandibular joint, J Prosthet Dent 60:715-724, 1988.

11. Kapandji I. Cervical spine. The physiology of the joints: annoted diagrams of the mechanics of the human joints, Chapter Three. Edinburgh (Scotland), New York: Churchill Livingstone; 1990.

12. Darling DW, Kraus S, Glasheen.W . Relationship of head posture and rest position of mandible. J Prosthet Dent. 1984 ; 52(1): 111–5

13. Darlow F, Pesco J, Greenberg, M . The relationship of posture to myofascial pain dysfunction syndrome. J Am Dent Assoc 1987 ; 114(1) :73–75.

14. Clark J, Green R, Dornan R, Flack S . Craniocervical dysfunction levels in a patient sample from a temporomandibular joint clinic. J Am Dent Assoc 1987 ; 115 (2): 251–6.

15. Mannheimer JS, Rossenthal RM . Acute and chronic postural abnormalities as related to craniofacial pain and temporomandibular disorders. Dental Clinics North America, 1991; 35 (1): 185–07.

16. Urbanoicz M . Alteration of vertical dimension and its effect on head and neck posture., J Craniomand Prac. 1991; 9 (2) :174-9

17. Braun BL. Postural differences between asymptomatic men and women and craniofacial pain patients. Arch Phys Med Rehab 1991; 72: 653-6.

18. Hackney J, Bade D, Clawson A . Relationship between forward head posture and diagnosed internal derangement of the temporomandibular joint. J Orofacial Pain. 1993; 7(4) 386–90

19. Baloh RW, Fife TD, Zwerling L, Socotch T, Jacobson K, Bell T, Beykirch K.Comparison of static and dynamic posturography in young and older normal people. J Am Geriatr Soc 1994; 42:(4) 405-12.

20. Lee WY, Okeson JP, Lindroth J: The relationship between forward head posture and temporomandibular disorders. J Orofac Pain. 1995; 9 (2): 161–7.

21. Ciancaglini.R, Association of neck pain with symptoms of temporomandibular dysfunction in the general adult population Scand J Rehab Med 1999; 31: 17–2.

22. Evcik D and Aksoy. O. Correlation of temporomandibular joint pathologies, neck pain and postural differences. J Phys Ther Sci 2000; 12(2) 97–100.

23. Visscher CM, Lobbezoo F, Boer W, Zaag J, Naeije M. Prevalence of cervical spinal pain in craniomandibular pain patients. Eur J Oral Sci. 2001;109:76–80.

24. Visscher CM, Boer W, Lobbezoo F, Habets L, Naeije M. Is there a relationship between head posture and craniomandibular pain? J Oral Rehabil 2002; 29(11) :1030-6.

25. Bracco P, Deregibus A, Piscetta R. Effects of different jaw relations on postural stability in human subjects. Neurosci Let 2004; 356(3) 228-30.

26. Pallegama RW, Ranasinghe AW, Weerasinghe VS, Sitheeque MA. Influence of masticatory muscle pain on electromyographic activities of cervical muscles in patients with myogenous temporomandibular disorders. J Oral Rehabil. 2004 ;31(5):423- 9.

27. Munhoz WC, Marques AP, Siqueira JT. Evaluation of Global Body Posture in Individuals with Internal Temporomandibular Joint Derangement. Cranio 2005; 23(4): 269-77

28. Olivo SA, Bravo J, Magee DJ, Thie NM, Major PW, Flores C. The association between head and cervical posture and temporomandibular disorders: A systematic review. J Orofac Pain 2006; 20(1) 9-23.

29. Armijo-olivo S. A comparison of the head and cervical posture between the self-balanced position and the Frankfurt method. J Oral Rehab 2006 ; 33(3): 194-01

30. Perinetti.G .Temporomandibular disorders do not correlate with detectable alterations in body posture. J Contem Dent Pract . 2007;8(5):566-72

31. Matheus RA,et al. The relationship between temporomandibular dysfunction and head and cervical posture. J Appl Oral Sci. 2009;17:204–8

32. Armijo-Olivo S, Fuentes JP, Costa BR, Major PW, Warren S, Thie NM, Magee DJ. Reduced endurance of the cervical flexor muscles in patients with concurrent temporomandibular disorders and neck disability. Man Ther. 2010 ;15(6):586-92.

33. Armijo-Olivo SL, Fuentes JP, Major PW, Warren S, Thie NM, Magee DJ. Is maximal strength of the cervical flexor muscles reduced in patients with temporomandibular disorders? Arch Phys Med Rehab. 2010 ;91(8):1236-42.

34. Olivo SA, Fuentes J, Major PW, Warren S, Thie NM, Magee DJ. The association between neck disability and jaw disability. J Oral Rehabil. 2010; 37(9):670-9.

35. Armijo-Olivo.S Head and Cervical Posture in Patients with Temporomandibular Disorders J Orofac Pain 2011;25(3)199–209.

36. Armijo-Olivo S, et al . Electromyographic activity of the cervical flexor muscles in patients with temporomandibular disorders while performing the craniocervical flexion test: A cross-sectional study. Phys Ther. 2011; 91(8):1184-97.

37. Armijo-Olivo S, Warren S, Fuentes J, Magee DJ. Clinical relevance vs. statistical significance using neck outcomes in patients with temporomandibular disorders as an example. Man Ther. 2011;16(6):563-72.

38. Armijo-Olivo. S Magee D. Cervical Musculoskeletal Impairments and Temporomandibular Disorders J Oral Maxillofac Res 2012; 3(4): 4

39. Armijo-Olivo S, Silvestre RA, Fuentes JP, da Costa BR, Major PW, Warren S, Thie NM, Magee DJ. Patients with temporomandibular disorders have increased fatigability of the cervical extensor muscles. Clin J Pain. 2012 ;28(1):55-64.

40. Rocha P, Croci CS, Caria.P.H.F. Is there relationship between temporomandibular disorders and head and cervical posture? A systematic review. J Oral Rehab 2013; 40: 875—81.

41. Okade D , Venkatesh G, Kruthika S, Nagaraj GT, Sinha P. Evaluation of cervical dysfunction in patients with myofascial pain dysfunction syndrome: A prospective study International Journal of Contemporary Dentistry 2014; 5: 5–10.

42. Saddu SC et al. The Evaluation of Head and Craniocervical Posture among Patients with and without Temporomandibular Joint Disorders- A Comparative Study Journal of Clinical and Diagnostic Research. 2015 ; 9(8): 55- 58

43. Silva MP et al. Biofotogrametric and electromyographic analysis in different position in women with temporomandibular disorder**.** MTP& Rehab Journal 2016, 14: 317- 24

44. Fernández FR,et al. Evaluation of validity and reliability of a methodology for measuring human postural attitude and its relation to temporomandibular joint disorders Singapore Med J 2016; 57(4): 204-08.

45. Pacella E, Dari M, Giovannoni D, Caterini L , Mezio M. The relationship between temporomandibular disorders and posture: A systematic review. 2017; 8(10):1-5.

46. Greenbaum T, Dvir Z , Reiter S , Winocur E. Cervical flexion-rotation test and physiological range of motion comparative study of patients

with myogenic temporomandibular disorder versus healthy subjects. Musculoskeletal Science and Practice 2017; 27 (1) :7-13.

47. Berry-Borowiecki B, Kukwa A, Blanks RH. Cephalometric analysis for diagnosis and treatment of obstructive sleep apnea. Laryngoscope. 1988;98:226-234.

48. Maltais F, Carrier G, Cormier Y, Series F. Cephalometric measurements in snorers, non-snorers, and patients with sleep apnoea. Thorax. 1991;46:419-423.

49. Riha RL, Brander P, Vennelle M, et al. A cephalometric comparison of patients with the sleep apnea/hypopnea syndrome and their siblings. Sleep. 2005;28:315.

50. Lyberg T, Krogstad O, Djupesland G. Cephalometric analysis in patients with obstructive sleep apnoea syndrome. I. Skeletal morphology. J Laryngol Otol. 1989;103:287.

51. Partinen M, Guilleminault C, Quera-Salva MA, et al. Obstructive sleep apnea and cephalometric roentgenograms. The role of anatomic upper airway abnormalities in the definition of abnormal breathing during sleep. Chest. 1988;93:1199.

52. Guilleminault C, Riley R, Powell N. Obstructive sleep apnea and abnormal cephalometric measurements. Implications for treatment. Chest. 1984;86:793.

53. Alessandro N. Posture stability in subjects with temporomandibular disorders and healthy controls ; A Comparative assessment. Journal of Electromyography and kinesiology.2017; 37: 21-24.

54. Gonzalez HE, Manns A. Forward head posture: its structural and functional influence on the masticatory system, a conceptual study. Cranio. 1996; 14: 71-80.

55. Sjolander P, Johansson H, Djupsjobacka M. Spinal and supraspinal effects of activity in ligament afferents. Journal of Electromyography and Kinesiology 2002; 12: 167 – 76.

56. Djupsjobacka M, Johansson H, Bergenheim M. Influences on the gamma-muscle spindle system from muscle afferents stimulated by increased intramuscular concentrations of arachidonic acid. Brain Research 1994; 663: 293 – 02.

57. Johansson H, Djupsjobacka M, Sjolander P. Influences on the gamma-muscle spindle system from muscle afferents stimulated by KCl and lactic acid. Neuroscience Research 1993; 16: 49 – 57.

58. Johansson H, Sjolander P, Sojka P. Receptors in the knee joint ligaments and their role in the biomechanics of the joint. Critical Reviews in Biomedical Engineering 1991; 18: 341-68.

59. Wenngren BJ, Pederson J, Sjolander P, Bergenheim M, Johansson H. Bradykinin and muscle stretch alter contralateral cat neck muscle spindle output. Neuroscience Research 1998; 32: 119 – 129.

60. Cleland, J. Orthopaedic clinical examination: an evidence-based approach for physical therapists. WB Saunders Co. 2005.

61. Wallden M .The trapezius Clinical & conditioning controversies. Journal of Bodywork & Movement Therapies 2014 ;18: 282- 91

62. Milanov, I., Bogdanova, D., Ishpekova, B. The trigemino-cervical reflex in normal subjects. Funct Neurol. 2001; 16 (2): 129-134.

63. Neumann, D. Kinesiology of the Locomotor System: Foundations for Physical Rehabilitation. 3rd edition Mosby. 2003.

64. Chek P. Personal Communication: the Totem Pole Hierarchy of Survival Reflexes. 1993.

65. Chek P. In: Curl, D. (Ed.), Posture and Craniofacial Pain in a Chiropractic Approach to Head Pain. Williams & Wilkins, Baltimore 1994. 121-162.

66. Macphail, K.. Is there a hierarchy of survival reflexes? Med. Hypo. 2013; 81(4): 638-642.

67. Niemi, K. A Brief Review of the Trapezius Muscle 2011.

68. Erick .E. Cervical Spine Functional Anatomy and the Biomechanics of Injury Due to Compressive Loading. J Athl Train 2005; 40(3): 155–161.

69. Ruth Jackson, M.D. The cervical syndrome 4th edition Thomas books , Springfield, Illinois, 1977, pg 40.

70. Mckenzie ,Williams J.F. The Dynamic Behaviour of the head and cervical spine during 'Whiplash" J Biomechanics, 1971; 4(6): 470-77.

71. Waxenbaum A.J, Futterman.B .Anatomy, Back, Cervical Vertebrae Treasure Island 2018.

ANNEXURE

SREE MOOKAMBIKA INSTITUTE OF DENTAL SCIENCES

KULASEKHARAM, KANYAKUMARI DIST., TAMIL NADU, INDIA.

INSTITUTIONAL RESEARCH COMMITTEE

Certificate

This is to certify that the research project protocol, ***Ref no. 01/09/2017*** titled, ***"Assessment of craniocervical posture in temporomandibular joint disorders using lateral view : a cross sectional study"*** submitted by ***Dr. Tanuja S., II Year MDS, Department of Oral Medicine and Radiology*** has been approved by the Institutional Research Committee at its meeting held on ***22nd September 2017.***

Convener
Dr. T. Sreelal

Secretary
Dr. Pradeesh Sathyan

INSTITUTIONAL HUMAN ETHICS COMMITTEE

SREE MOOKAMBIKA INSTITUTE OF MEDICAL SCIENCES,
KULASEKHARAM, TAMILNADU

Communication of Decision of the Institutional Human Ethics Committee(IHEC)

SMIMS/IHEC No: 2 / Protocol no: 20 / 2017

Protocol title: ASSESSMENT OF CRANIOCERVICAL POSTURE IN TEMPOROMANDIBULAR JOINT DISORDERS USING LATERAL VIEW: A CROSS SECTIONAL STUDY.
Principal Investigator: Dr.Tanuja.S
Name& Address of Institution: Department of Oral Medicine and Radiology Sree Mookambika Institute of Dental Sciences ☑ New review ☐ Revised review ☐ Expedited review
Date of review (D/M/Y): 05-12-2017 Date of previous review , if revised application:
Decision of the IHEC: ☑ Recommended ☐ Recommended with suggestions ☐ Revision ☐ Rejected
Suggestions/ Reasons/ Remarks:
Recommended for a period of :One year

Please note*

- Inform IHEC immediately in case of any Adverse events and Serious adverse events.
- Inform IHEC in case of any change of study procedure, site and investigator
- This permission is only for period mentioned above. Annual report to be submitted to IHEC.
- Members of IHEC have right to monitor the trial with prior intimation.

Reneegalgangadhar

Signature of Member Secretary (IHEC)

SREE MOOKAMBIKA INSTITUTE OF MEDICAL SCIENCES * KULASEKHARAM *
IHEC
Date...6/12/17..

CONSENT FORM

PART 1 OF 2

INFORMATION FOR PARTICIPANTS OF THE STUDY

Dear Volunteers,

We welcome you and thank you for your keen interest in participation in this research project. Before you participate in this study, it is important for you to understand why this research is being carried out. This form will provide you all the relevant details of this research. It will explain the nature, the purpose, the benefits, the risks, the discomforts, the precautions and the information about how this project will be carried out. It is important that you read and understand the contents of the form carefully. This form may contain certain scientific terms and hence, if you have have any doubts or if you want more information, you are free to ask the study personnel or the contact person mentioned below before you give your consent and also at any time during the entire course of the project

1. Name of the Principal Investigator:

Tanuja.S
Second Year Post Graduate student
Department of Oral Medicine and Radiology
SreeMookambika Institute of Dental Sciences,
Kulasekharam

2. Name of the Guide:

Dr. Tatu Joy. E MDS
Professor and Head
Department of Oral Medicine and Radiology
SreeMookambika Institute of Dental Sciences
Kulasekharam, KanyaKumari District-629161.

3. Name of the Co-Guide:

Dr Rahul.R MDS
Reader
Department of Oral Medicine and Radiology.
SreeMookambika Institute of Dental Sciences.
Kulasekharam, KanyaKumari District-629161

4. Institute: SreeMookambika Institute of Dental Sciences,

V.P.M Hospital complex, Padanilam, Kulasekharam,

Kanyakumari – 629161

Tamilnadu

5. Title of the study: Assessment of Craniocervical posture in Temporomandibular Joint disorder using lateral view images: A cross sectional study.

6. Background information:

Tempero mandibular joint disorder is one of the commonest functional disturbances of the masticatory system. Opinions on the cause of Temporomandibular joint disorders are numerous and widely varying. Some of the causes leading to Temporomandibular joint disorders are occulsal factors, trauma, emotional stress, and parafunctional activity .As the condition prolong the pain can move from acute to chronic and it eventually results in tenderness of the muscles of mastication and later it leads to radiating pain to the nape of the neck, shoulders, and back of neck which can lead to change in head posture. In this study we are evaluating the postural change that can occur on the head and cervical region those with Temporomandibular joint disorders and comparing the results with non Temporomandibular joint disorders.

7. Aims and Objectives:

- To determine the Craniocervical posture in the Temporomandibular joint disorders from lateral radiographs in Asymptomatic and symptomatic patients
- To compare the changes between the two groups.

8. Scientific justification of the study:

Many studies were carried out to diagnose, and evaluate changes on Temporomandibular joint disorders related head postures. However, there are only few studies that explain the changes of head posture. When there is a change in the head posture skull protrudes forward resulting in tilt of the cervical spine therefore which eventually causes increase in the load to the neck and results in forward head posture. Change in the head posture results in joint diseases, disc herniation, myospasm, osteoporosis, and decrease in vital lung capacity. Hence the dynamics of the head posture plays an important role by preventing excessive propagation of degenerative disorders.

9. Procedure in detail

This study will be carried out in the Department of Oral Medicine and Radiology, sreeMookambika Institute Of Dental Sciences Kulasekharam. Individuals satisfying the inclusion and exclusion criteria will be included in the study. Patients with a clinical examination and palpation diagnosed with Temporomandibular joint disorders according to Laskin's criteria will be taken. The lateral skull radiograph of the cranium and cervical spine images are taken in a normal standing position which were acquired using Planmeca Proline XC Digital OrthopantomographMachine, Finland which is used to assess the craniocervical posture. The angles which determines the craniocervical posture in the lateral images will be measured using "Romexis 4.0" software. Four parameters related to head and of cervical spine were evaluated using Planmeca Proline .Four angles are used to measure the position of the skull, in relation to spine . Craniovertebral angle, Cobbs angle, Individual Vertebral angles and odontoid plane angle. And linear measurements were used to cross verify the angle parameters and individual vertebral angles.

Craniovertebral Angle

This angle is formed by a tangent line drawn from the posterior nasal spine to the opisthion and a tangent line marked to the most posterior surface of the body from the first to seven cervical vertebrae extending to the cranium. The intersecing point of these tangent line forms the craniovertebral angle.This angle measures the position of the head in relation to spine**.** The landmark used to measure the postural changes must be present below the skull because it is the area where the whole weight of the skull rests, hence opisthion was taken to measure the postural changes of head in relation to spine. .

Cobbs Angle

The cervical loridosis measured by Cobbs angle and Individual vertebral angles. The Cobbs angle is the result of intersection of the two perpendicular lines. One perpendicular to the superior end plate of C_7 and the other perpendicular to the superior end plate of C_3. And the intersection of these perpendicular lines makes the cobbs angle. The cobbs angle is used to measure the degree of curvature of spine.

Individual Vertebral Angles

The Individual vertebral angles is measured by making tangent line drawn from the occiput to the posterior surface of the spinous process of C_7 and superior surface body of the

cervical vertebrae from C_3 to C_7 connecting to the tangent line. It is used to assess changes in the various vertebral stacking.

Odontoid Plane Angle

To localize the dimensional relation of the skull to the vertebrae. A tangent line is drawn from menton which passes through gonion to reach opisthion. This line bisects the vertebral tangent line which pass through the most posterior surface bodies of the first to seventh cervical vertebrae extending to the cranium. This is used as it appears to be the most logical relation of the skull to the vertebral stack and also to assess the changes

LINEAR MEASUREMENTS

- Opisthion to intersecting point of craniovertebral angle.
- Opisthion to spinous process of seventh cervical vertebrae.
- Body of Atlas (first cervical vertebrae) to the lower border of seventh cervical vertebrae.
- These measurements were included to assess and cross verify the changes present in the angle parameters of head in relation to spine.
- Individual inter vertebral spaces measured from C1-C7.
- These measurements were included to assess and cross verify the changes pertaining to individual vertebrae

The angles and linear measurements thus obtained from the lateral radiographs are measured using “Romexis 4.0 “software. The data of bothcase and control are entered in to the data sheet. The craniocervical posture of Temperomandibular joint disorder versus controls will be compared. The results will be analysed through the Z test

10. Expected **risks** for **the participants:**

NIL

11.Expected benefits of research for the participants:

The study will help health care practitioners understand the ill effects that occur due to change in the head posture and in due course improve health care for the patients at large.

12.Maintenance of confidentiality:

a. You have the right to confidentiality regarding the privacy of your medical information (Personal details, results of physical examinations, investigations, and your medical history).
b. By signing this document, you will be allowing the research team investigators, other study Personnel, sponsors, institutional ethics committee and any person or agency required by law to view your data, if required.
c. The results of study performed as part of this research may be included in your medical record.
d. The information from this study, if published in scientific journals or presented at scientific meetings, will not reveal your identity and you are in consent for such publication.

13.Why have I been chosen to be in this study?

a. Chosen because of grouping under the inclusion and exclusion criteria
b. Need of good sampling size
c. No invasive procedure that harm your health and helps in diagnosis and helpful for the society

14. How many people will be in the study?

120

15.Agreement of compensation to the participants (In case of a study related injury):

No related injury anticipated.Patient will be taken care in case of complication and medical treatment will be provided.

16.Anticipated prorated payment, if any, to the participant(s) of the study:

Not applicable.

17.Can I withdraw from the study at any time during the study period?

- The participation in this research is purely voluntary and you have the right to withdraw from this study at any time during the course of the study without giving any reasons.
- However, it is advisable that you talk to the research team prior to stopping information.

18. If there is any new findings/information, would I be informed?

Yes

19. Expected duration of the participant's participation in the study?

12 months

20.Any other pertinent information?

No other information

21.Whom do I contact for further information?

For any study related queries, you are free to contact :

Dr .Tanuja S,
Post Graduate Student,
Department of oral Medicine and Radiology
SreeMookambika Institute of DentalSciences
Kulasekharam,KanyaKumari District-629161
9787460552
tanu12.ganesh@gmail.com

Place: **Signature of Principal Investigator**

Date: **Signature of the participant**

CONSENT FORM

PART 2 OF 2

PARTICIPANTS CONSENT FORM

The details of the study have been explained to me in writing and the details have been fully explained to me. I confirm that I have understood the study and had the opportunity to ask questions. I understand that my participation in the study is voluntary and that I am free**to** withdraw at any time, without giving any reason, without the medical care that will**normally** be provided by the hospital being affected. I agree not to restrict the use of any data or results that arise from this study provided such a use is only for scientific purpose(s). I have been given an information sheet giving details of the study. I fully consent to participate in the study titled: **"Assessment of Craniocervical posture in Temporomandibular Joint disorders using lateral view: A cross sectional study".**

Serial no / Reference no:

Name of the participant:

Address of the participant:

Contact number of the participant:

Signature / thumb impression of the participant /

Legal guardian

Witnesses:

1.

2.

Date:

Place:

സമ്മത പത്രം – ഭാഗം – 1

പഠനവുമായി സഹകരിക്കുന്ന വ്യക്തികളുടെ അറിവിലേയ്ക്ക്

പ്രിയപ്പെട്ട സന്നദ്ധ സേവകരേ,

ഞങ്ങൾ നിങ്ങളെ സ്വാഗതം ചെയ്യുന്നു. അതോടൊപ്പം ഈ പഠനവുമായി സഹകരിക്കാനുള്ള സന്നദ്ധതയോട് നന്ദി രേഖപ്പെടുത്തുന്നു. നിങ്ങൾ ഈ പഠനത്തിൽ പങ്കെടുക്കുന്നതിനു മുൻപ് ഈ പഠനം എന്തിനാണ് നടത്തപ്പെടുന്നത് എന്ന് അിറയേണ്ടതുണ്ട്. അതിനാൽ ഈ ഫോറത്തിൽ ഗവേഷണ പഠനത്തിന്റെ വിവരങ്ങളും മറ്റും വിശദമായി രേഖപ്പെടുത്തിയിരിക്കുന്നു. ഈ പഠനത്തിന്റെ രീതി, ഉദ്ദേശം, പ്രയോജനം, അപകടസാദ്ധ്യത, ക്ലേശം, മുൻകരുതൽ, എങ്ങനെ ഈ പഠനം മുൻപോട്ടു കൊണ്ടുപോകുന്നു എന്നിങ്ങനെ എല്ലാ വിവരങ്ങളും ഫോറത്തിൽ രേഖപ്പെടുത്തിയിരിക്കുന്നു. സദയം ഈ വിവരങ്ങൾ വായിച്ചു മനസ്സിലാക്കുവാൻ അഭ്യർത്ഥിക്കുന്നു. ഈ വിവരങ്ങളിൽ ശാസ്ത്രപരമായ പദങ്ങൾ ഉള്ളതിനാൽ സംശയനിവാരണത്തിനു പ്രധാന പഠനകർത്താവിനോടോ താഴെ രേഖപ്പെടുത്തി യിരിക്കുന്ന വ്യക്തികളോടോ ഫോറം ഒപ്പിടുന്നതിനു മുൻപോ അല്ലെങ്കിൽ ഈ പഠനത്തിന്റെ കാലാവധി തീരുന്നതുവരേയോ സമീപിക്കാവുന്നതാണ്.

1. മുഖ്യ ഗവേഷകൻ : **ഡോ.ധനുജ. എസ്.**
രണ്ടാം വർഷം പോസ്റ്റുഗ്രാജുവേറ്റ്
ഡിപ്പാർട്ട്മെന്റ് ഓഫ് ഓറൽ മെഡിസിൻ & റേഡിയോളജി,
ശ്രീ മൂകാംബിക ഇൻസ്റ്റിറ്റ്യൂട്ട് ഓഫ് ഡെന്റൽ സയൻസ്,
കുലശേഖരം - 629 161.

2. പ്രധാന മാർഗ്ഗദർശി : **ഡോ.റ്റാറ്റു ജോയ്. ഇ, എം.ഡി.എസ്.**
പ്രൊഫസർ & ഹെഡ് ഓഫ് ദി ഡിപ്പാർട്ടുമെന്റ്,
ഡിപ്പാർട്ട്മെന്റ് ഓഫ് ഓറൽ മെഡിസിൻ & റേഡിയോളജി
ശ്രീ മൂകാംബിക ഇൻസ്റ്റിറ്റ്യൂട്ട് ഓഫ് ഡെന്റൽ സയൻസസ്,
കുലശേഖരം.

3. സഹ മാർഗ്ഗ ദർശി : **ഡോ. രാഹുൽ.ആർ, എം.ഡി.എസ്.**
റീഡർ
ഡിപ്പാർട്ട്മെന്റ് ഓഫ് ഓറൽ മെഡിസിൻ & റേഡിയോളജി
ശ്രീ മൂകാംബിക ഇൻസ്റ്റിറ്റ്യൂട്ട് ഓഫ് ഡെന്റൽ സയൻസസ്,
കുലശേഖരം.

4. ഇൻസ്റ്റിറ്റ്യൂട്ട് : **ശ്രീ. മൂകാംബിക ഇൻസ്റ്റിറ്റ്യൂട്ട് ഓഫ് ഡെന്റൽ സയൻസസ്**
പടനിലം, കുലശേഖരം, കന്യാകുമാരി - 629 161.
തമിഴ്നാട്.

5. പഠനത്തിന്റെ ശീർഷകം:

ശിരസിന്റെയും കഴുത്തിന്റെയും സ്ഥിതിയും ടി.എം.ജെ. രോഗവുമായുള്ള ബന്ധവും ലാറ്ററൽ റേഡിയോഗ്രാഫ് ഉപയോഗിച്ചുള്ള വിലയിരുത്തൽ ഒരു ക്രോസ് സെക്ഷനൽ പഠനം.

6. പഠന പാശ്ചാത്തലം

ചർവണ പ്രക്രിയയുടെ പ്രവർത്തനത്തെ ബാധിക്കുന്ന സാധാരണയായി കണ്ടുവരുന്ന ഒരു പ്രശ്നമാണ് ടി.എം.ജെ രോഗം. ടി.എം.ജെ. രോഗത്തെപ്പറ്റി വളരെ വ്യത്യസ്ത അഭിപ്രായമാണുള്ളതെങ്കിലും കടിയിലെ പ്രശ്നങ്ങൾ, ആഘാതം, മാനസിക പിരിമുറുക്കം ഇവ ഈ രോഗത്തിന് കാരണമാവുന്നു. ഇത്തരം പ്രശ്നങ്ങൾ ചിലപ്പോൾ വിട്ടുമാറാതെ നിൽക്കുകയും വേദന പേശികളിലോട്ടും കഴുത്തിലോട്ടും തോളിലോട്ടും പടർന്ന് ശരസിന്റെ സ്ഥാനം ചെറുതായെങ്കിലും മാറപ്പെടാനും സാധ്യത ഉണ്ട്. ഇവിടെ ശിരസിന്റേയും കഴുത്തിന്റേയും സ്ഥാനാംശം ടി.എം. ജെ രോഗികളിലും അല്ലാത്തവരിലും താരതമ്യം ചെയ്ത് പഠനം നടത്തുന്നു.

7. പഠനോദ്ദേശ്യം

- കഴുത്തിന്റെയും ശിരസിന്റെയും സ്ഥാനഭ്രംശം ടി.എം.ജെ. രോഗികളിൽ എന്നത് ലാറ്ററൽ റേഡിയോഗ്രാഫ് ഉപയോഗിച്ച് രോഗരഹിതരുമായുള്ള താരതമ്യ പഠനം.

- രണ്ടു ഗ്രൂപ്പുകൾ തമ്മിലുള്ള വ്യത്യാസം വിലയിരുത്തുക.

8. പഠനത്തെക്കുറിച്ചുള്ള ശാസ്ത്ര ന്യായീകരണം

ശിരസിന്റെ സ്ഥാനവും ടി.എം.ജെ.രോഗവും തമ്മിലുള്ള ബന്ധം വിലയിരുത്തൽ അനേകം പഠനങ്ങൾ നടന്നിട്ടുണ്ടെങ്കലും ശിരസിന്റെ സ്ഥാനവ്യത്യാസം വിലയിരുത്തുന്ന വളരെ കുറച്ചു പഠനമേ നടന്നിട്ടുള്ളു. തലയുടെ സ്ഥാനം മുന്നോട്ടാകുന്നതു വഴി കഴുത്തിലെ കശേരുക്കൾ മുന്നോട്ടു വളയുകയും അധിക ഭാരം കഴുത്തിനു വഹിക്കേണ്ടി വരികയും ചെയ്യുന്നു. ഇങ്ങനെ ഉണ്ടകുന്ന ശിരസിന്റെ സ്ഥാനഭ്രംശം താടിയെല്ലിലെ സന്ധിവേദനയും എല്ലു തേയുന്നതിനും, ശ്വാസകോശത്തിന്റെ സുഗമമായ പ്രവർത്തനത്തിന് തടസ്സം ഉണ്ടാക്കുകയും ചെയ്യുന്നു.

9. പഠനരീതി

ഈ പഠനം നടത്തപ്പെടുന്നത് ഓറൽ മെഡിസിൻ ആന്റ് റേഡിയോളജി ഡിപ്പാർട്ട്മെന്റിൽ ആണ്. ഉൾപ്പെടുത്തൽ ഒഴിവാക്കൽ നിബന്ധനകൾ പാലിച്ചവരെ ഈ പഠനത്തിൽ ഉൾപ്പെടുത്തിയിരിക്കുന്നു. ടി.എം.ജെ രോഗം ബാധിച്ചവരെ രോഗലക്ഷണം വിലയിരുത്തി പഠിക്കുന്നു. തലയോട്ടിയുടെയും കഴുത്തിന്റെയും ലാറ്ററൽ റേഡിയോഗ്രാഫ് രോഗിയെ നിറുത്തി പ്ലാൻമേക്ക പ്രൊലൈൻ എക്സ്.സി ഡിജിറ്റൽ ഓർത്തോപാന്റോമോഗ്രാഫ് മെഷീൻ ഫിൻലാന്റ് ഉപയോഗിച്ച് എടുത്ത് തലയുടെയും കഴുത്തിന്റെയും സ്ഥാനം കണ്ടെത്തുന്നു. ഇതിലെ ആങ്കിൾസ് ഇമേജ് ജെ സോഫ്റ്റ് വയർ ഉപയോഗിച്ച് നിർണയിക്കുന്നു. നാലു കോണുകൾ തലയുടെയും കഴുത്തിന്റെയും സ്ഥാനം വച്ച് നിർണയിക്കുന്നു. മുന്നിലോട്ടുള്ള തലയുടെ സ്ഥാനം ക്രോനിയോ വെർട്ടിബ്രൽ ആങ്കിൾ, കോബ്സ് ആങ്കിൾ, ഇൻഡിവിഡുവൽ വെർട്ടിബ്രൽ ആങ്കിൾ, മാൻഡിബുലാർ പ്ലെയിൻ ആങ്കിൾ ഇവ ഉപയോഗിച്ച് കണ്ടെത്തുന്നു.

ക്രോനിയോ വെർട്ടിബ്രൽ ആങ്കിൾ

ഈ ആങ്കിൾ ഉണ്ടായിരിക്കുന്നത് മെക്ഗ്രിഗർ പ്ലെയിനും (ഓക്സിപിറ്റൽ അസ്ഥിയുടെ അടിവാരത്തെയും പുറകിലെ നേസൽസ്പൈനിനേയും സ്പർശിച്ച് കടന്നു പോകുന്നു) മാന്റിബിൾ ബോഡിയുടെ പുറകും ഒന്നു മുതൽ ഏഴുവരെയുള്ള പ്രതലത്താൽ ഉണ്ടായിരിക്കുന്നു. ഇത് ശിരസിന്റെ സ്ഥാനം നിർണയിക്കാൻ സഹായിക്കുന്നു.

കോബാസ് ആങ്കിൾ

മുതുകിലെ ഇൻ കോബ്സ് ആങ്കിൾ കൊണ്ട് കണ്ടെത്താം രണ്ട് ലംബമായ പ്രതലങ്ങളുടെ സംയോഗം വഴി ഉണ്ടാകുന്നതാണ്. കോബ്സ് ആങ്കിൾ. ഒരു പ്രതലം സി.6-ന്റെ മുകളിലത്തെ പ്രതലത്തിന് ലമ്പവും ആയിരിക്കും.

ഇൻഡിവിഡുവൽ വെർട്ടിബ്രൽ ആങ്കിൾ

ഓക്സിപുട്ടിന്റെ പുറകുവശം സി.7-ന്റെ സ്പൈനസ് പ്രോസസ് ചേർന്ന പ്രതവും, സി.3 യുടെ മുകൾ ഭാഗവും സി.7 വരെയുള്ള പ്രതലവും ചേർന്ന് ഉണ്ടായിരിക്കുന്നു. ഇത് കശേരുക്കൾ ഒന്നിച്ചു കൂടുന്നതിനെ നിശ്ചയിക്കുന്നു.

ഒഡന്റായ്ഡ് പ്ലെയിൻ ആങ്കിൾ

ഇത് തലയുടെ സ്ഥാനവും കഴുത്തിലെ കശേരുക്കളുടെ ബന്ധവും നിർണയിക്കൽ സഹായിക്കുന്നു. ഗോണിയൺ മുതൽ ഓക്സിപുട്ട് വരെയുള്ള പ്രതലം, മാൻഡിബിൾ ബോഡി കഴുത്തിലെ കശേരുക്കളും തലയോട്ടിയും ചേർന്നുണ്ടാകുന്ന വെർട്ടിബ്രൽ ടാൻജന്റ് ലൈനിനെ മുറിച്ചു കാക്കുന്നു. ഇത് തലയോട്ടിയും, കഴുത്തിലെ കശേരുക്കളും തമ്മിലുള്ള ബന്ധത്തെക്കുറിച്ച് സമഗ്രമായ അവബോധം നൽകുന്നു.

ഈ ആങ്കിൾകളെ ലേറ്ററൽ റേഡിയോഗ്രാഫ് വഴിയായി എടുക്കപ്പെട്ട് ഇമേജ് ജെ. എന്ന സോഫ്റ്റ് വെയർ മുഖേന അളക്കപ്പെടുന്നു. ഈ ആങ്കൾ ഡാറ്റാ അറിയിപ്പുകൾ എല്ലാം ഡാറ്റാ ഷീറ്റിൽ എഴുതപ്പെട്ട് ടി.എം.ജെ. പ്രശ്നങ്ങൾ ഉള്ളവർ മറ്റും ഇല്ലാതവർ തമ്മിലുള്ള താരതമ്യം **Z**ടെസ്റ്റ് മുഖേന കണ്ടെറിയാൻ സാധിക്കുന്നു.

10. പഠനം മൂലം പങ്കെടുക്കുന്ന ആൾക്ക് ഉണ്ടാകാൻ ഇടയുള്ള അപകട സാധ്യത – ബാധകമല്ല

11. രോഗികൾക്ക് പ്രതീക്ഷിക്കുന്ന ഗുണങ്ങൾ ?

രോഗി ആവശ്യപ്പെടുകയാണെങ്കിൽ ഈ പഠനത്തിനൊടുവിൽ ഏറ്റവും നല്ല ചികിത്സാരീതി നിർദ്ദേശിക്കുന്നതാണ്.

12. വിവരങ്ങൾ രഹസ്യമായി സൂക്ഷിക്കുമോ ? അതെ

13. എന്നെ എന്തുകൊണ്ട് ഈ പഠനത്തിൽ ഉൾപ്പെടുത്തി ?

നിങ്ങൾ ഞങ്ങളുടെ പഠനത്തിന് അനുയോജ്യയായ ഘടകങ്ങൾ പാലിക്കപ്പെടുന്ന മാതൃകാപരമായ ഉദാഹരണമാകുന്നു. ഈ പഠനം മൂലം രോഗനിർണ്ണയത്തിന് സഹായവും സമൂഹത്തിന് നന്മയും പ്രധാനം ചെയ്യുന്നു.

14. എത്ര ആളുകൾ ഈ പഠനത്തിൽ ഉൾപ്പെടുന്നു. 120

15. പഠനം മൂലമുണ്ടാകുന്ന ക്ഷതങ്ങൾക്ക് നഷ്ടപരിഹാരത്തിനുള്ള സമ്മതം ? ബാധകമല്ല

16. ഏതെങ്കിലും വിധത്തിൽ വേതനം ലഭിക്കുമോ – ഇല്ല

17. എപ്പോൾ വേണമെങ്കിലും എനിക്ക് ഈ പഠനത്തിൽ നിന്ന് പിന്മാറാമോ – സ്വയ താൽപര്യപ്രകാരം ഈ പഠനത്തിൽ നിന്ന് എപ്പോൾവേണമെങ്കിലും പിന്മാറാവുന്നതാണ് കാരണങ്ങൽ നൽകാതെ തന്നെ. എന്നിരുന്നാലും ഗവേഷണ സംഘത്തോട് പിന്മാറുന്നതിനുമുൻപ് സംസാരിക്കുവാൻ ഞങ്ങൾ നിങ്ങളോട് അഭ്യർത്ഥിക്കുന്നു.

18. ഈ ഗവേഷണത്തിന്റെ ഫലമായി പുതിയ എന്തെങ്കിലും കണ്ടെത്തലുകളുണ്ടെങ്കിൽ അത് എന്നെ അിറയിക്കുമോ ?

അതെ

19. ഈ പഠനത്തിന്റെ സമയ ദൈർഘ്യം എത്രയാണ് ? ഒരു വർഷം

20. ഇതിന്റെ ഭാഗമായി എന്തെങ്കിലും കൂടുതൽ വിവരങ്ങൾ വേണ്ട

21. കൂടുതൽ വിവരങ്ങൾക്കായി താഴെ പറയുന്നവരെ നിങ്ങൾക്ക് ബന്ധപ്പെടാവുന്നതാണ്.

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രണ്ടാം വർഷം പോസ്റ്റുഗ്രാജുവേറ്റ്
ഡിപ്പാർട്ട്മെന്റ് ഓഫ് ഓറൽ മെഡിസിൻ & റേഡിയോളജി,
ശ്രീ മൂകാംബിക ഇൻസ്റ്റിറ്റ്യൂട്ട് ഓഫ് ഡെന്റൽ സയൻസ്,
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തീയതി : പങ്കെടുക്കുന്ന ആളിന്റെ ഒപ്പ്

സമ്മതപത്രം

ഭാഗം – 2

ഈ പഠനത്തെ പറ്റിയുള്ള എല്ലാ കാര്യങ്ങളും എനിക്ക് പറഞ്ഞ് മനസ്സിലാക്കി തരികയും അതിന്റെ ഒരു പകർപ്പ് എനിക്കു നൽകുകയും ചെയ്തിട്ടുണ്ട്. ഈ പഠനം ഗവേഷണത്തിനായി ഉള്ളതാണെന്നും എനിക്ക് ഇതിൽ നിന്ന് നേരിട്ട് ഒരു ഫലവും ഉണ്ടാകില്ലെന്നും ഞാൻ മനസ്സിലാക്കുന്നു. ഈ പഠനത്തിന്റെ രീതിയും ഉദ്ദേശവും എനിക്ക് മനസ്സിലാക്കി തന്നിട്ടുണ്ട്. അതു പോലെ എനിക്ക് സംശയങ്ങൾ ചോദിക്കാൻ അവസരങ്ങൾ ലഭിച്ചിട്ടുമുണ്ട്. ഇതിൽ പങ്കെടുക്കാനും പങ്കെടുക്കാതിരിക്കാനും ഉള്ള അവകാശം എനിക്കുണ്ടെന്നും അതുപോലെ പഠനത്തിന്റെ ഏതു ഘട്ടത്തിലും ഇതിൽ നിന്ന് പിൻവങ്ങാനുള്ള സ്വാതന്ത്ര്യവും എനിക്കുണ്ടെന്ന് ഞാൻ മനസ്സിലാക്കുന്നു. ഈ പഠനത്തിൽ പങ്കെടുക്കുന്നതു കൊണ്ടോ, പങ്കെടുക്കാത്തതുകൊണ്ടോ എന്റെ മറ്റു ചികിത്സകളെ ബാധിക്കുന്നതല്ലെന്ന് ഞാൻ അിറയുന്നു.

ശിരസിന്റെയും കഴുത്തിന്റെയും സ്ഥിതിയും ടി.എം.ജെ. രോഗവുമായുള്ള ബന്ധവും ലാറ്ററൽ റേഡിയോഗ്രാഫ് ഉപയോഗിച്ചുള്ള വിലയിരുത്തൽ ഒരു ക്രോസ് സെക്ഷനൽ എന്ന ഗവേഷണത്തിൽ പങ്കെടുക്കുന്നതിനും ഇതിന്റെ ഫലങ്ങൾ ശാസ്ത്രലേഖനത്തിൽ പ്രസിദ്ധീകരിക്കുന്നതിനും എനിക്ക് സമ്മതമാണെന്ന് ഞാൻ ഇതിനാൽ അിറയിച്ചുകൊള്ളുന്നു.

സീരിയൽ നമ്പർ / റഫറൻസ് നമ്പർ :

പങ്കെടുക്കുന്ന ആളിന്റെ പേര് :

മേൽവിലാസം :

ഫോൺ നമ്പർ :

ഒപ്പ് / വിരലടയാളം

സാക്ഷി :

സ്ഥലം :

തീയതി

ஒப்புதல் வாக்குமூலம்

முதல் பாகம்

ஆர□ய்ச்சி□ல் பங்□□ப□ □வ□□க்க□ன தகவல் □றிப்□

அன்பார்ந்த பங்கேற்பாளர்களே,

இந்த ஆராய்ச்சியில் தங்களை ஈடுபடுத்திக்கொள்ள மிகுந்த ஆர்வத்துடன் முழுமனதுடன் கலந்துகொள்ள வந்த வரவேற்பாளர்களை வரவேற்கிறேன். நீங்கள் இந்த ஆராய்ச்சியில் பங்கெடுத்துக்கொள்வதற்கு முன் இந்த ஆராய்ச்சி எதற்காக நடத்தப்படுகிறது என்பதை தெளிவாக புரிந்துகொள்ளவேண்டும். உங்களுக்கு தேவையான அனைத்து விபரங்களும் கீழே கொடுக்கப்பட்டுள்ளது. இந்த ஆராய்ச்சியின் மூலம் ஏற்படும் நன்மைகள், ஏதேனும் ஆபத்துகள் மற்றும் அதற்காக மற்றும் எவ்வாறு இந்த ஆராய்ச்சி மேற்கொள்ளப்படும் முறைகளையும் தெரிவிக்கப்பட்டுள்ளது. இதில் கொடுக்கப்பட்டுள்ள விபரங்களை தெளிவாக படித்து புரிந்து கொள்ளவேண்டும். நீங்கள் ஆராய்ச்சியில் பங்கேற்பாளர்களாக ஒப்புதல் வழங்குவதற்குமுன்பு உங்களுக்கு ஏற்படும் அறிவியல் சார்ந்த சந்தேகங்கள் மற்றும் ஆராய்ச்சி சம்பந்தப்பட்ட சந்தேகங்கள் அனைத்தும் இந்த ஆராய்ச்சியின் எந்த காலகட்டத்திலும் நீங்கள் படிவத்தில் குறிப்பிட்ட நபரிடம் கேட்டு தெளிவுபடுத்திக்கொள்ளலாம்.

1. தலைமை ஆய்வாளர் : டாக்டர். தனுஜா .எஸ்
   தகுதி : முதுகலை (MDS)
   பிரிவு : ஓறல் மெடிசின் & ரேடியோளஜி துறை
   நிறுவனம் : ஸ்ரீ முகாம்பிகா இன்ஸ்டிட்யூட் ஆப் டென்டல் சயன்ஸஸ்,
   இடம் : குலசேகரம்

2. வழிகாட்டி : டாக்டர். டாட்டு ஜோய். இ, MDS.
   தகுதி : பேராசிரியர் & துறை மேலாளர்
   பிரிவு : ஓறல் மெடிசின் & ரேடியோளஜி துறை
   நிறுவனம் : ஸ்ரீ முகாம்பிகா இன்ஸ்டிட்யூட் ஆப் டென்டல் சயன்ஸஸ்,
   இடம் : குலசேகரம்

3. இணைவழிகாட்டி : டாக்டர். ராகுல். ஆர். MDS.
   தகுதி : பேராசிரியர்
   பிரிவு : ஓறல் மெடிசின் & ரேடியோளஜி துறை
   நிறுவனம் : ஸ்ரீ முகாம்பிகா இன்ஸ்டிட்யூட் ஆப் டென்டல் சயன்ஸஸ்,
   இடம் : குலசேகரம்

4. கல்லூரி : ஸ்ரீ முகாம்பிகா இன்ஸ்டிட்யூட் ஆப் டென்டல் சயன்ஸஸ், படநிலம் குலசேகரம்- 629 161.

5. ஆராய்ச்சியின் தலைப்பு

டி.எம்.ஜெ. சீர்குலைவு உள்ளவர்களின் கிரேனியோ சர்வைக்கிள் தோற்றப்பாங்கை மதிப்பீடுதல்

6. பின்னணி தகவல்கள்

டி.எம்.ஜெ. சீர்குலைவு மெல்லும்போது வரக்கூடிய செயல்பாட்டு குழப்பங்களில் முக்கியமான ஒன்றாகும். டி.எம். ஜெ. சீர்குலைவுக்கான வேறு காரணங்கள் மாறுபட்ட கடிமானம் அதிக மன அழுத்தம் ஒற்றுமை பழக்கங்கள் ஆகியவையா கும். டி.என்.ஜெ. சீர்குலைவு உள்ளவர்கள் நெடுநாட்கள் சிகிட்சை மேற்கொள்ளாமல் இருக்கும்போது நாள்பட டி.எம்.ஜெ. கிளைடிங், கிளைடிங் கூட்டிங் வலியானது கடிமான தசை கழுத்து தசை கழுத்து தசை தோல் தசை ஆகிய தசைகளில் அ திக வலிஅழுத்தம் உண்டாகும், ஆதலால் தலை வடிவமைப்பின் தோற்றபாங்குகளை டி.எம்.ஜெ. சீர்குலைவு உள்ளவர்கள் இல்லாதவர்கள் ஆகிய இருபாலர்கள் இடையே ஆய்வு செய்யப்படுகிறது.

7. கொள்கள் மற்றும் நோக்கங்கள் :

கிரேணியோ சர்வைக்கல் தோற்றபாங்கை டி.என்.ஜெ. சீர்குலைவு உள்ளவர்கள் மற்றும் இல்லாதவர்கள் ஆகிய இருபாலர்கள் இடையே மதிப்பீடுதல்.

8. ஆய்வினைப் பற்றிய அறிவியல் விளக்கம்

இதுவரை பல ஆய்வுகள் தலையுடன் முதுகு தண்டின் அமைப்பு மற்றும் அதனால் ஏற்படும் மாற்றங்களை டி.என். ஜெ.சீர்குலைவு உள்ளவர்களில் மேற்கொள்ளப்பட்டுள்ளன. ஆனால் சில ஆய்வுகளே தலையுடன் முதுகு தண்டின் அமை மப்பு மற்றும் தோற்றப்பாங்கின் மாறுபாடுகளை எடுத்துரைத்துள்ளது எப்பொழுதெல்லாம் தலையுடன் முதுகு தண்டின் தே ாற்றப்பாங்கு மாறுபடுகிறதோ அப்பொழுதெல்லாம் நமது மண்டை ஓடு முன்னே தள்ளப்பட்டு சர்வைக்கல் பல் சரிந்து கழு த்துக்கு அதிக சுமை கொடுக்கப்பட்டு தலையானது முன்னே வருகிறது. இவ்வாறு மாறுபட்ட தலை தோற்றப்பாங்கு ஏற்படு வதால் மூட்டு நோய்கள், டிஸ்க் ஹர்னியேஷன் , மயோஸ்பாஸம், எலும்பு தேய்வு மற்றும் நுரையீரலின் வைட்டல் திறன் குறைவதற்கு காரணமாகிறது. எனவே தலையின் மாறபட்ட தோற்ற்பாங்கு பலவிதமான நோய்களுக்கு வழி வகுக்கிறது. ஆகையால் தலையுடன் முதுகு தண்டின் சீரான அமைப்பை பாதுகாப்பதின் மூலம் இவ்விதமான சீர்குலைவுகளை தவிர் க்கலாம்.

9. ஆய்வின் செயல்முறை

இந்த ஆய்வு ஓறல் மெடிசின் & ரேடியோளஜி ஸ்ரீ மூகாம்பிகா இன்ஸ்டிட்யூட் ஆப் டென்டல் சயன்ஸஸில் இடம் பெறுகிறது. இந்த ஆய்வின் விதிமுறைகளுக்கு உட்பட்டவர்களை மட்டும் இந்த ஆய்வில் சேர்க்கப்படுவார். தனி ஒருவர் டி.எம்.ஜெ.சீர்குலைவு உள்ளவர்கள் அதிலும் டிஸ்க் டீ அரேஞ்சுமென்ட் உள்ளவர்களே இந்த ஆய்வுக்கு உட்பட்டவர் ஆவார் . லேட்றல் மண்டை ஓடு கதிர்வீச்சின் மூலம் தலையோடு முதுகு தண்டு அமைப்பின் புகைப்படம் டி.எம்.ஜெ. சீர்குலைவு உள்ள ஒருவர் நிற்கும்போது பிளான்மேக்கா பொற்லின் எக்சீ டிஜிட்டல் ஆட்டோ பேன்றமோகிராப் என்னும் கருவியின் மூலம் எடுக்கப்பட்டு கோணங்கள் மதிப்பீடு செய்யப்படுகிறது. தலை முதுகுதண்டு அமைப்பின் கோணங்கள் இ.எம்.ஜே. சாப்ட்வேயரில் மதிப்பீடு செய்யப்படுகிறது. நான்கு கோணங்கள் மதிப்பீடு செய்யப்படுகிறது.

கிரேனியோ வெர்டிபிரல் கோணம்

இந்த கோணம் மெக்கிரஹர் பிளேன் (இந்த பிளேன் ஆக்சிபுட் மற்றும் போஸ்டீரியா நேசல் ஸ்பைன் ஆகிய இரு க்கூர்களை கொண்டது) வெர்டிபிரல் கோடு ஆகிய இரு கூறுகளை ஒன்றிணைக்கும் இந்த கோணத்தால் தலைமுதுகு த ண்டின் அமைப்பு புலப்படும்.

காப்ஸ் கோணம்

இந்த கோணம் மூலம் முதுக தண்டின் வளைவுகளை அறிய இயலும். இரு செங்கோணங்களை வரைந்து அச்செ சங்கோணங்கள் சேரும் இடம் காப்ஸ் ஆங்கிள் என்று கூறப்படுகிறது. இரு செங்கோணங்களை வரைந்து ஒரு செங்கோ ணம் சுப்பீரியர் பிளேட் ஆப் சி.6 மற்றொரு செங்கோணம் சுப்பீரியர் பிளேட் ஆப் சி.7. இந்த இரு செங்கோணங்கள் இணையும் போது வரும் கோணம் காபஸ் ஆங்கிள் ஆகும்.

இன்டிவிஜுவல் வெர்டிபுரல் கோணங்கள்

ஓர் நேர்கோடு ஆக்ஸிபுட்டிலிருந்து ஓஸ்டீரியர் பகுதியான ஸ்பைனஸ் புரோஸஸ் வரை வரையப்படும். வரைந்த அக்கோட்டில் சுப்பீரியர் பகுதி சி.3-யிலிருந்து சி7 வரையிலுள்ள வெர்ட்டிபிரே அக்கோட்டில் இணைந்து தனி தனி வெர்ட் டிபுரல் கோணங்கள் அளக்கப்படும்.

ஒடன்டாய்ட் பிளையின் கோணம்

தலையுடன் வெர்டிபிரேக்குள்ள பரிமாணத்தை அளக்க ஓர் நேர்கோடு கொணியோணிலிருந்து ஆக்ஸிபுட் வரைக்கும் வரையப்படும். பின்பு வெர்டிபிரல் டான்ஜன் கோடு (அதாவது போஸ்டீரியர் பகுதியில் உள்ள சி.1 லிருந்து சி7 வரை இணைக்கும் கோடு) இதனுடன் இணையும் போது இருகூறாக அமைந்து தலையுடன் வெர்டிபிரேக்குள்ள தருக்க உறவை நமக்கு வெளிப்படுத்துகிறது. இந்த கோணங்கள் லேட்ரல் ரேடியோகிராப் வழியாக எடுக்கப்பட்டு இமேஜ் ஜெ. என்னும் சாப்ட்வெயர் மூலம் அளக்கப்படுகிறது. கோண தகவல்கள் எல்லாம் தரவுத்தாளில் எழுதப்பட்டு டி.எம்.ஜெ. சீர்கு லைவு உள்ளவர்கள் இல்லாதவர்கள் ஆகிய இருவர்களிடையே உள்ள வேறுபாட்டை Z
டெஸ்ட் மூலம் ஆய்வு செய்யப்படும்.

10. ஆய்வில் கலந்து கொள்பவர்களுக்கு எதிர்பார்க்கப்படும் ஆபத்துகள் ? ஒன்றும் இல்லை

11 . பங்கேற்பாளர்களுக்கு எதிர்பார்க்கப்படும் பயன்கள்?

நல்ல ஒரு மருத்துவம் நோயாளிக்கு அளிக்கப்படும்

12 இரகசியத்தன்மை காத்தல் ?

உங்களிடம் இருந்து சேகரித்த எந்த விபரமும் இரகசியமாக வைக்கப்படும். இதன்மூலம் கிடைக்கும் புள்ளிவிபரம் மட்டும் வெளியிடப்படும். மற்றபடி தனிநபரின் சொந்த விபரங்கள் வெளியிடப்படமாட்டாது.

13. . எதனால் இந்த ஆய்வில் நான் பங்கேற்க தேர்ந்தெடுக்கப்பட்டேன் ?

அ, எனது கல்வி நிறுவனத்தின் நிபந்தனைகளுக்கு இது உட்பட்டது.

ஆ. நோய்களின் ஆய்வு

இ. எந்த வகையிலும் நோயாளிகளை மிகுந்த சிரமத்திற்கு உட்படுத்தாது.

14. இந்த ஆய்வில் எத்தனைபேர் பங்கேற்கிறார்கள் ? 120

15. இந்த ஆய்வின் மூலம் ஏதேனும் பின்விளைவுகள் ஏற்பட்டால் ஆராய்ச்சியாளர் பொறுப்பு ஏற்பாரா ?

பொருத்தமல்லை

16. இந்த ஆராய்ச்சியில் பங்குபெறுவோருக்கு எவ்வித தொகையும் வழங்கப்படுமா ? இல்லை

17. நான் இந்த ஆராய்ச்சியிலிருந்து விருப்பப்பட்டால் எந்த காலகட்டத்திலும் விலகலாமா ? நோயாளியின் எந்த ஒரு கட்டுப்பாடு / நிபந்தனைகளின் கீழ் இந்த ஆய்விற்கு உட்படுத்தப்படவில்லை. அவர்களின் முழு ஒத்துழைப்பு மற்றும் சம்ம தத்தின் பேரில் மட்டுமே பங்கெடுத்துள்ளனர்.

18. ஏதேனும் புதிய செய்தி, புதிய கண்டுபிடிப்பு பற்றி நான் அறிவிக்கப்படுவேனா ? ஆம்

19. ஆராய்ச்சியின் எதிர்பார்க்கப்படும் பங்குகால அளவு ? ஒரு நாள்

20. வேறு ஏதேனும் பொருத்தமான விபரங்கள் உண்டா ? இல்லை

21. இவ்வாராய்ச்சியைப் பற்றிய விவரங்களை யாரிடம் கேட்டு தெரிந்துக்கொள்வது ?

: டாக்டர். தனுஜா .எஸ்

தகுதி : முதுகலை (MDS)

பிரிவு : ஓறல் மெடிசின் & ரேடியோளஜி துறை

நிறுவனம் : ஸ்ரீ மூகாம்பிகா இன்ஸ்டிட்யூட் ஆப் டென்டல் சயன்ஸஸ்,

இடம் : குலசேகரம்

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இடம் :

தேதி : முதன்மை ஆராய்ச்சியாளரின்

கையொப்பம்

ஒப்புதல் படிவம்

பாகம்-2

இந்த ஆராய்ச்சியின் தகவல்கள் அனைத்தும் என்னிடம் தெளிவாக எழுத்துமூலம் விளக்கப்பட்டுள்ளது. இந்த ஆராய்ச்சியின் முடிவுகள் எனக்கு நேரடியாக பயன்பராவிட்டாலும் மருத்துவத்துறையின் முன்னேற்றத்திற்கு பயன்படும் என்பதை அறிவேன். இவ்வாராய்சியைப் பற்றி நான் தெளிவாக புரிந்துக் கொண்டுள்ளேன். நான் தானாக முன்வந்து இதில் பங்குப் பெறுகிறேன். என்பதை அறிவேன். இதிலிருந்து எந்த நேரமும் எக்காரணமும் கூறாமல் வந்தாலும் இந்த மருத்துவமனையில் எனக்கு கிடைக்கும் மருத்துவ உதவி எவ்விதத்திலும் பாதிக்கப்படாது என்பதையும் அறிவேன். இவ்வாராய்ச்சியின் மூலம் வரும் முடிவுகள் மற்றும் தகவல்களை அறிவியல்துறையின் பயன்பாடுகளுக்கு (மட்டுமே) உபயோகப்பட்டிக்கொள்ள சம்மதிக்கிறேன். எனக்கு இவ்வாராய்ச்சியைப் பற்றிய விரிவான தகவல்கள் அடங்கிய படிவம் தரப்பட்டுள்ளது.

நான் ‘‘டி.எம்.ஜெ. சீர்குலைவு உள்ளவர்களின் கிரேனியோ சர்வைக்கிள் தோற்றப்பாங்கை மதிப்பீடுதல்’’ என்கிற ஆராய்ச்சியில் பங்கேற்க முழுமனதுடன் சம்மதிக்கிறேன்.

பங்கு கொள்பவரின் தொடர், மருத்துவ எண் :

பங்கு கொள்பவரின் பெயர் :

18 வயதிற்கு கீழ் உள்ளவர்களுக்கு பாதுகாவலரின் கையொப்பம்:

முகவரி

தொலை தொடர்பு எண் :

பங்கு கொள்பவர் பராமரிப்பவர் கையொப்பம்/பெருவிரல் சுவடு :

சாட்சி 1

சாட்சி 2

தேதி:

இடம்: குலசேகரம்

DATA SHEET

	TABLE: CONTROLS									
S. No	Asymptomatic		Cranio vertebral angle	Odontoid Plane angle	Cobbs angle	Individual vertebral angles				
	Gender	Age				C3	C4	C5	C6	C7
1	Female	20yrs	101.38	74.20	3.21	92.58	90.59	98.80	93.89	90.19
2	Female	21yrs	102.02	70.62	5.12	96.11	94.19	92.96	92.29	91.21
3	Female	32yrs	109.80	82.45	6.59	92.22	94.64	94.69	91.04	90.19
4	Female	27yrs	98.13	70.39	7.27	91.13	90.89	89.50	92.91	89.87
5	Female	20yrs	101.38	74.20	3.21	92.58	90.59	98.80	93.89	90.19
6	Female	20yrs	110.44	74.29	5.66	95.10	90.24	90.46	89.93	89.79
7	Female	50yrs	101.81	83.04	3.89	99.75	92.99	98.71	96.87	95.63
8	Female	40yrs	117.50	78.82	3.22	95.48	90.04	95.49	91.24	93.11
9	Female	22yrs	106.06	75.07	4.59	92.95	96.01	96.01	99.00	95.36
10	Female	38 yrs	106.26	75.84	5.44	90.23	86.01	87.02	85.28	85.41
11	Female	30yrs	108.60	76.76	3.78	90.15	92.48	91.01	92.05	85.17
12	Female	45yrs	101.14	79.25	4.26	90.36	93.76	95.81	90.49	93.68
13	Female	28yrs	94.31	67.78	7.80	94.50	92.78	92.47	94.01	87.21
14	Female	35yrs	104.36	77.58	3.24	98.63	95.98	90.68	89.12	88.59
15	Female	29yrs	112.98	75.72	4.62	95.49	97.04	90.03	95.91	95.21
16	Female	40yrs	107.50	78.82	3.22	95.48	90.04	95.44	93.11	88.82
17	Male	45yrs	111.95	80.36	1.99	96.15	97.14	89.93	91.55	90.34
18	Female	32yrs	102.32	75.80	3.56	95.84	92.35	96.14	92.15	91.18
19	Male	43yrs	96.68	68.64	2.95	97.95	93.66	97.37	91.70	94.02
20	Female	38yrs	95.35	65.60	2.99	92.03	89.78	93.05	92.20	87.37
21	Female	34yrs	105.91	78.22	8.49	90.32	88.42	82.92	83.26	78.31
22	Male	22yrs	111.86	82.88	7.28	90.76	94.16	90.16	93.08	87.54
23	Male	23yrs	91.56	70.50	3.32	84.49	84.19	83.61	86.90	80.66
24	Female	23yrs	105.38	75.67	7.49	93.46	92.10	93.86	90.96	90.50
25	Female	21yrs	103.97	71.57	3.31	92.57	95.46	90.02	90.58	87.93
26	Female	22yrs	96.80	68.20	9.57	95.46	90.62	90.58	92.57	88.33
27	Female	21yrs	104.70	68.85	7.65	96.78	95.76	96.82	95.81	96.68
28	Female	37yrs	101.55	84.94	5.04	90.58	95.08	89.21	87.93	89.11
29	Male	22yrs	90.53	73.89	6.89	90.75	92.81	97.59	96.45	89.80
30	Female	34yrs	104.46	77.94	6.52	88.49	92.56	95.75	91.53	90.77

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	TABLE: TMJ DISORDER PATIENTS [MILD SYMPTOMATIC]									
S. No	Symptomatic gender	Age	Cranio vertebral angle	Odontoid Plane angle	Cobbs angle	Individual vertebral angles				
						C3	C4	C5	C6	C7
1	Female	22 yrs	101.76	74.68	5.27	96.20	95.66	92.66	90.80	87.61
2	Male	24yrs	100.36	70.40	5.81	92.30	96.83	93.94	93.68	91.81
3	Female	32yrs	105.15	73.41	5.38	98.97	96.15	97.08	97.46	96.87
4	Female	28yrs	107.40	70.58	5.75	96.37	97.42	98.19	96.85	94.26
5	Female	21yrs	95.22	65.63	6.74	91.14	93.28	91.56	90.00	86.35
6	Male	22yrs	103.39	78.23	6.10	98.67	95.05	96.42	92.04	95.17
7	Male	48 yrs	101.85	66.96	3.01	98.28	96.19	96.35	94.02	95.04
8	Female	48yrs	106.36	70.59	6.48	96.36	90.29	90.34	93.02	90.04
9	Female	23 yrs	112.68	80.05	6.72	95.63	97.21	96.12	97.14	91.98
10	Female	23yrs	96.36	70.29	6.48	90.37	91.29	91.34	93.02	90.04
11	Female	32 yrs	105.83	71.02	6.72	97.67	94.19	96.28	95.16	92.15
12	Male	32yrs	105.83	73.18	8.40	93.16	95.19	92.37	93.18	90.17
13	Female	22yrs	106.17	81.17	5.18	90.26	91.28	90.65	91.85	89.78
14	Female	32 yrs	104.12	78.16	6.15	95.17	96.18	94.32	90.17	92.28
15	Male	22 yrs	98.39	75.27	5.37	98.17	91.21	92.29	92.96	91.35
16	Male	29yrs	115.46	78.11	4.64	93.57	91.58	93.35	96.17	91.21
17	Female	39yrs	105.86	78.65	4.70	93.86	90.79	92.04	90.26	90.33
18	Female	51yrs	109.25	76.95	6.27	95.28	94.85	91.29	92.86	91.10
19	Male	47yrs	102.78	80.19	7.07	95.78	93.54	94.10	83.07	80.26
20	Male	23yrs	106.29	66.35	10.55	95.75	90.06	90.92	91.11	93.66
21	Male	21yrs	110.12	83.61	3.27	96.52	92.47	93.54	96.34	90.30
22	Female	50yrs	112.76	84.97	9.34	98.28	92.36	92.20	94.12	93.42
23	Male	32 yrs	114.83	82.42	10.25	97.23	96.15	94.87	93.17	90.89
24	Male	24yrs	90.38	64.64	6.80	91.33	88.95	89.64	89.48	92.88
25	Male	50yrs	116.23	87.60	11.59	96.97	91.66	90.39	92.03	93.11
26	Male	43yrs	119.81	86.23	3.75	92.19	92.54	94.57	92.09	92.83
27	Female	21yrs	102.96	70.64	10.21	90.65	85.92	85.20	84.93	82.58
28	Female	21yrs	95.28	70.89	5.88	90.90	90.20	92.03	90.37	90.26
29	Female	21 yrs	110.62	84.04	7.02	90.96	91.84	91.00	90.82	91.56
30	Female	21 yrs	106.14	72.57	5.54	90.15	90.74	90.37	91.32	87.90

	TABLE: TMJ DISORDER PATIENTS [MODERATELY SYMPTOMATIC]									
S. No	symptomatic	Age	Cranio vertebral angle	Odontoid Plane angle	Cobbs angle	Individual vertebral angles				
						C3	C4	C5	C6	C7
1	Male	24yrs	113.65	84.32	5.17	98.40	94.00	92.98	92.80	91.89
2	Male	22yrs	101.74	71.24	6.68	91.82	90.44	85.09	85.47	85.43
3	Female	33yrs	112.30	84.06	6.98	92.06	96.34	94.75	88.19	90.92
4	Female	37yrs	114.85	83.78	5.23	95.58	93.45	97.82	93.25	90.79
5	Female	22yrs	102.77	74.25	5.57	98.26	96.16	93.38	96.06	97.09
6	Female	34yrs	107.98	82.76	6.27	97.18	96.71	93.26	94.99	90.97
7	Female	24yrs	115.46	87.42	9.96	99.50	93.50	92.73	93.12	92.69
8	Male	47yrs	112.30	86.90	7.07	95.78	93.54	94.10	83.07	80.26
9	Male	25yrs	105.70	85.46	3.76	92.99	90.91	92.17	93.14	93.68
10	Male	20yrs	103.96	67.22	10.17	101.96	102.64	100.98	100.30	97.28
11	Female	37yrs	118.00	85.97	8.18	88.25	88.01	87.03	91.27	91.42
12	Female	35yrs	122.01	88.81	10.79	95.01	92.61	84.27	87.49	89.05
13	Female	21yrs	110.08	82.57	7.07	88.41	92.25	92.39	90.60	86.33
14	Female	21yrs	108.82	81.87	7.91	93.38	91.70	94.20	92.75	90.90
15	Female	22yrs	115.14	86.58	10.28	90.43	90.72	91.53	90.68	81.32
16	Female	23yrs	102.77	63.85	3.73	95.86	95.53	96.96	93.50	93.26
17	Female	41yrs	120.60	86.92	7.14	90.87	90.68	90.88	90.68	89.63
18	Female	46yrs	116.13	85.14	8.23	91.23	90.68	90.88	90.08	81.32
19	Female	23yrs	102.80	72.44	7.78	90.80	93.32	90.17	92.65	90.86
20	Female	37yrs	118.94	85.14	15.97	94.31	91.63	84.81	83.85	82.17
21	Male	39yrs	113.99	85.76	9.48	91.28	91.77	90.85	89.97	80.76
22	Female	22yrs	121.17	80.10	8.94	92.85	91.61	90.07	88.52	89.52
23	Female	27yrs	111.21	83.31	5.68	91.33	91.70	90.24	90.18	92.27
24	Female	40yrs	104.07	71.50	5.73	90.73	91.32	90.66	91.64	90.85
25	Male	24yrs	112.05	83.23	6.18	91.16	90.08	94.05	85.21	88.20
26	Male	24yrs	112.12	87.65	7.28	90.13	92.28	91.67	90.75	90.12
27	Male	48yrs	104.73	79.97	16.13	91.24	91.83	91.46	89.59	84.46
28	Female	34yrs	104.73	78.21	6.23	89.32	88.61	90.48	87.31	85.75
29	Male	29yrs	106.00	77.83	7.54	93.40	92.94	94.49	91.26	93.34
30	Female	35yrs	117.18	82.85	7.63	92.84	91.63	95.23	91.67	90.12

	TABLE: TMJ DISORDER PATIENTS [SEVERE SYMPTOMATIC]									
S. No	Symptomatic	Age	Cranio vertebral angle	Odontoid Plane angle	Cobbs angle	Individual vertebral angles				
						C3	C4	C5	C6	C7
1	Female	50yrs	108.75	79.28	6.13	96.15	94.38	93.17	95.29	92.18
2	Female	25yrs	102.20	75.43	7.77	97.78	96.71	98.76	94.99	90.97
3	Female	24yrs	102.77	72.45	3.06	96.02	95.54	92.04	93.34	93.56
4	Male	50yrs	114.58	83.58	4.72	96.51	98.25	91.07	92.21	91.65
5	Female	21yrs	105.90	87.11	3.87	93.07	91.98	90.84	90.79	89.06
6	Female	50yrs	114.77	81.09	4.59	98.92	94.69	92.38	90.00	92.45
7	Female	55yrs	108.95	84.75	4.01	96.47	94.26	91.51	91.14	93.05
8	Female	34yrs	109.67	83.25	5.38	95.23	95.27	92.18	92.15	90.87
9	Female	39yrs	107.82	81.06	7.23	92.67	93.15	93.15	96.27	92.13
10	Female	37yrs	113.65	76.23	5.25	93.14	92.18	92.14	91.13	94.02
11	Male	35yrs	105.37	75.89	6.95	95.27	93.45	93.73	92.78	93.18
12	Male	35yrs	118.24	84.95	4.98	93.87	96.23	92.18	94.26	89.75
13	Female	35yrs	106.58	82.14	5.28	95.42	94.65	93.27	93.97	90.27
14	Male	35yrs	109.28	81.09	4.98	96.18	92.17	91.64	94.57	92.16
15	Male	21yrs	110.15	85.62	3.75	95.79	93.28	94.17	92.67	89.86
16	Female	28yrs	113.86	78.32	10.74	94.47	94.35	93.20	94.08	81.57
17	Female	28yrs	111.27	81.77	6.25	99.46	94.34	94.22	91.29	94.43
18	Male	22yrs	103.96	73.52	5.72	96.66	97.91	96.81	92.25	93.35
19	Female	42yrs	109.21	84..35	5.36	91.86	94.26	92.52	90.11	90.96
20	Female	21yrs	120.68	88.74	7.21	90.13	92.08	93.23	90.12	88.68
21	Male	21yrs	115.92	86.87	5.66	94.21	95.63	95.40	92.66	94.46
22	Female	45yrs	110.17	79.42	3.21	89.10	85.87	89.08	87.69	88.82
23	Female	23yrs	104.02	72.15	4.90	92.24	90.19	91.39	91.31	87.03
24	Male	40yrs	104.07	75.01	4.59	96.73	91.32	90.66	91.64	90.85
25	Female	22yrs	115.82	85.27	9.86	97.28	96.54	94.80	92.17	90.63
26	Male	32yrs	117.75	82.42	10.25	105.67	106.30	103.54	100.03	100.93
27	Female	24yrs	123.12	89.13	9.34	93.48	93.01	95.43	92.99	90.38
28	Female	25yrs	123.17	81.00	18.94	92.21	83.07	91.69	88.52	89.52
29	Female	24yrs	103.53	84.66	13.21	95.77	93.02	94.39	90.95	90.76
30	Female	35yrs	119.54	86.17	9.26	94.86	92.17	93.82	91.32	90.65

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LINEAR MEASUREMENTS

CONTROLS

S.NO	C1-C7 Length	Opisthion-spinous process of C7	Opisthion to intersection of CV angle
1	106.9	97.1	45.4
2	104.5	96.6	36.6
3	93.7	85.6	35.8
4	99.4	88.0	44.0
5	97.9	89.2	34.8
6	105.3	101.9	45.7
7	105.7	93.1	37.1
8	91.2	84.8	39.6
9	96.6	88.5	31.7
10	109.8	87.6	41.1
11	105.4	99.7	35.3
12	104.1	95.7	31.4
13	105.7	91.2	40.8
14	96.80	92.5	32.1
15	108.1	101.6	34.5
16	112.9	103.3	30.8
17	100.9	101.5	31.7
18	109.2	92.3	34.5
19	115.9	105.0	32.1
20	100.2	92.3	49.4
21	117.2	108.1	40.1
22	107.2	98.1	25.7
23	110.2	98.5	40.5
24	115.0	102.0	29.3
25	113.0	100.5	36.8
26	98.2	86.9	33.8
27	91.3	110.7	48.9
28	103.2	92.7	46.5
29	95.6	81.2	39.6
30	100.0	93.5	43.8

MILD CASES

S.NO	C1-C7 Length	Opisthion-spinous process of C7	Opisthion to intersection of CV angle
1	105.6	91.0	42.4
2	92.8	84.0	37.1
3	116.6	90.5	41.9
4	98.3	94.4	27.5
5	94.1	80.1	31.7
6	96.3	72.4	45.4
7	110.6	90.4	47.2
8	110.3	99.5	30.9
9	106.8	93.9	47.9
10	97.0	83.0	47.1
11	119.9	103.7	38.6
12	117.6	109.3	30.2
13	101.6	99.5	45.4
14	106.7	96.7	48.6
15	102.5	99.0	43.6
16	115.4	98.1	38.5
17	97.3	76.1	48.9
18	96.6	93.2	38.1
19	98.3	91.4	40.6
20	112.4	101.6	33.0
21	106.9	90.1	42.1
22	109.0	99.0	40.5
23	117.8	126.0	34.7
24	107.9	95.8	32.4
25	99.4	92.2	29.1
26	96.8	104.5	38.0
27	108.1	101.6	34.5
28	95.6	81.2	37.6
29	102.1	92.3	39.8
30	94.3	82.5	32.5

MODERATE CASES

S.NO	C1-C7 Length	Opisthion-spinous process of C7	Opisthion to intersection of CV angle
1	119.0	100.8	53.0
2	116.5	109.5	59.8
3	96.4	92.5	34.8
4	108.5	88.5	53.1
5	107.4	99.2	31.6
6	106.7	96.8	42.3
7	113.5	95.3	51.6
8	101.6	95.3	35.5
9	102.2	83.5	48.1
10	97.9	91.9	25.9
11	87.4	72.2	49.4
12	111.0	80.4	47.3
13	93.9	85.9	42.6
14	104.5	85.3	48.2
15	125.0	110.3	31.2
16	101.7	95.2	43.5
17	91.2	82.8	47.8
18	120.7	106.0	43.6
19	99.3	91.9	31.5
20	97.6	85.6	39.8
21	119.6	96.7	41.1
22	94.6	77.1	53.7
23	102.7	88.1	31.4
24	95.4	88.3	29.9
25	96.1	88.5	40.3
26	110.0	86.6	50.1
27	98.2	87.5	42.1
28	103.7	91.2	45.8
29	95.6	82.9	39.6
30	101.4	92.8	45.7

SEVERE CASES

S.NO	C1-C7 Length	Opisthion-spinous process of C7	Opisthion to intersection of CV angle
1	100.4	90.4	40.1
2	114.3	98.2	55.5
3	119.3	102.0	46.2
4	112.1	95.6	34.5
5	96.9	83.8	38.6
6	102.8	88.0	48.7
7	78.0	68.8	49.1
8	110.5	99.2	45.3
9	105.5	95.1	43.8
10	118.2	101.9	31.8
11	106.3	89.7	43.3
12	104.5	97.2	58.8
13	105.0	87.3	42.3
14	91.0	81.2	53.6
15	95.6	81.4	34.2
16	95.2	91.1	34.5
17	97.3	87.4	44.5
18	105.4	89.3	44.2
19	102.8	95.8	34.5
20	117.5	95.7	47.2
21	108.5	96.8	49.6
22	103.6	91.7	46.9
23	105.3	91.6	43.5
24	99.8	82.7	43.6
25	89.3	81.2	41.6
26	107.5	96.8	45.4
27	94.3	81.2	39.6
28	98.3	82.7	44.6
29	105.0	96.2	53.7
30	96.3	81.7	42.3

LINEAR MEASUREMENTS

INDIVIDUAL INTERVERTEBRAL SPACES

CONTROLS

S.NO	C2-C3	C3-C4	C4-C5	C5-C6	C6-C7
1	2.0	2.5	3.3	3.1	4.0
2	3.5	3.6	3.3	4.0	6.1
3	3.1	3.4	3.6	3.4	5.9
4	3.5	4.1	4.1	4.3	4.0
5	2.6	2.8	4.2	3.7	3.9
6	5.6	5.2	4.7	3.8	4.3
7	3.2	3.6	3.0	3.3	3.5
8	4.6	4.1	4.3	3.8	4.3
9	3.2	3.7	4.8	4.0	5.7
10	4.1	3.5	3.8	4.3	3.8
11	3.5	3.6	3.6	4.0	3.6
12	4.6	4.3	4.4	4.1	4.2
13	2.7	3.8	3.6	3.5	3.9
14	3.0	3.8	3.3	3.5	3.6
15	4.5	3.5	3.7	3.7	4.2
16	4.7	4.7	3.7	3.8	4.8
17	3.6	4.1	4.1	5.8	5.9
18	2.6	3.2	2.5	3.3	2.8
19	2.9	3.0	2.4	2.9	2.9
20	3.0	3.5	4.0	3.5	3.9
21	4.1	4.0	4.7	3.9	3.7
22	4.6	4.8	4.1	4.0	4.0
23	4.1	4.1	4.5	4.7	3.6
24	2.7	2.5	2.8	2.7	2.9
25	4.2	4.7	4.7	3.7	3.6
26	4.2	4.7	4.7	4.8	4.5
27	3.5	4.1	4.5	4.1	4.5
28	2.7	3.7	3.9	3.3	2.9
29	3.3	3.6	4.0	3.6	3.4
30	2.3	2.3	3.0	3.5	3.8

MILD CASES

S.NO	C2-C3	C3-C4	C4-C5	C5-C6	C6-C7
1	4.1	4.1	4.1	3.9	4.4
2	3.7	3.5	3.7	3.5	4.2
3	3.7	3.6	3.1	3.7	4.2
4	2.6	2.7	3.2	3.5	4.0
5	3.6	4.2	4.4	4.1	4.2
6	4.0	4.4	4.0	4.6	4.5
7	2.9	3.2	3.1	3.7	3.8
8	3.8	3.0	3.9	3.0	3.4
9	4.3	4.5	3.3	4.0	4.5
10	4.4	4.4	3.9	4.3	4.3
11	4.0	3.7	3.8	4.1	4.0
12	3.5	2.4	2.8	2.6	3.2
13	4.0	3.6	3.8	3.7	3.0
14	4.7	4.0	5.5	5.6	5.4
15	3.4	4.2	3.9	2.9	2.8
16	3.5	4.3	4.0	3.8	3.2
17	3.7	4.2	3.9	3.8	3.6
18	4.1	4.0	3.8	3.5	3.3
19	3.6	3.6	3.1	3.6	3.7
20	4.5	4.1	4.1	3.5	3.9
21	3.6	4.7	5.0	4.9	4.4
22	4.4	3.9	4.4	3.5	2.7
23	3.7	4.2	4.0	4.3	3.9
24	4.0	4.4	3.8	3.9	4.3
25	3.0	4.0	4.4	3.7	3.7
26	3.3	4.0	3.4	3.3	3.9
27	3.2	3.4	4.9	4.0	4.5
28	3.2	2.9	2.9	3.2	3.7
29	2.6	4.0	3.3	3.2	4.3
30	4.0	3.4	3.6	3.2	4.2

MODERATE CASES

S.NO	C2-C3	C3-C4	C4-C5	C5-C6	C6-C7
1	4.9	4.9	5.4	5.6	5.0
2	4.0	4.0	4.5	4.1	4.3
3	3.9	3.7	4.4	3.3	3.4
4	4.4	4.0	4.2	4.2	4.0
5	5.1	6.2	5.7	5.4	5.5
6	4.0	4.1	4.4	4.4	3.4
7	4.9	2.7	2.7	2.7	3.7
8	4.5	5.2	4.3	4.3	4.2
9	4.7	3.1	4.1	4.7	3.3
10	3.8	3.1	3.7	3.5	3.8
11	2.8	2.8	2.4	2.5	2.1
12	1.5	2.6	3.0	3.1	2.5
13	3.2	2.5	3.7	4.2	3.5
14	3.7	3.3	3.8	2.9	2.9
15	3.6	4.2	4.3	3.9	4.5
16	4.3	3.3	3.7	3.1	3.4
17	4.0	4.4	4.0	4.6	4.5
18	3.2	4.4	4.1	3.8	3.4
19	3.7	4.1	3.9	4.2	4.0
20	3.0	3.3	3.2	3.1	3.3
21	4.2	4.4	4.1	4.8	4.4
22	3.7	4.0	3.9	3.0	3.5
23	4.0	3.8	3.8	4.1	4.6
24	3.6	3.3	3.9	3.2	4.1
25	4.2	3.8	4.6	4.2	4.0
26	4.0	3.8	4.0	4.1	4.2
27	3.8	3.4	3.1	3.4	4.0
28	4.8	4.0	4.5	5.0	5.1
29	4.4	4.6	4.9	3.4	4.5
30	3.7	4.0	4.2	3.8	3.4

SEVERE CASES

S.NO	C2-C3	C3-C4	C4-C5	C5-C6	C6-C7
1	3.8	3.7	4.0	3.5	3.4
2	4.7	4.2	5.1	4.4	3.8
3	3.3	3.7	3.0	3.3	3.3
4	4.0	3.8	4.1	4.5	4.4
5	4.3	3.4	3.4	3.3	4.6
6	3.4	3.5	4.0	3.5	3.9
7	3.5	4.3	3.5	2.7	3.6
8	4.3	3.9	3.9	3.8	4.2
9	3.6	2.9	3.6	4.1	4.3
10	4.5	4.1	4.0	3.9	3.9
11	4.1	3.5	4.2	4.5	4.7
12	3.9	4.0	4.3	4.1	4.2
13	3.7	5.1	5.3	3.2	3.2
14	4.1	4.5	4.7	4.1	4.6
15	4.2	4.0	4.3	3.7	3.7
16	4.2	5.1	5.2	4.7	4.3
17	4.3	4.2	4.3	4.4	4.2
18	2.7	3.3	3.2	3.6	3.7
19	3.8	4.2	3.4	3.9	4.0
20	4.5	4.4	3.8	4.4	4.6
21	4.1	3.8	4.9	3.7	4.6
22	3.5	3.6	3.5	3.1	4.1
23	4.2	4.0	3.8	3.6	4.2
24	3.3	3.5	4.1	3.3	3.1
25	4.6	3.8	3.3	2.5	2.5
26	3.4	4.0	3.9	3.9	4.3
27	4.7	3.5	3.7	4.0	4.5
28	3.5	4.0	5.0	4.5	3.9
29	4.1	3.9	4.2	3.9	4.3
30	3.7	4.1	4.7	3.8	4.4