ASSESSMENT OF MANDIBULAR SURFACE AREA CHANGES IN BRUXERS VERSUS CONTROLS ON PANORAMIC RADIOGRAPHIC IMAGES: A CASE CONTROL STUDY

DISSERTATION

Submitted to The Tamil Nadu Dr. M.G.R Medical University
in partial fulfillment of the requirement for the degree of

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BRANCH IX

ORAL MEDICINE AND RADIOLOGY

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CERTIFICATE

This is to certify that the dissertation titled **"Assessment of Mandibular Surface Area Changes in Bruxers Versus Controls on Panoramic Radiographic Images: A Case Control Study"** is a bonafide record of the work done by **Dr. Lakshmi P.S.** under our guidance during her postgraduate study period of 2015-2018. The dissertation is submitted to **The Tamil Nadu Dr. M.G.R Medical University, Chennai,** in partial fulfillment of the requirement for the Degree of Master of Dental Surgery in Oral Medicine and Radiology, Branch IX. It has not been submitted (partial or full) for the award of any other degree or diploma.

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I hereby declare that this dissertation "**Assessment of Mandibular Surface Area Changes in Bruxers Versus Controls on Panoramic Radiographic Images: A Case Control Study"** is a bonafide record of work undertaken by me and that this thesis or a part of it has not been presented earlier for the award of degree, diploma, fellowship or similar title of recognition.

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CONTENTS

LIST OF ABBREVIATIONS

CT	-	Computed Tomography
CBCT	-	Cone Beam Computed Tomography
EMG	-	Electromyography
GPT	-	Glossary of prosthodontic terms
JPEG	-	Joint Photographic Experts Group
MBF	-	Maximal Bite Force
NDPI	-	National Data Processing Initiative
NIH	-	National Institutes of Health
OFA	-	Oro-facial activities
OPG	-	Orthopantomogram
PDA	-	Personal Digital Assistant
PSG	-	Polysomnography
RAM	-	Random -Access Memory
RDC	-	Research Diagnostic Criteria
RMMA	-	Rhythmic masticatory muscle activities
SB	-	Sleep Bruxism
SMA	-	Sleep motor activities
TIFF	-	Tagged Image File Format
TMD	-	Temporomandibular Disorders
TMJ	-	Temporomandibular Joint

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ABSTRACT

Background: Bruxism was the commonest of the many parafunctional activities of the masticatory system. Opinions on the causes of bruxism were numerous and widely varying. It can occur on sleep as well as wakefulness. Bruxism was for long considered a major cause of tooth wear. Other effects of bruxism may include tooth movement and tooth mobility, as well as changes in oral soft tissues and jaw bone. Since the exact etiology and manifestations are unclear it was difficult to diagnose Bruxism. In this study we evaluated the area change that can occur on the lower jaw bone in those with Bruxism and comparing the results with nonbruxers.

Aims and Objective: To determine the surface area changes of the mandible, condylar and coronoid processes in Bruxers from Panoramic radiographs and to compare and contrast the changes with age and gender matched controls.

Materials and Method: The study was conducted in the department of Oral Medicine and Radiology. The total sample size was 40.The sample was divided in to two groups, Bruxers and nonbruxers with 20 subjects in each group. Healthy volunteers aged between 20- 30 years diagnosed with Bruxism and Healthy volunteers aged between 20- 30 years diagnosed without Bruxism were included in group II (Non Bruxers). Bruxchecker was made use of in confirming the Bruxism in Group I. The Orthopantomogram was used as the imaging modality for the study. The measurements were made with the help of a software, Image J. All the measurements were tabulated and statistical analysis was made using ANOVA (Post hoc) followed by Dunnet t-test and unpaired t-test.

Results and Discussion: The present study was conducted to assess the mandibular surface area changes in bruxers and nonbruxers. It was carried out on a study group comprising 20 healthy individuals as controls in comparison with 20 bruxers (10

males and 10 females).A comparison of the mandibular surface area as a whole and also condylar and coronoid processes individually were carried out. Significant results were obtained incase of condylar and coronoid processes between the two groups. The surface area of condylar process of Group I was found to be lower than that of Group II. The surface area of the right coronoid process of group I was found to be less when compared to that of group II but the values of the left coronoid process of group I was found to be more when compared with group II. The surface area of the mandible showed no significant difference between the groups. There was significant difference between the genders incase of mandible, condyle and coronoid. The surface area of mandible and condylar process was found to be lower in female when compared to male. The surface area of coronoid process was found to be more incase of females when compared to that of males in Group I.

The results of our study show that while the overall surface area of bruxers remain unaffected when compared to controls, the condylar and coronoid process show significant change. The hitherto belief that the primary brunt of bruxism is borne by the masseter would require a revisit since alteration in tonicity of the masseter would reflect in surface area change of the mandible as a whole. An increase in the surface area of the coronoid process in bruxers was observed in our study which could be attributed to altered activity of the temporalis, a muscle largely responsible for the posture of the mandible. This could imply that bruxers show alteration in temporalis activity which would explain several clinical manifestations such as headache, neck pain, shoulder pain and altered posture and so on which we have observed in the clinical practice of neuromuscular dentistry. Further studies

examining the activity of the temporalis and masseter would further corroborate our findings and for the basis for future research in this arena.

Conclusion: This study is an original study that was carried out to assess the surface area changes in mandible and condylar and coronoid processes of Bruxers and nonbruxers. The results showed significant changes in the surface area of condylar and coronoid process in Bruxers when compared to the controls. This study was a step made to assess the bony changes in Bruxers which is seldom carried out by other researchers. We hope this study would be a stepping stone for the future studies in this field.

Key words: Bruxism, Condyle, Sleep Bruxism, temporomandibular joint, temporomandibular joint disorders.

INTRODUCTION

Activities of the masticatory system can be divided into two types: Functional, which includes chewing, speaking, and parafunctional, which includes clenching or grinding of the teeth (referred to as bruxism). The functional activities are those which allow the masticatory system to perform necessary functions with minimum damage to the structures of this system. There are some abnormal tooth contacts which have negative effects on functional muscle activity. For this reason the functional activities are considered to be directly influenced by the occlusion. Premature occlusal contacts were considered to be one of the etiologic factors of Bruxism. The deflective occlusal interference could cause changes in the normal path of bite. Occlusion affects the function of masticatory muscles, which in turn affects the function of the temporomandibular joint (TMJ). So, if there are changes in one's occlusion it will have an effect on the TMJ structures and jaw muscles.[1]Parafunctional activities associated with the stomatognathic system include lip and cheek chewing, nail biting, and teeth clenching. The term parafunction was introduced by Drum to suggest distinction between the occlusal stress during mastication and swallowing and the occlusal stress due to other actions other than the normal function.[2] Parafunctional activities like jaw clenching, bruxism, tooth grinding, tooth tapping, cheek biting, lip biting, object biting etc. can occur alone or in combination and are different from functional activities like chewing, speaking and swallowing.[2]

Bruxism is an oral condition of great interest to scholars in the dental, neurological and sleep medicine domains. It is associated with a number of clinical manifestations , like orofacial pain, tooth wear and failing dental fillings. But still bruxism remains difficult to manage in effective and safe ways.[3,4,5] Parafunctional

habits are considered to be risk factors for TMD manifestation. The main parafunctional habit is bruxism, which is classified as parafunction because it does not have a functional objective.[6]

During bruxism the forceful masticatory muscle activity may also induce deformations of the Dentoalveolar tissues and the supporting skeleton, yielding various tooth loads despite an apparently even distribution of tooth contacts.[7]

Bruxism is an involuntary masticatory muscle activity that is characterized by clenching and/or grinding of the teeth.[8] In the Glossary of Prosthodontics Terms (GPT-8), bruxism is defined as 'the parafunctional grinding of teeth', and as 'an oral habit consisting of involuntary rhythmic or spasmodic non-functional gnashing, grinding or clenching of the teeth, in other than chewing movements of the mandible, which may lead to occlusal trauma'.[9] Bruxism are of two types, 'Awake Bruxism' (AB) and 'Sleep Bruxism' (SB) like those occurs during wakefulness or during sleep. Bruxism during daytime is known as 'Awake Bruxism'(AB) or diurnal Bruxism (DB). AB can be associated with stress caused by familial responsibility or work pressure. Bruxism during sleep that can be either during daytime or during night is termed as'Sleep Bruxism' (SB) . The main difference between two types are , in most episodes of diurnal bruxism there are only tooth clenching, while, in nocturnal bruxism both clenching and grinding are observed. [10] About 10% of general adult population has Bruxism and is considered as one of the possible causative factors, among others, of temporomandibular pain, tooth wear in the form of attrition, and loss of dental implants.[11] Two groups of proposed etiological factors can be distinguished: peripheral (morphological) and central (pathophysiological and psychological).

Generically identified "bruxism" was assessed in two studies reporting an 8% to 31.4% prevalence, awake bruxism was investigated in two studies describing a 22.1% to 31% prevalence, and prevalence of sleep bruxism was found to be more consistent (12.8% ± 3.1%). Bruxism activities were found to be unrelated to sex and also it is found that the habit decreases with age in elderly persons.[12]

There are different techniques by which Bruxism can be confirmed or ruled out. In this study we made use of Bruxchecker method for recording bruxing pattern in order to confirm bruxism patients. Once the sleep bruxism was confirmed by the bruxchecker, the patient was subjected to panoramic radiographic examination. In the Orthopantomogram the complete outline of the mandible including the coronoid processs and condyle were traced. Orthopantomogram (OPG) was one of the most popular records which provides important bilateral dental and skeletal informations.[13,14] A public domain image processing software ("Image J") was used to automate and facilitate measurements. Image J software was made use of because that can run on any operating system (Macintosh, Windows, Linux and even a PDA operating system) and also this software was easy to use.[15]Image J was used for determination of linear and angular measurements, calculation of areas, particle analysis, cell counts, etc.[16]

In this study we evaluated the total area change that can occur on the lower jaw bone in those with Bruxism and compared the results with nonbruxers. A change in the surface area of the entire mandible and condylar process and coronoid process of bruxers was anticipated when compared to controls. Physiologically functional loads predictably could stimulate more bone formation, while dysfunctional overloads could remove bone, which in turn would shed new light on

the dynamics and kinesis of the mandible with respect to parafunction and in turn temporo-mandibular dysfunctions. Here in this study first the cases and controls were selected based on the wearing pattern on bruxchecker and then the tracings were done on the Orthopantomogram using image J software. The area of the coronoid, condyle and the mandible as such were measured and the results were compared between the cases and controls to assess the change. Many studies have been carried out to diagnose, manage and evaluate changes on Bruxers. However, no study explains the changes of jaw bones. In this study we evaluated the jaw bone changes in bruxers which provides valid information on the TMD domain in those with the habit of Bruxism.

- To determine the surface area changes of the mandible in Bruxers from Panoramic radiographs.
- To determine the surface area changes of the condylar process in Bruxers from Panoramic radiographs.
- To determine the surface area changes of the coronoid process in Bruxers from Panoramic radiographs.
- To determine the surface area changes of the mandible, condylar process and coronoid process in age and gender matched controls from Panoramic Radiographs
- To compare and contrast the changes between the two groups.

REVIEW OF LITERATURE

BRUXISM:

In 1907, Marie and Pletkiewicz suggested the term "bruxomania" which is derived from French word "la bruxomanie".[17] Activities of the masticatory system can be divided into two types: Functional and Parafunctional. Among which Functional activities includes chewing, speaking, and that of Parafunctional activities associated with the stomatognathic system includes clenching or grinding of the teeth(referred to as bruxism) include lip and cheek chewing, nail biting. The functional activities are those with controlled muscle activities, which allow the masticatory system to perform necessary functions with no or minimum damage to the structures of the system.[18]

According to glossary of prosthodontic terms (GPT)-87

Bruxism is defined as the ***"parafunctional grinding of the teeth (or). An oral habit consisting of involuntary rhythmic or spasmodic nonfunctional gnashing, grinding or clenching of teeth, in non-chewing movements of the mandible, that can lead to occlusal trauma."*** It is also called tooth grinding, or occlusal neurosis.[18]

Bruxism is considered to be a undesirable muscular and jaw movement causing overload of the stomatognathic structures. It is also considered to be a common cause for attritional wear, loose teeth, fractured cusps, alveolar exostoses and muscle pain due to its noxious pattern of abnormal clenching and grinding. The etiology of bruxism is unclear. Psychological stress and emotional stress have been attributed as one of the causes of bruxism. Occlusal discrepancy or interference and

sleep positioning can predispose to grinding. Genetic factors, certain medications and few systemic diseases are also considered as etiologic factors of Bruxism. [19]

The common signs and symptoms of Bruxism involves occlusal wear facets, fractures of teeth and restorations, mobility of teeth, tenderness and hypertrophy of masticatory muscles, muscle pain when the patient wakes up, Temporomandibular joint pain.[20,21]

TYPES :

- Clenching (Centric Bruxism)
- Eccentric Bruxism

Clenching (Centric Bruxism):

Clenching of the teeth can be considered as a normal manifestation if it is due to increased muscle tonicity caused by emotional stress, heavy lifting or other physical demands. Abnormal clenching without any physical or emotional triggers is a form of bruxism. There will not be any noticeable jaw movement but repeated clenching causes movement of teeth with deflective premature contact.

Eccentric Bruxism:

Eccentric Bruxism refers to non-functional grinding of the lower teeth against the upper teeth in excursive pathways. In simple terms it is the screeching, grating sound in the night. If left untreated it leads to severe attritional wear of the occlusal surfaces, hypermobility of the teeth and adaptive changes in the TMJs, resulting in flattening of the condyles and gradual loss of convexity of the eminence.[21]

Forces of Tooth Contacts

Direction of applied force

The movement of Mandible depends on the direction of force. During normal functions such as chewing and swallowing, it is found that the mandible moves in a vertical direction. As the mandible closes and when the teeth contacts occur, the predominant forces applied to the teeth are also in a vertical direction so that they are accepted well by the supportive structures of the teeth. During bruxism, the movement of mandible is altered because the mandible shifts from side to side. Hence in Bruxism heavy horizontal forces are applied on the teeth, which are not well-accepted by the supporting structures and which increase the chances of damage to the teeth and/or supportive structures.[22]

Mandibular position

Majority of the functional activity of mandible occurs at or near the centric occlusion position. During functional activity the forces are distributed to many teeth so that potential damage to a single tooth is minimized. But Bruxism occurs in eccentric positions. Only few tooth contacts occur during the activity and also, the mandibular position is far from its stable position in this activity. This position change of the mandible causes more strain on the masticatory system, which in turn makes the system more susceptible to breakdown. Thus there will be application of heavy forces to a few teeth.[23]

Type of muscle contraction

For a normal functional activity of jaws there should be a well-controlled, rhythmic contraction and relaxation of the muscles. This rhythmic activity provides

adequate blood flow, thus there will be adequate oxygen supply to the tissues and eliminates by products accumulated at the cellular level. By contrast, Bruxism results in sustained muscle contraction for long periods. Thus there is reduced blood flow which inturn reduces the oxygenation within the muscle tissues. As a result, there will be increased levels of carbon dioxide and accumulation of cellular waste by products within the muscle tissue creating fatigue, pain, and spasms.[23]

Influence of protective reflexes

During functional activities there are Neuromuscular reflexes which protects the dental structures from damage. But these Neuromuscular reflexes appear to be absent during bruxism, or at least the reflex thresholds are raised, resulting in less influence over muscle activity. For this reason, the tooth contacts that inhibit muscle activity during function do not inhibit Parafunctional activity. Thus there will be breakdown of the structures involved due to increase in the levels of parafunctional activity.[22]

For over 200 years people have tried to understand mechanical influences on living bone. There is a law named Wolffs law explains bony changes.[24,25,26,27,28,29]

Wolff's Law states that ***" Every change in the form and function of bone or of their function alone is followed by certain definite changes in their internal architecture, and equally definite alteration in their external conformation in accordance with mathematical laws."***[29]

A true scientific law can predict a system's particular reactions to given stimuli, mathematics can express it and observation and experiment can test it.[30,31,32,33,34]

STRESS AND STRAIN

If bone is loaded, it undergoes a deformation. The amount of strain quantifies the amount of deformation. Strain is defined as a change in length per unit of length. Strain is dimensionless. Due to the deformation, tension occurs in the bone tissue. This is quantified by the amount of stress. Stress is defined as force per unit area. The unit of stress is Pascal. [35]

On Stress and Strain:

When a load (force) is applied on a bone there can be deformation or strains. This causes stretching of intermolecular bonds within the bone that resist with an elastic force called stress.[36,37]

D'Arcy Thompson suggested long ago that living bone may depend more on strain than stress to generate the signals that control its biological reactions to mechanical load.[38,39,40,41,42,43,44,45,46,47,48]

Modeling and remodelling:

It is considered that there are two biologic activities of bone that can affect a bone's architecture.[38,43,49,50,51] Modeling bymeans of resorption and formation drifts can move surfaces of bone's in tissue space to size and shape it. In Remodeling the bone turn over occurs in small packets. For mechanical and other influences each activity can respond in its own way.[52,53] Global remodelling can remove or conserve bone but apparently cannot add to it. Increased remodelling

tends to remove bone next to marrow and make a bone weaker. Decreased remodelling tends to conserve bone and its strength.[54]

Intermittent and continuous loading:

Clinical, pathologic and experimental evidence suggests continuous bone loads may have somewhat different effects on bone modelling and remodelling than the intermittent loads normally involved in use of the mandible and extremity bones.[55,56,57,58]

ADAPTIVE CAPACITY OF THE PERIODONTIUM TO OCCLUSAL FORCES:

When the forces are exerted on the crown the periodontium attempts to accommodate. The adaptive capacity differs in person to person and often in the same person at different times. The magnitude, direction, duration and frequency of the forces influences the effect of occlusal forces on the periodontium. When the magnitude of occlusal forces is increased , there will be widening of the periodontal ligament space, increase in number and width of periodontal ligament fibers and increase in the density of alveolar bone.

As the direction of occlusal forces changes the areas of the stresses and strains within the periodontium also differs. According to the structural anatomy of the principal fibers of the periodontal ligament they best accommodate the occlusal forces along the long axis of the tooth. The forces in any other directions like Lateral (horizontal) and torque (rotational) forces are more likely to injure the periodontium.

Apart from magnitude the alveolar bone response is also affected by the duration and frequency of occlusal forces. Constantly applied pressure on the bone is more injurious than intermittent forces. If the frequency of application of an

intermittent force is more, then it is considered tobe more injurious the force to the periodontium.

Trauma from occlusion:

Commonly there is a margin of safety to all tissues that some variations in occlusion shall be permitted without adverse effects to the periodontium. But when this adaptive capacity is exceeded tissue injury results. This is termed as trauma from occlusion or traumatism or occlusal trauma. The occlusal force that led to the tissue injury is called as traumatic occlusion.

Due to excessive occlusal forces, the function of the muscles of mastication may be disrupted and also painful spasms. This inturn injure the temporomandibular joints and also can produce excessive tooth wear. The criterion that determines if An occlusion is considered to be traumatic based on its ability to produce periodontal injury; and not how the teeth occlude. Other terms used for these Traumatic occlusal relationships are occlusal disharmony, functional imbalance, and occlusal dystrophy. All these terms refer to the effects on the periodontium rather than to the position of the teeth.

Trauma from occlusion may be acute or chronic. Acute trauma from occlusion as the term suggest sudden or quick onset from an abrupt occlusal impact like trauma produced by biting on a hard object. Chronic trauma from occlusion is more common than the acute form and chronic form is of greater clinical significance. Chronic trauma develops from gradual changes in occlusion produced by tooth wear, drifting movement, and extrusion of the teeth and parafunctional habits (eg bruxism, clenching).

Trauma from occlusion is considered as one of the causes of bone destruction in periodontal disease that can occur with or without inflammation. If the trauma from occlusion is present without any inflammation, then the changes will vary. There can be increased compression and tension of the periodontal ligament, increased osteoclasis of alveolar bone, necrosis of the periodontal ligament and bone and the resorption of bone and tooth structure. All these changes are reversible if the offending forces are removed.

Bone formation sometimes occurs in an attempt to buttress bony trabeculae that are by resorption. When it occurs within the jaw, it is termed central buttressing bone formation. When it occurs on the external surface, it is referred to as peripheral buttressing bone formation. [59]

BRUXCHECKER:

Diagnosis is the process of determining which disease or condition is responsible for a person's symptoms and signs. Early diagnosis is very important in any medical condition for the doctor and patient and so for Bruxism.[60] Always the Parafunctions can lead to aesthetic and functional defects. Inorder to identify and measure bruxism an accurate diagnosis is important. To achieve this, there is a need of technique or technology that is usually unavailable to the general practitioners. Incase of bruxism the tools for detection and evaluation include: clinical diagnosis from clinical symptoms, clinical signs and test for quantification of wear facets, polysomnography, etc. [61]Focus should also be on measuring tooth wear, detection of bite force, electromyography (EMG) of masticatory muscles.[62]

Always there is a font for simple techniques for evaluations, the BruxChecker comes under such fraternity. It is a simple diagnostic tool for recording and evaluating parafunctional activity patterns. It enables the identification of different occlusal contacts, the identification of kind of tooth contacts, and the differentiation of the dynamic occlusal contacts. Hence, this enables the practitioner to assess the occlusal contact and the pattern of Bruxism, if present. This helps in the treatment plan depending on ones occlusal pattern which will be different individualiy. Bruxchecker is the simple tool used to diagnose bruxism clinically and it is customised for each patient. The patients are instructed to wear the bruxchecker at night during sleep. The patients suffering from bruxism will leave definitive occlusal wear patterns on the surface of the Bruxchecker. It is proved that the grinding pattern caused by bruxism always appears in the same region and with the same direction.

Bruxchecker is an effective device used for diagnosing Bruxism and for determining the patterns of occlusal contacts performed by patients with bruxism, that is, the lateral grinding movements of the lower jaw. [63]Using the bruxchecker, we can record the occlusal contact points and direction of grinding during nocturnal bruxism. Bruxchecker can also be used to indicate the correlation of the state of occlusion to periodontal disease and Temporomandibular Disorders.[64] The first step in preparation of bruxchecker is getting an anatomic impression of the patient's teeth and a model is fabricated from the impression.All the bubbles in the working model after the casting. The model is then inserted in to the chamber of the apparatus for thermal pressing and immersed such that only the crowns of the teeth are exposed. Now the model is ready for adaptation of the foil with the method of

heat pressure and vacuum folding. This foil is made up of polyvinyl layer with thickness of 0.1mm, colored on only one side with edible colors. The foil is placed on the model in such a way that its colored surface is placed upward. The time and temperature for heat adjusted molding under pressure is 15 seconds and 220°C respectively. The time varies in different apparatuses, like 25s in the New Biostar, 30s for Ministar, and 35s for Ministar.[65] Once the foil is adapted, its thickness will be reduced. It will be less than 0.1mm in thickness, so that there will not be a change in the strength of masticatory muscles under EMG testing.[66]

The adapted foil is then removed from the apparatus and it is cut at cervical margin of the teeth. This foil is now ready for use, the patient wears the bruxchecker during sleep. Once the bruxchecker was removed from the patient's mouth if there are white points created by occlusal contacts that can be due to clenching or vertical bruxism and if there are white surfaces it is indicative of teeth grinding was preformed or horizontal bruxism.[67]

The BruxChecker captures the prevailing bruxism pattern and the present occlusion scheme. In the case of patients with symptoms of dysfunction, this allows a more differentiated diagnosis and can be utilized for treatment planning and implementation of various treatment options. Since the BruxChecker is a simple clinical technique and it is possible to examine and understand the wear pattern by the practitioners easily there wide acceptance for the method.[68]

IMAGEJ:

There are various advances in recent years in medical and biological sciences and also there increased need of determining the relationship between structure and

function of various objects that have made imaging examination or analysis an progressively important discipline. Medical professionals, especially dentists, rely on image analysis from radiology centers; but all the radiology centers will have their own restrictions to the services and also the software programs designed for this purpose are expensive. Thus, the utilization of a easy-to-use open space project for examination from advanced pictures may be about fundamental vitality.

Image J involves an exceptional position as an open area programming that can be run on any working framework (Macintosh, Windows, linux , Furthermore actually a PDA operating system). Because of its ease of use and its ability to perform a full set of imaging manipulations, this has enormous proficient client groups. [69]

Wayne Rasband is the creator of ImageJ software. The first version(version 0.50) was released on September 23rd, 1997 and its most recent version (version 1.47h) was released on December 23rd, 2012. Following creating the Macintosh-based image bank for the National Institutes of Health (NIH) throughout 10 years, Rasband made the valuable choice of beginning Image J once more utilizing the Java programming language (the letter J in the name stands for Java), which liberated those product from an unique working framework. [70] As stated by the NIH, those product need been downloaded from its web site many times, with An current rate from claiming regarding 24,000 downloads for every month. There are a number of useful tools in Image J that can be utilized for digital image processing. This can be used for determination of linear as well as angular measurements, calculation of areas and length, particle analysis, cell counts, etc. This device need been utilized as a solution in Medicine and additionally for different fields of

knowledge, for example, Engineering, Physics, Astronomy, Computer science and science. But in the field of Dentistry only few studies have been published.[70,71,72]

An extensive variety of programming or software is available from commercial to academic, but for scientific inquiry those key trademark obligatorily to a programming may be its approachability or accessibility .Subsequently those open-source product will be perfect to experimental endeavours that can be freely and easily inspected, modified, and redistributed. Since, the open software platform ImageJ meets all the above mentioned merits it has a wide acceptance in the field of science till date. From its inception, the growth of Image J is significant to being freely available and its vibrant and helpful user community. ImageJ is used ahead as an everyday support by Scientists, Researchers, interested hobbyists, technical assistants, students, scientific staff, and advanced biology researchers. Image J can be used as a tool for not only data visualization but also teaching to advanced image processing and statistical analysis. The software's continues to attract the medical professionals as well as biologists and computer scientists who wants to effectively implement specific image-processing algorithms.[73]

In 1976 an article by Weinberg LA suggested that many of the empirical datas have been reevaluated in the light of newly developed concepts of TMJ function. Although the centric relation is reproducible, it may not necessarily be correct always. It was reported that a "functional" centric relation exists when the TMJ radiographs can be correlated with the occlusal findings, in which case, the retruded classical centric relation should be used. When a "dysfunctional" centric relation is present, there will not be any correlation between the TMJ radiographs and occlusal findings. In such cases, the most retruded position should not be used

instead a therapeutic centric occlusion should be created by the dentist. Because TMJ radiographs are not routinely used for diagnosis, Subclinical TMJ dysfunction occurs more frequently than commonly thought. Retruded condylar displacements can be easily overlooked, because the lateral pterygoid muscle has relatively few stretch receptors compared to the elevator muscles of the mandible. It is for this reason, the Condylar retrusion would not necessarily cause lateral pterygoid spasm as might be expected. There are experimental evidence that the condyle can be displaced superiorly with posterior unsupported muscle force but the exact mechanism of the TMJ suspension system is unknown. This indicates that the immutability of the condylar path under varying clinical conditions is questionable. The condyle does not act as the fulcrum in mandibular kinetics due to the superior displacement characteristics of the TMJ. Hence depending on the specific situation, the fulcrum, therefore, shifts to the teeth and/or bolus. In either instance, whether considering bruxism or mastication, for most patients, an occlusion based on group function is preferable to a canine protected occlusion to insure TMJ health. Scientifically, no scheme of occlusion or articulation has been proven to be superior to any other scheme; therefore, it is the choice or the personal preference of the dentist that matters.[74]

In 1992 Schiffman EL in his study investigated the association between occlusion, parafunctional habits and stress relative to the level of mandibular dysfunction. The specific subgroups involved in the study were normal, joint disorder, muscle disorder and joint/muscle disorder. The participants of the study were 269 nursing students. The study material includes a set of questionnaire and also clinical examination. The questionnaire included items to calculate an oral habit

index and a social readjustment rating scale. The examination included items for calculating occlusal index and two craniomandibular indices and also diagnostic criteria for specific subgroups. The results of the total population were significant, that is, a positive association between mandibular dysfunction and three postulated risk factors was confirmed. The total population was then divided into diagnostic subgroups. There were significant results incase of diagnostic subgroups also. A positive correlation was found between the degree of mandibular dysfunction and parafunctional habits for subgroups such as normals, muscle disorders and joint/muscle disorders. A positive correlation was found between mandibular dysfunction and occlusion for the subgroup normals only. Also positive correlation was found between mandibular dysfunction and stress for the subgroup muscle disorders only. According to the results it was clear that associations between the postulated aetiologic factors and mandibular dysfunction vary depending on whether the subjects have a muscle and/or joint disorder.[75]

In the study in 1997 by Kikuchi M stated that the contact area during habitual biting can vary according to the activity of the jaw musculature. Forceful masticatory muscle activity yields various tooth loads despite an apparently even distribution of tooth contacts and it may also induce deformations of the dentoalveolar tissues and the supporting skeleton. To investigate this variability, the bite forces were measured simultaneously at multiple dental sites during maximum effort clenching. An acrylic maxillary appliance was made use of in each of four healthy adults with complete natural dentitions. The four strain-gauge transducers in the right side of the acrylic maxillary appliance occluded with the lower canine, second premolar, and first and second molars. Articulating paper and

a force monitor (type F appliance) were made use of to balance these contacts and matching contralateral contacts. Bite forces were recorded when the subjects clenched maximally on the appliance. Type R and type U appliances respectively were made use of for similar recordings when contralateral molar and all contralateral contacts were removed. During the initial increase in force, the relation between individual forces often changed, but it was generally constant around the maximum. There were variations in distribution of the maximum forces between subjects at the four dental locations, but were characterized by posteriorly increasing forces. The result showed significant increase of forces in the anterior region, especially at the canine (up to 10 times) when clenching took place on unilateral contacts only (type U) as compared with fully balanced ones (type F). The results also showed that there were changes in the Bite force distribution with variations in the biting strength and the location of occlusal contacts.[7]

In a 1999 study, the authors have analyzed the biomechanical reactions in the mandible and TMJ during clenching under various restraint conditions. A three-dimensional finite element model of the mandible, including the TMJ, was created for test purposes. The result of the study showed that, under any restraint conditions, displacement was greatest on the surface of the condyle and less on the articular disc and even on the surface of the glenoid fossa, in that order. Resultant stresses followed the same pattern. Also the authors found out that the displacement and stress were greatest when the lower central incisor was restrained and attenuated as the posterior teeth were restrained. The biomechanical reaction of the TMJ during clenching was greatest when the lower central incisor was restrained. This concept was based on the finding that Premature contacts

were considered to be one of the factors involved in the initiation of temporomandibular arthrosis.[76]

In 2000, Van Eriden TMGJ, in the article on the Biomechanics of mandible pictorises the biomechanical behavior of the mandibular bone as a whole and bone tissue, in response to external loading. In this article the author has done a survey of the determinants of mandibular stiffness and strength, the mechanical properties and distribution of bone tissue and the size and shape of the mandible. Along with these normal findings the Mandibular deformations, stresses, and strains that occur during static biting and chewing are reviewed. During biting and the process of mastication, there will be a combination of sagittal bending, corpus rotation, and transverse bending which results in a complex pattern of stresses and strains in the mandible. Both the material properties and the geometrical design of the mandible carries importance in ability to resist forces and bending and torsional moments. It was suggested that the mandible is stiffer in the longitudinal direction, than in transverse directions, and the vertical cross-sectional dimension of the mandible is larger than its transverse dimension. For the regulation of bone modeling and remodeling stresses and strains are considered to be important factors. It is for this reason the amount and disposition of cortical bone, and the structure and density of cancellous bone, are assumed to be (partly) regulated by loading conditions. But the exact mechanisms of loading conditions which leads to modeling and remodeling of the mandible is unknown.[35]

In 2000 a study by Molina OF et al., assessed the profile of TMD and Bruxer compared to TMD and nonbruxer patients based on the chief complaint, previous consultations, modes of therapy, and chronicity.340 patients with TMD were

selected which includes 275 Bruxers and 65 nonbruxers. The results of the study revealed that the most common chief complaints in TMD bruxers and nonbruxers were facial, temporomandibular joint, headache and/or cervical pain, and joint noises. It was also apparent that the need for management increases as the severity of Bruxism increases.[77]

A study (2001) the variability in sleep bruxism activity overtime was evaluated. In the study, Sleep bruxism (SB) is defined as an oral activity associated with jaw movements and tooth grinding. Sleep bruxism is believed to be highly variable, that is, it is different with subjects as well as with time, like showing no activity on some nights and intense activity on others. For the efficient management, it is necessary to assess SB variability in individual patients. In this study,the authors have analysed SB night-to-night variability over time in SB patients. Nine moderate to severe SB patients were included in the study. A total of 37 nights were analysed, with a range of 2-8 nights per subject. The interval between the first and the last recording was between 2 months and 7.5 years. The results were tabulated under three main headings like the number of SB episodes per hour, number of SB bursts per hour and number of SB episodes with grinding noise. In order to verify the diagnosis of subjects, the oromotor outcomes were compared with a standard research diagnostic cut-off. The Number of SB episodes per hour >4, The Number of SB bursts per hour >25, The Number of SB episodes with noise per night >1. The mean coefficient of variation for the nine subjects were as follows : SB episodes per hour 25.3%, SB bursts per hour 30.4% and episodes with noise 53.5%. The SB diagnosis remained constant over time for every subject, while grinding was present every

night. These results indicate that while the SB diagnostic remains relatively constant over time in moderate to severe sleep bruxers, there can be individual variability in some SB patients.[78]

In a study in 2002 the etiologies or the risk factors of painful Temporomandibular disorders were evaluated. To test this hypothesis, risk factors for three diagnostic subgroups of painful TMD were considered. Ninety-seven subjects were included in the study and they were divided in to subgroups like with myofascial pain only, 20 with arthralgia only, 157 with both myofascial pain and arthralgia, and 195 controls without TMD pain. Investigated risk factors included both physical and psychological variables. Myofascial pain occurring alone was significantly associated with the following in its order like trauma, clenching, third molar removal, somatization, and female gender. Also, Myofascial pain with arthralgia was significantly associated with the following in its order like trauma, clenching, third molar removal, somatization, and female gender. No significant associations were found for the small-arthralgia-only group.[79]

In 2002 Fukui T et al have published a study correlating the facial morphology, mouth opening ability and condylar movement during opening and closing jaw movements in female adults with normal occlusion.21 adult female in the age group between 20 to 24 was selected. The subjects selected for the study had normal occlusion without signs and symptoms of TMJ disorders. Maximal jaw opening and condylar movements were noted. The result of the study suggests that the facial morphology size has a limited effect on maximal voluntary mandibular opening and condylar movements in normal adult women.[80]

In 2003 study, Pergamalian A et al., aimed at assessing the association between wear facets, bruxism, and severity of facial pain in patients with temporomandibular disorders.84 subjects previously diagnosed with TMDs were selected for the study.The result of the study revealed that Bruxism activity was not correlated with muscle pain on palpation and was inversely associated with TMJ pain on palpation. Tooth wear was not significantly correlated with bruxism, TMJ pain, or muscle pain. The authors have also concluded that the amount of bruxism activity was not associated with more severe muscle pain and was associated with less pain in the TMJ on palpation.[81]

In a 2003 study which was undertaken to test a hypothesis that there will be reduction in the three-dimensional stress distribution in the condyle, the disc and articular eminence by the addition of articular fibrocartilage in the condyle of the temporomandibular joint. For analysing joint loading before and after the addition of condylar fibrocartilage, a three-dimensional, nonlinear finite-element model was developed. Each of the disc, condyle and articular eminence in the model was arbitrarily divided into five regions: the anterior, posterior, medial, lateral and central. The test shows reduction in the Von Mises stresses virtually in all regions of the disc, condyle and articular eminence after the addition of condylar fibrocartilage. Especially the remarkable result was that there was approximately four-fold reduction in von Mises stresses in the anterior, central and medial regions of the mandibular condyle. Also the test shows that only slight to moderate stress reductions occurred in the disc and articular eminence. This suggests that condylar fibrocartilage absorbs considerable stresses and likely dampens more loads than the disc and articular eminence. From the result it was confirmed that, after the addition

of articular fibrocartilage, the mandibular condyle demonstrated the largest total displacement in all directions, followed by the disc and articular eminence. They have concluded that the addition of articular fibrocartilage primarily causes reduction in the loading of the mandibular condyle, rather than the disc and articular eminence. From these findings it is clear that the mandibular condyle more likely functions as a shock absorber than the disc.[82]

In a 2004 study, the Relationship Between Bruxism and Occlusal Factors were evaluated among Seven- to 19-Year-Old Turkish Children. 965 Turkish subjects that included 472 boys and 493 girls with a mean age of 12.8 years were included in the study. Also the study aims at identifying the relationship between occlusal factors and bruxism and also to identify possible sex differences. The study population was divided into two groups like, bruxers or nonbruxers based on a clinical examination and self-reports. The examiner also recorded the malpositions of teeth and the malocclusions like Angle molar classification bilaterally, severity of anterior crowding, existence of anterior and posterior crossbite, open and deep bite, functional shift, and excessive overjet. The study aims at evaluating the relationships between occlusal factors and bruxism and their sex differences. The results showed that bruxism was diagnosed in 12.6% of all subjects. From the findings of this study there was no statistically significant relationships were determined between bruxism and occlusal factors. Also no sex differences were found between occlusal factors in relation to bruxism. The prevalence of bruxism in boys and girls was similar, and no statistically significant differences were found. The authors in the study concluded that none of the occlusal factors seem to play a role in the development of bruxism. Based on the results obtained, it can be concluded that the data obtained from the

physical examination and questionnaire identified no statistically significant relations between bruxism and all occlusal factors investigated in seven- to 19-year-old Turkish subjects. No evidence that the occlusal factors studied play a role in the development of bruxism was found. No statistically significant sex differences were found between different occlusal factors and bruxism.[83]

In 2007, Pizolato RA et al in the study on Maximal bite force in young adults with temporomandibular disorders and bruxism reported that Parafunctional habits, such as bruxism, are considered to be the contributory factors for temporomandibular disorders (TMD). The aim of this study was to evaluate the maximal bite force (MBF) in young adults with bruxism(TMDB) and TMD. This was a case control study in which 12 women (mean age 21.5 years) and 7 men (mean age 22.4 years), composed the TMDB group and 10 healthy women and 9 men (mean age 21.4 and 22.4 years, respectively) formed the control group. The candidates were evaluated for TMD by a structured questionnaire and clinical examination. To assess stress a visual analogical scale was applied. Gnatodynamometer was used to measure the MBF. In this study the subjects were asked to bite 2 times with maximal effort for 5 seconds, with a rest interval of about one minute and the highest values were considered. The results reveal that in both TMDB and control group women presented lower values of MBF as compared to those presented by men. The Maximal Bite Force of men in TMDB group and the control group was found to be similar. The proportion of TMDB women with signs and symptoms of TMD was significantly higher than that of men .It was concluded that Men presented higher MBF values than women, but TMD and bruxism did not significantly decrease MBF.[84]

In 2007 Spijker AV et al in a systematic review on Attrition, occlusion, dysfunction and intervention stated that all these factors are interrelated. In their search of review articles the inclusion criteria includes occlusal factors, function or dysfunction, temporomandibular disorders, bruxism, intervention and attrition. The systematic review reveals the fact that the attrition seems to be coexistent with self reported bruxism. Also little understanding of the relationship between attrition and TMD signs and symptoms are reported.[85]

In a 2009 study, it was stated that the large spectrum of sleep motor activities (SMA) present in the head and neck region has not yet been systematically estimated in normal and sleep bruxism (SB) subjects. It was hypothesized that in the absence of audio-video signal recordings, normal and SB subjects would present a high level of SMA that might confound the scoring specificity of SB. A retrospective analysis of several SMA, including oro-facial activities (OFA) and rhythmic masticatory muscle activities (RMMA), was made from polygraphic and audio-video recordings of 21 normal subjects and 25 SB patients. Sleep motor activities were scored, blind to subject status, from the second night of sleep recordings. Discrimination of OFA included the following types of activities: lip sucking, head movements, chewing-like movements, swallowing, head rubbing and scratching, eye opening and blinking. These were differentiated from RMMA and tooth grinding. The frequency of SMA per hour of sleep was lower in normal subjects in comparison with SB patients ($P < 0.001$). Up to 85% of all SMA in normal subjects were related to OFA while 30% of SMA in SB patients were related to OFA scoring ($P < 0.001$). The frequency of RMMA was seven times higher in SB patients than in normal

subjects ($P < 0.001$). Several SMA can be observed in normal and SB subjects. In the absence of audio-video signal recordings, the discrimination of various types of OFA is difficult to achieve and may lead to erroneous estimation of SB-related activities.[86]

In 2011 Diracoglu D et al in one of his studies evaluated the relationship between maximal bite force and tooth wear in bruxist and nonbruxist individuals. The objective of the study was to compare the individuals with self reported bruxism and nonbruxist individuals in terms of maximal bite force (MBF) and temporomandibular joint (TMJ) and also to evaluate the relationship between MBF and tooth wear in these subjects. The sample size of both case and control group were 29. The bite force recorder was made use of for MBF measurements. For every subject Tooth wear indices, maximal mouth opening, maximal lateral excursions and maximal protrusions were measured. The results of the study revealed that MBF and tooth wear index scores were significantly higher in bruxists compared to nonbruxists. No differences in masticatory clinical examination parameters were identified between the groups. This study is considered to be the first study which showed that MBF can increase in bruxist individuals and that the increase in MBF are correlated with tooth wear in bruxist subjects.[87]

In a 2012 study, Cunali RS conducted a systematic review on the relation of SB with TMDs. The study failed to find a positive relation of SB with TMDs. Hence the authors have concluded the study suggesting that the patients with TMDs and SB lack positive correlation and they suggests the need for referring the patients with TMD and SB for PSG evaluation.[88]

In a 2012 study, assessment of mandibular asymmetry was performed through Orthopantomographic analysis. The objective was to introduce simplified analysis for preliminary diagnosis of mandibular asymmetry using digital OPG. The purpose of the study was to provide an analysis involving vertical and angular measurements of mandible done on a digital panoramic radiograph for diagnosing mandibular asymmetries with particular emphasis on differential diagnosis of condylar hyperplasia, hemimandibular hypertrophy, Hemimandibular elongation and coronoid hyperplasia. Mandibular asymmetry is a complex problem. Mandibular asymmetry can be caused by various factors. The diagnosis may be confusing and it requires clinical and radiographic assessment. The panoramic radiography is considered to be the gold standard for dental diagnosis and treatment planning. Panoramic radiograph is relatively accessible and provides a bilateral view of the mandible. It is suggested that Panoramic can produce reproducible measurements.[89]

In a 2012 study, Evaluation of bone changes in the temporomandibular joint using cone beam CT was done. The aim of this study was to assess bone changes and mobility in temporomandibular joints (TMJs) using cone beam CT (CBCT) in a population sample in Brazil. The effect of age and gender on the occurrence of bone changes was assessed using an adjusted logistic regression model. Bone changes were present in 71% of patients. The result showed statistically significant association of age group and gender with the presence of bone changes. The results also showed that there was no significant difference between the right and left sides and in condylar mobility with regard to the presence of degenerative bone changes. There is a high prevalence of degenerative bone alteration in TMJs, which is found tobe more frequent in women and also they are mostly located in the condyle. It was

concluded by the authors that as the age increases the prevalence of degenerative bone changes also increases. From the results the authors have concluded that there is no correlation between condylar mobility and the presence of degenerative bony changes in TMJs.[90]

In a study article in 2013, it was suggested that digital pathology images are increasingly used both for diagnosis and research, because slide scanners are nowadays broadly available and because the quantitative study of these images yields new insights in systems biology. However, such virtual slides build up a technical challenge since the images occupy often several gigabytes and cannot be fully opened in a computer's memory. Moreover, there is no standard format. Therefore, most common open source tools such as ImageJ fail at treating them, and the others require expensive hardware while still being prohibitively slow. They have developed several cross-platform open source software tools to overcome these limitations.

The NDPI Tools provide a way to transform microscopy images initially in the loosely supported NDPI format into one or several standard TIFF files, and to create mosaics (division of huge images into small ones, with or without overlap) in various TIFF and JPEG formats. They can be driven through ImageJ plugins. The Large TIFF Tools achieve similar functionality for huge TIFF images which do not fit into RAM. We test the performance of these tools on several digital slides and compare them, when applicable, to standard software. A statistical study of the cells in a tissue sample from an oligodendroglioma was performed on an average laptop computer to demonstrate the efficiency of the tools. The open source software enables dealing with huge images with standard software on average computers.

They are cross-platform, independent of proprietary libraries and very modular, allowing them to be used in other open source projects. They have excellent performance in terms of execution speed and RAM requirements. They open promising perspectives both to the clinician who wants to study a single slide and to the research team or data centre who do image analysis of many slides on a computer cluster.[91]

In a 2014 study, comparison of the electrical activity of masseter and temporal muscles, were done at rest, in maximum voluntary isometric contraction and chewing. The Surface Electromyography was held in the masseter and temporal muscles (anterior portion) bilaterally. The sample population involved 18 women in the age group between 27 and 50 years. The assessment was carried out in three situations: at rest, in maximum voluntary isometric contraction and habitual chewing dried vine fruit without seeds, as food. The results suggests that there was a minimum of electrical activity at rest. Both the tooth clenching and mastication of dried vine fruit the Root Mean Square average values were found to be greater than original mean values. Also they have concluded that there has been greater electrical activity of muscles masseters when compared to the temporal muscle, both in maximum voluntary isometric contraction as well as in chewing.[92]

In 2014, a study was conducted to show the use of bruxchecker in patients with different type of bruxism as a useful device for early diagnosis. The horizontal bruxism is recognized by the extreme wear of the incisal edges of the front teeth, tubers of the lateral teeth and by temporomandibular disorder (TMD). Vertical bruxism is an unconscious centric rotation of the lower jaw, diagnosed by occlusal wear in the fissures caused by contact with the functional tubers and musculoskeletal

pain. Bruxchecker is used to clinically diagnose bruxism, and it is individually made for each patient. After taking an impression from the mouth the device is constructed by pressure molding from a prefabricated layer of polyvinyl. The patients wear the bruxchecker each night during sleep. On 140 patients it was showed that 60% suffered from horizontal type of bruxism and 40% had vertical bruxism. Depending on the pattern of bruxing movements, repositioning splints for horizontal bruxism with TMD, and stabilization splints for vertical bruxism with musculofascial pain were prescribed. In this study the authors concluded that the horizontal type of bruxism is growing in the population and it has more severe repercussions compared to the vertical bruxism. The study also concluded that the patients with horizontal bruxism have more pronounced dental morphological defects, whereas vertical bruxism is characterized by significant morphological defects, but stronger and more frequent musculoskeletal pain.[93]

Lemos D A et al in 2014 proposed a new analysis of digital panoramic radiographs for a differential diagnosis between functional and morphological mandibular asymmetry in children with and without unilateral posterior crossbite using "Image J". In this study they have found that there was considerable divergence between the right and left sides in the measurements of mandibular length and position of condyles in patients with unilateral posterior crossbite in comparison to individuals with normal occlusion.[16]

In 2014 study the temporomandibular joint during bruxism was evaluated. A finite element model of the temporomandibular joint (TMJ) and the human mandible was fabricated to study the effect of abnormal loading, such as awake and asleep bruxism, on the articular disc. A quasilinear viscoelastic model was used to simulate

the behaviour of the disc. The viscoelastic nature of this tissue is shown to be an important factor when sustained (awake bruxism) or cyclic loading (sleep bruxism) is simulated. From the comparison of the two types of bruxism, it was seen that sustained clenching is the most detrimental activity for the TMJ disc, producing an overload that could lead to severe damage of this tissue. This work presents a numerical tool to study temporomandibular disorders. In this study, the focus was on bruxism, but this tool could be applied to different pathologies. It was observed that the stress level observed in the disc is not proportional to the muscle activation level due to the nonlinear behaviour of the articular disc. Additionally, different activation rates seem to produce no significant changes in the stress level. The shear stresses estimated in this work for any type of bruxism, but especially those obtained in sustained clenching, can induce damage in the articular disc, which, in turn, can lead to TMDs. As a numerical model, many assumptions and hypotheses were needed, but in light of the results, the most influential is a good characterisation of the articular disc. In this regard, it seems very important to consider the nonlinear viscoelastic behaviour of the articular disc.[94]

In a 2015 study, Raphael KG et al conducted a study for assessing the validity of Self-reported Sleep Bruxism among Myofascial Temporomandibular Disorder Patients and Controls. In the study it was mentioned that, since the laboratory polysomnographic assessment is extremely expensive and time consuming the researchers rely on the patients self report of SB. The result of the study revealed that self-reported SB failed to significantly predict presence or absence of either moderate or severe SB as assessed by PSG. The authors concluded that, the self-report of tooth grinding awareness is highly unlikely to be a valid

indicator of true SB. Also they have added that the studies relying on self-report to assess SB must be viewed with extreme caution.[95]

In 2015 a study was conducted to evaluate and treat bruxism using bruxchecker. Bruxism is associated with occlusal trauma, abrasion, attrition and abfraction of hard tooth structures, cervical defects, tooth migration, and the etiology of temporomandibular disorders (TMDs). The evaluation of the individual masticatory movement pattern is decisive for the assessment of "pathological" influences of occlusion and the long-term stability and quality of occlusal rehabilitation, both in reconstructive dentistry and orthodontics. The involuntary and incalculable forces acting particularly during nocturnal parafunctional activity are difficult to reproduce or record in everyday clinical practice. The aim of study was to present the BruxChecker (Scheu Dental) and evaluate existing dental literature on this topic. The BruxChecker is a simple diagnostic tool that facilitates the recording and evaluation of patients' parafunctional activity patterns. It enables the visualization of static and dynamic occlusal contacts, the identification of physiological or unphysiological tooth contacts, and the classification and differentiation of the dynamic occlusal scheme. The assessment of these patterns in the context of occlusion diagnostics enables the development of a precise, personalized treatment plan for each patient based on his or her respective current bruxism pattern.

Bruxism can be classified as one of the physiological functions of the human organism. Its effect on the TMS is evidently decisively influenced by the prevailing occlusal scheme. According to the studies described, the potentially damaging effect of bruxism for the tissue of the masticatory system (dentition, periodontal tissue,

musculature, TMJ) is likewise significantly dependent on the occlusion scheme. Laterotrusive and mediotrusive posterior guidance contacts increase the danger of unphysiological loading, which means a significant risk of damage to the masticatory system components. Pronounced bruxism with a "poor" occlusion pattern was shown to increase the potential neurophysiological stress response of the human organism. The BruxChecker enables the structured capture of the prevailing bruxism pattern and the currently active occlusion scheme. This allows a more differentiated diagnosis in the case of patients with symptoms of dysfunction, and can be utilized for treatment planning and implementation, both in the case of splint therapy and possible irreversible treatment options at a later date (occlusal adjustment therapy; endodontic, reconstructive or prosthodontic treatment). The BruxChecker offers simple clinical handling and makes it possible to examine whether, in the case of the patients examined, the abraded surfaces visible on the models currently still play a part in the dynamic occlusion. In future clinical studies, however, the results of studies on the BruxChecker should be compared with and checked against other diagnostic standards for bruxism.[68]

In 2015,in a study aimed at assessing the association between sleep bruxism, low quality of sleep and the degenerative changes of TMJ. The study mainly aimed to evaluate the presence of degenerative bone changes of the temporomandibular joint (TMJ) in individuals suffering from sleep bruxism (SB), associating these characteristics with the quality of sleep. For this, the International Classification of Sleep Disorders for the diagnosis of SB was followed, in addition to the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) for the classification of TMD and cone beam computed tomography. It was found that

97.7% of the individuals with bruxism had at least 1 RDC/TMD group III diagnosis, 75.6% of the subjects considered their sleep quality as poor, and the largest group (23%) had centric bruxism. There was no significant association between the pattern of sleep quality, the type of SB, and the presence of degenerative changes of the TMJ. It was concluded that regardless of the quality of sleep and the type of bruxism presented, degenerative bone disorders was high among women with a mean age of 46 years and a clinical diagnosis of SB.[96]

In a 2016 study, Palinkas et al assessed the impact of SB on masseter and temporalis muscles and bite force. The authors have analysed the impact SB on EMG activity and the thickness of the masseter and temporal and maximal molar bite force.90 individuals, aged between 18 and 45 years, were selected and divided into two groups. Group I includes the case group with 45 subjects and Group II includes the control group with 45 subjects. The result of the study revealed that SB negatively altered the masticatory muscles functions. Based on the results, the authors concluded that individuals with SB showed decreased EMG activity in the masticatory muscles.[97]

In a 2017 study, Silva JA et al., evaluated the sleep and awake bruxism in adults and its relationship with temporomandibular disorders in a systematic review.Sleep bruxism could be associated with myofascial pain, arthralgia and joint pathology as disc displacement and joint noises. Although the evidence of the study was inconclusive and does not provide information according to the type of bruxism (bruxism sleep and wakefulness), it is possible to suggest that bruxism would be associated with TMD.[98]

In a 2017 study, a research was conducted for determining sleep bruxism events recorded by polysomnography and electromyography, for assessing masseter and temporalis muscle activity before and after performing a selective grinding. The study contained three stages like Pre-test, Selective grinding and Post- test. A sample of 10 subjects with premature contact points were assessed. The age group between 21 and 23 years were assessed. All of them had premature contacts. Among which, 8 subjects presented subsequent interferences during lateral movements. The results of the study revealed a decrease in amplitude, length and area of the masseter and temporalis muscles after selective grinding. The surface electromyography of temporal muscle showed a statistically significant reduction of action potentials after the selective grinding. [99]

MATERIALS AND METHOD

The study was conducted in the department of Oral Medicine and Radiology, Sree Mookambika Institute Of Dental Sciences, Kulasekharam, Kanyakumari district to assess the mandibular surface area changes in Bruxers versus controls on Panoramic radiographic images.

METHOD OF SELECTION OF DATA

1. Sample Size

- Total number of subjects :40
- Total no of Bruxers :20
- Total no of non Bruxers :20

2. Selection of Cases

Inclusion criteria:

- Healthy volunteers aged between 20- 30 years diagnosed with Bruxism.
- Dentate individuals ,with minimum of 28 teeth except the third molars.
- Patients with symmetrically intercuspating teeth.

Exclusion criteria:

- Developmental anomalies and Syndromes affecting the size and shape of the mandible.
- Bone altering diseases such as osteo-dystrophies and also including pathologies of the mandible such as neoplasms, cysts and fractures.
- Pregnant patients.
- Patients with asymmetrically intercuspating teeth.
- Patients with periodontal disease.

- Patients undergoing / undergone orthodontic treatment.
- Age below 20 years and above 30 years.

Selection of Control Group:

Inclusion criteria:

- Healthy volunteers aged between 20- 30 years diagnosed without Bruxism.
- Dentate individuals,with minimum of 28 teeth except the third molars.
- Patients with symmetrically intercuspating teeth.

Exclusion criteria:

- Developmental anomalies and Syndromes affecting the size and shape of the mandible.
- Bone altering diseases such as osteo-dystrophies and also including pathologies of the mandible such as neoplasms,cysts and fractures.
- Pregnant patients
- Patients with asymmetrically intercuspating teeth.
- Patients with periodontal disease.
- Patients undergoing / undergone orthodontic treatment.
- Age below 20 years and above 30 years.
- Patients with para functional habits.

PARAMETERS TO BE STUDIED:

- Mandible surface area.
- Condylar surface area
- Coronoid surface area

MATERIALS REQUIRED:

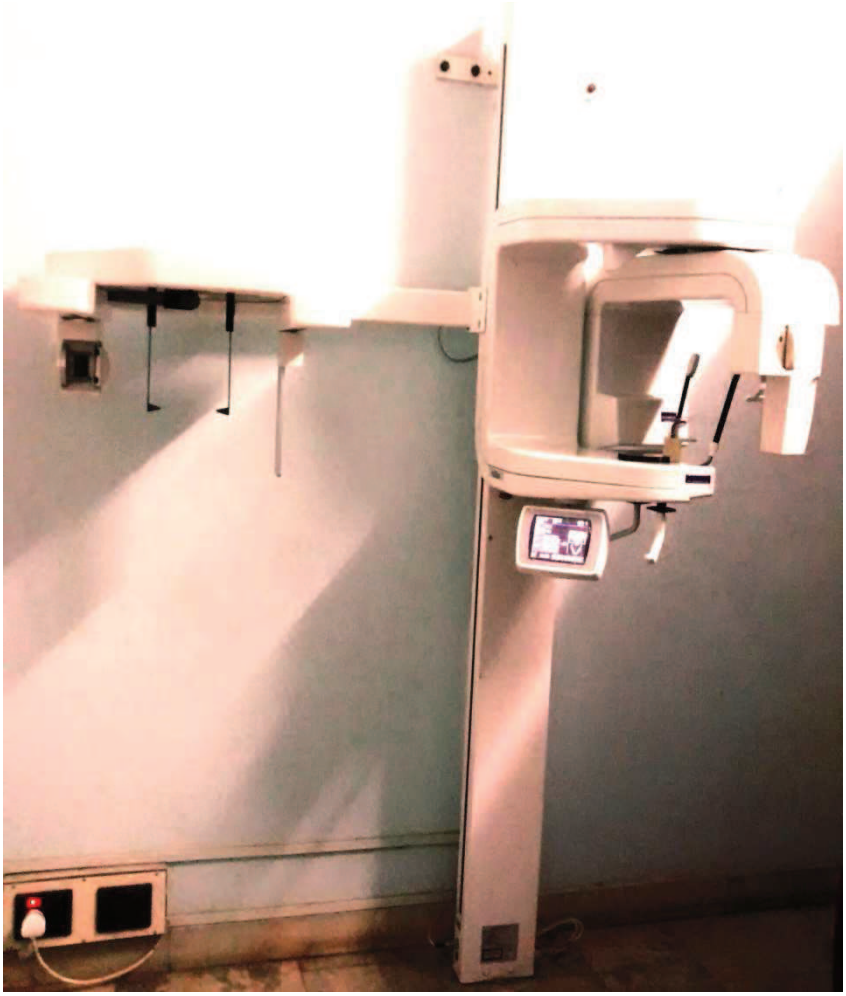
- Kidney tray
- Mouth mirror
- Probe
- Tweezer
- Gloves
- Mouth mask
- Alginate
- Impression tray
- Dental stone
- Bowl
- Spatula
- Cast
- Brux checker
- Biostar machine
- Scissor
- OPG machine
- Image J software

PROCEDURE:

This study was carried out in the Department of Oral Medicine and Radiology, SMIDS. Individuals satisfying the inclusion and exclusion criteria were included in the study. Patients with a clinical history suggestive of Bruxism were taken and a 0.1mm bruxchecker were customised using a biostar machine. The suspected case was asked to wear the bruxchecker during sleep and included or

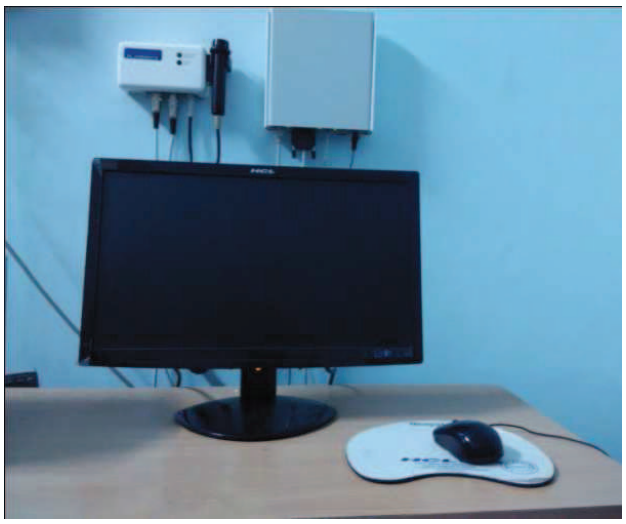
excluded as Bruxer based on the wearing on the bruxchecker . Patients identified as bruxers were subjected to an OPG. The images were acquired using Planmeca Proline XC Digital Orthopantomograph Machine, Finland. The external surface area of the mandible was measured using "Image J" software. The mandible was traced along the outermost margin's of the mandibular image, and then through the buccal aspect of the alveolar crest .A straight line was drawn across the pterygoid fovea on both sides and the condyle is traced along its outermost margins that extends till the straight line.A straight line was drawn connecting the deepest point of sigmoid notch on both sides and the coronoid is traced along its outermost margins that extends till the straight line.The tracings were counterchecked by two experts in the field (Radiologists).The area thus obtained from the "Image J" software. The data of both case and control were entered in to the data sheet. The surface area of the mandible, condyle and coronoid of Bruxers versus controls were compared. The results were obtained by the student 't' test statistical analysis.

COLOUR PLATES



ORTHOPANTOMOGRAPH

LEAD APRON



MONITOR

ARMAMENTARIUM

BRUXCHECKER

BRUXCHECKER BEFORE USE

BRUXCHECKER AFTER USE

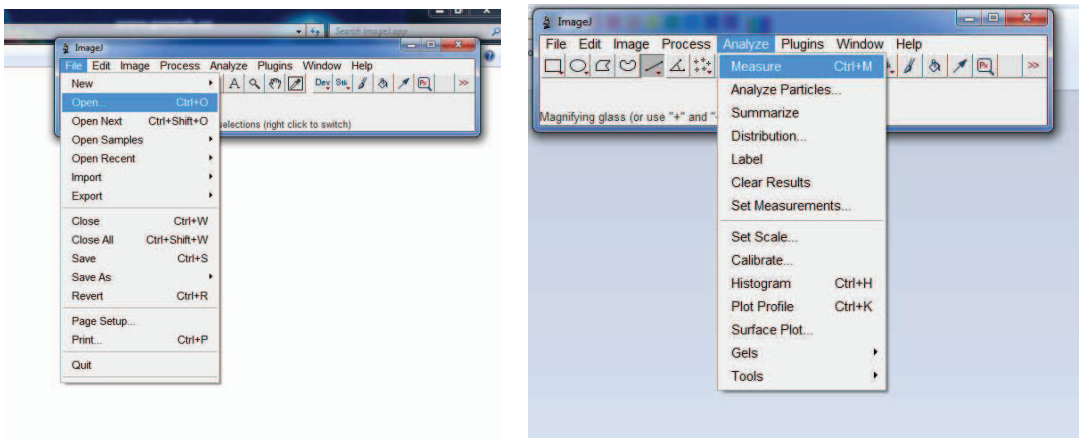
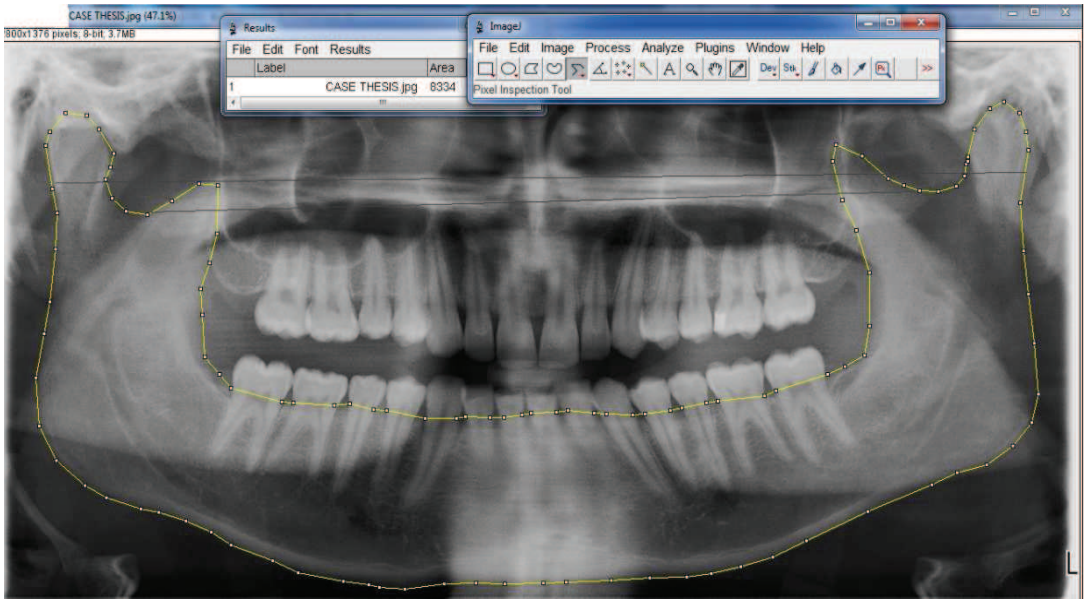
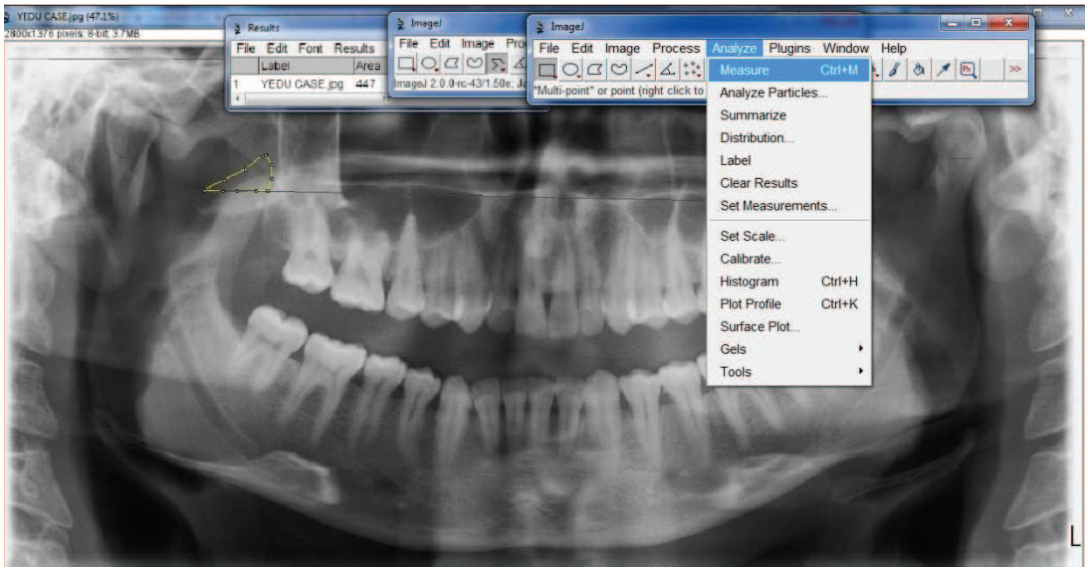


IMAGE J SOFTWARE



MANDIBULAR TRACING WITH IMAGE J

CONDYLAR PROCESS TRACING WITH IMAGE J



CORONOID PROCESS TRACING WITH IMAGE J

RESULTS AND OBSERVATION

Statistical analysis: The data was expressed in number, percentage, mean and standard deviation. Statistical Package for Social Sciences (SPSS 16.0 version) used for analysis. ANOVA (Post hoc) followed by Dunnet t-test and unpaired t test applied to find the statistical significant between the groups.

Table-1: Distribution of patients based age of different groups

Age (Years)	Group-I		Group-II	
	Number	Percentage (%)	Number	Percentage (%)
20-25 years	14	70.00	16	80.00
26-30 years	6	30.00	4	20.00
Total	20	100.00	20	100.00

Table-2: Comparison of mean mandible surface area of different groups

Groups	Mandible surface area (mm) (MEAN±SD)	P value
Group-I	7315.30±3.67	**0.67**
Group-II	7347.03±2.99	

(p>0.05 no significant difference compared Group-I with Group-II)

Table-3: Comparison of mean condylar process surface area of different groups

Groups	Condylar process (mm) (MEAN±SD)			
	Right	P value	Left	P value
Group-I	425.15±5.83	0.04	427.85±5.58	0.04
Group-II	455.80±4.36*		467.45±5.71*	

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

Table-4: Comparison of mean Coronoid process surface area of different groups

Groups	Coronoid process (mm) (MEAN±SD)			
	Right	P value	Left	P value
Group-I	497.65±6.87	0.04	525.65±7.23	0.04
Group-II	502.50±3.96*		516.70±4.14*	

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

Table-5: Comparison of mean mandible surface area between the genders within the groups

Gender	Group-I Mandible surface area (mm) (MEAN±SD)	P value	Group-II Mandible surface area (mm) (MEAN±SD)	P value
Female	7195.30±2.11	0.04	7176.50±2.90	0.03
Male	7435.20±2.54*		7517.40±2.01*	

(*p<0.05 significant compared Female with Male)

Table-6: Comparison of mean condylar process surface area between the genders within the groups

Gender	Group-I Condaylar process surface area (mm) (MEAN±SD)		Group-II Condaylar process surface area (mm) (MEAN±SD)	
	Right	Left	Right	Left
Female	391.30±2.45	398.40±2.08	454.00±3.46	439.50±4.36
Male	459.00±6.36*	457.30±6.49*	457.60±5.29	495.40±5.69*

(*p<0.05 significant compared Female with Male)

Table-7: Comparison of mean coronoid process surface area between the genders within the groups

Gender	Group-I Coronoid process surface area (mm) (MEAN±SD)		Group-II Coronoid process surface area (mm) (MEAN±SD)	
	Right	Left	Right	Left
Female	495.10±5.19	537.80±6.18	512.70±1.51	516.20±3.65
Male	500.20±8.51	513.50±8.29*	492.30±5.34*	517.20±4.79

(*p<0.05 significant compared Female with Male)

Table-8: Comparison of mean mandible surface area between the genders between the groups

Gender	Group-I Mandible surface area (mm) (MEAN±SD)	Group-II Mandible surface area (mm) (MEAN±SD)	P value
Female	7195.30±2.11	7176.50±2.90	0.56
Male	7435.20±2.54	7517.40±2.01	0.78

(p>0.05 no significant difference compared Group-I with Group-II)

Table-9: Comparison of mean condylar process surface area between the genders between the groups

Gender	Group-I Condaylar process surface area (mm) (MEAN±SD)		Group-II Condaylar process surface area (mm) (MEAN±SD)	
	Right	Left	Right	Left
Female	391.30±2.45	398.40±2.08	454.00±3.46	439.50±4.36*
Male	459.00±6.36	457.30±6.49	457.60±5.29	495.40±5.69*

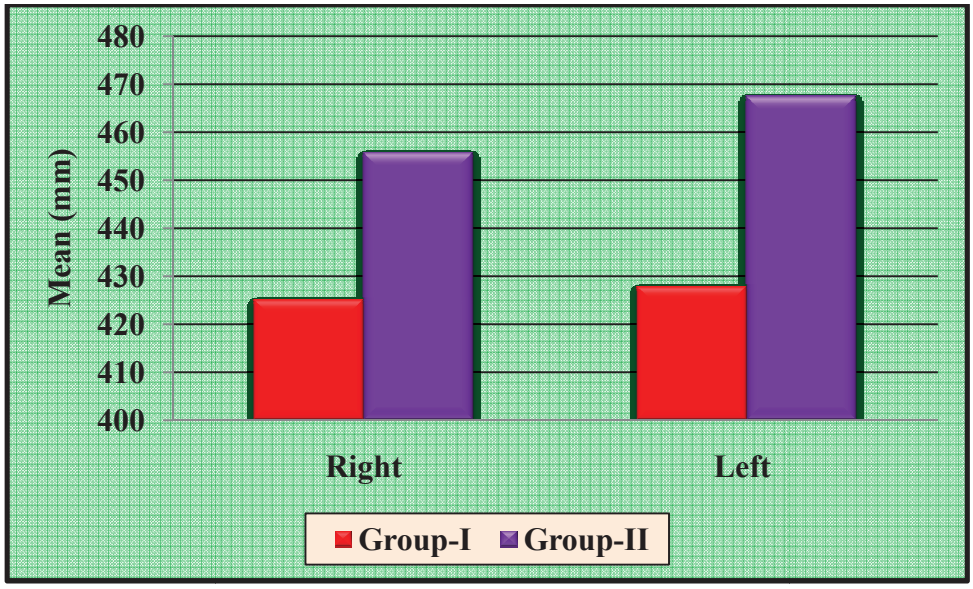
(*p<0.05 significant compared Group-I with Group-II)

Table-10: Comparison of mean coronoid process surface area between the genders between the groups

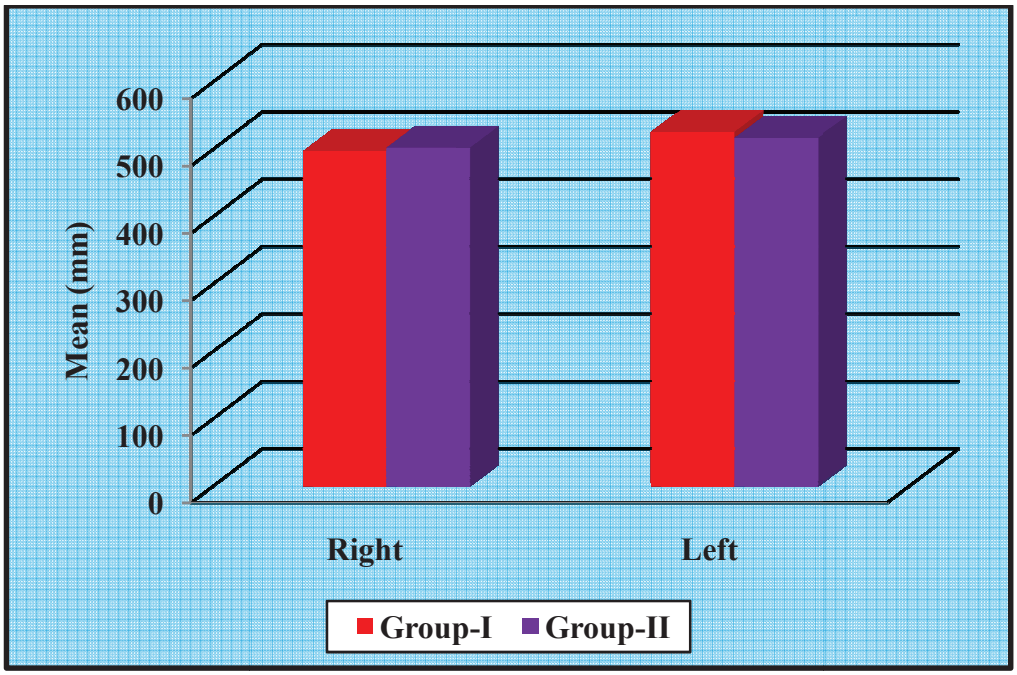
Gender	Group-I Coronoid process surface area (mm) (MEAN±SD)		Group-II Coronoid process surface area (mm) (MEAN±SD)	
	Right	**Left**	**Right**	**Left**
Female	495.10±5.19	537.80±6.18*	512.70±1.51	516.20±3.65
Male	500.20±8.51	513.50±8.29	492.30±5.34	517.20±4.79*

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

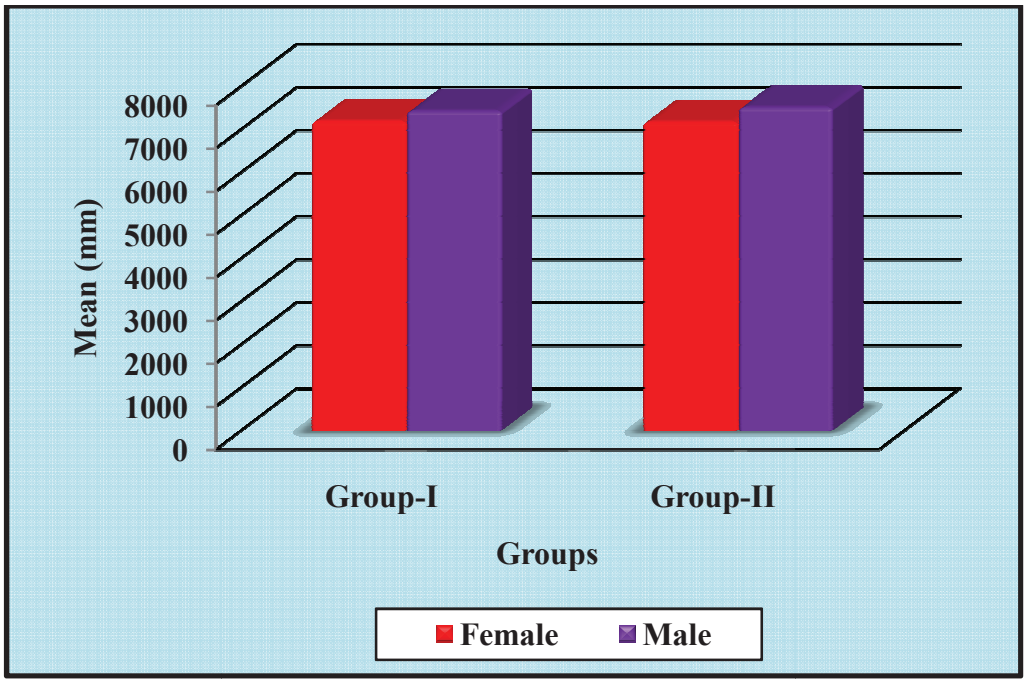
Graph-1: Comparison of mean condylar process surface area of different groups



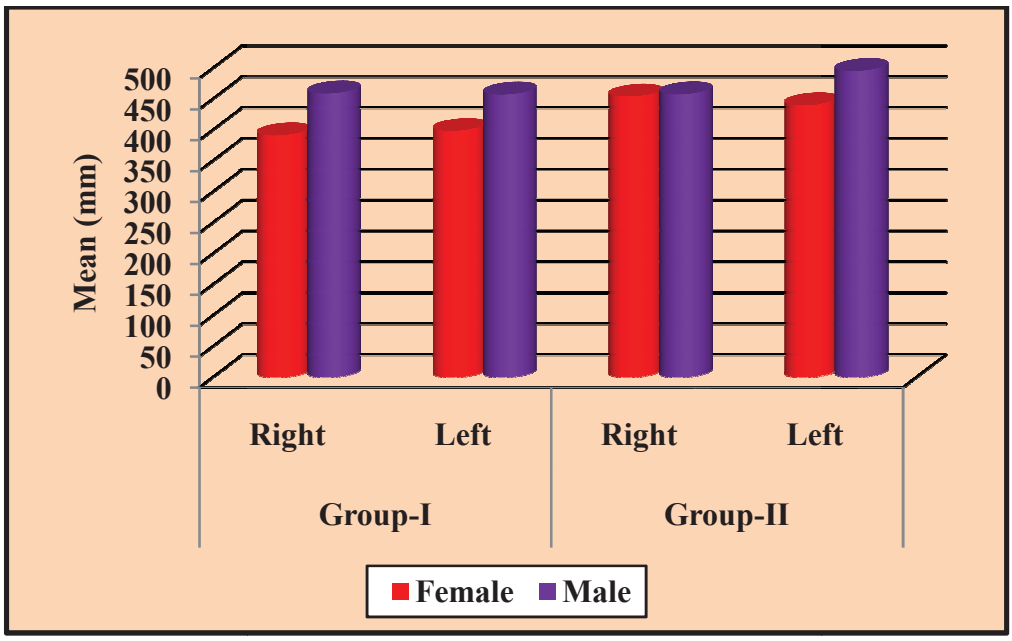
Graph-2: Comparison of mean Coronoid process surface area of different groups



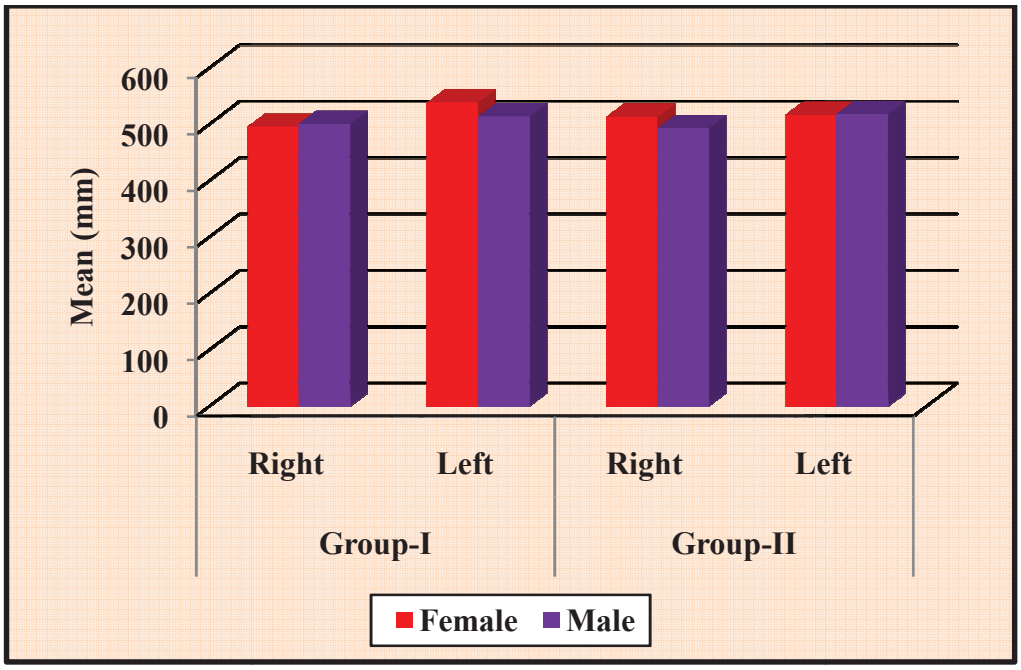
Graph-3: Comparison of mean mandible surface area between the genders within the groups



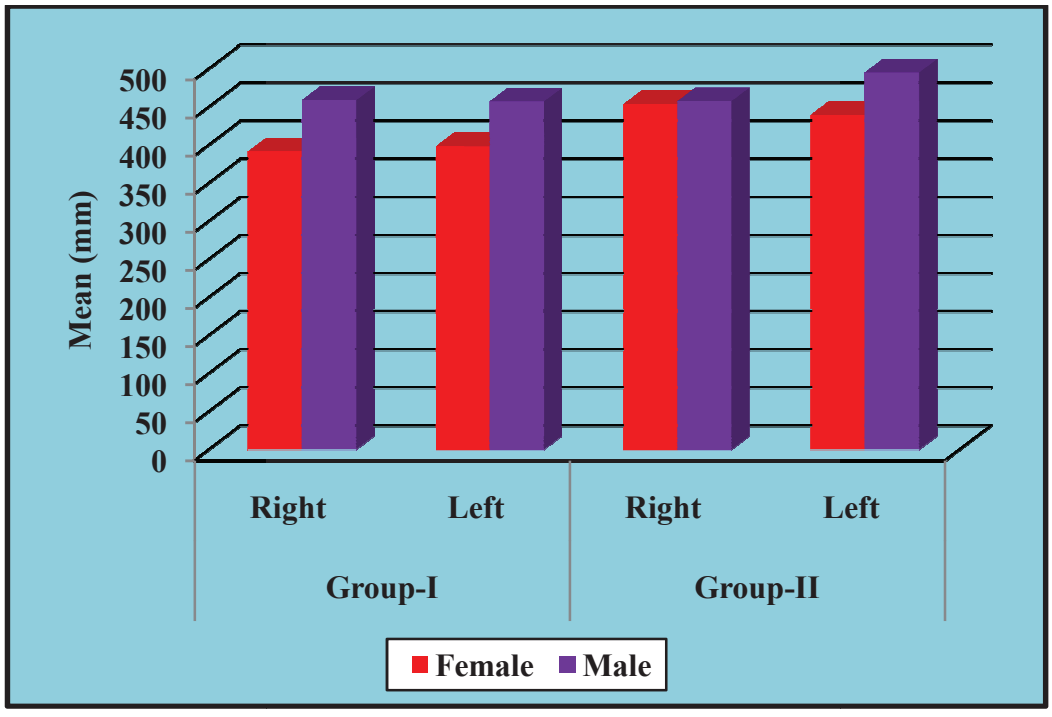
Graph-4: Comparison of mean condylar process surface area between the genders within the groups



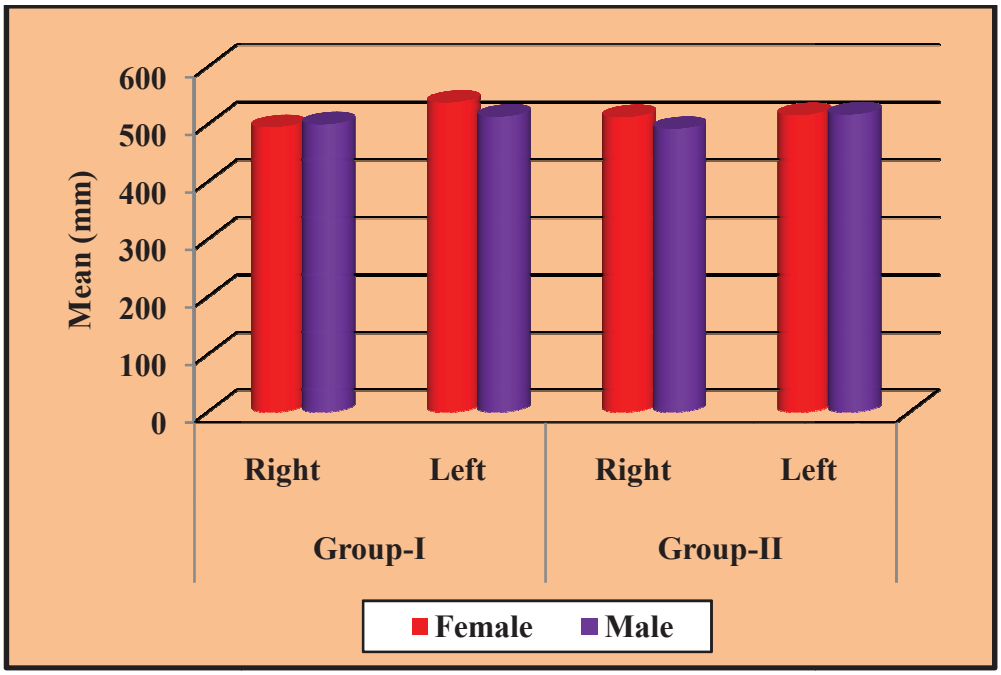
Graph-5: Comparison of mean coronoid process surface area between the genders within the groups



Graph-6: Comparison of mean condylar process surface area between the genders between the groups



Graph-7: Comparison of mean coronoid process surface area between the genders between the groups



The present study was conducted to assess the mandibular surface area changes in bruxers and nonbruxers. It was carried out on a study group comprising 20 healthy individuals as controls in comparison with 20 bruxers (10 males and 10 females).A comparison of the mandibular surface area as a whole and also condylar and coronoid processes individually were carried out. The mean surface area of two groups are found to be 7315.30±3.67 and 7347.03, which showed no significant difference. The mean condylar surface area of two groups are found to be 425.15±5.83 and 427.85±5.58 for right and left condylar processes of bruxers respectively and 455.80±4.36 and 467.45±5.71 for the right and left condylar processes of nonbruxers respectively. The values of Group I was found to be lower than the values of Group II. The mean coronoid process surface area of two groups are found to be 497.65±6.87 and 525.65±7.23 for right and left coronoid processes of bruxers respectively and 502.50±3.96 and 516.70±4.14 for the right and left coronoid processes of nonbruxers . The surface area of the right coronoid process of group I was found to be less when compared to that of group II but the values of the left coronoid process of group I was found to be more when compared with group II.

A Comparison of the mean mandible surface area between the genders within the groups was performed. The mean value of Group I females was found to be 7195.30±2.11 and that of Group II was found to be 7176.50±2.90. The mean value of Group I male was found to be 7435.20±2.54 and that of Group II was found to be 7517.40±2.01. The female and male mean values were compared and it showed significant difference. The mandible surface area of female were found to be lower when compared to that of men in both the groups.

A Comparison of mean condylar process surface area between the genders within the groups was performed. The mean values of Group I female was found to be 391.30±2.45(right) and 398.40±2.08 (left) and that of Group II female was found to be 454.00±3.46(right) and 439.50±4.36(left) .The mean values of Group I male was found to be 459.00±6.36 (right) and 457.30±6.49 (left) and that of Group II male was found to be 457.60±5.29 (right) and 495.40±5.69(left). All these mean values were compared and it showed a significant difference. The condylar surface area of female were found to be lower when compared to that of male in both the groups.

A Comparison of mean coronoid process surface area between the genders within the groups were carried out.The mean values of Group I female was found to be 495.10±5.19(right) and 537.80±6.18 (left) and that of Group II was found to be 512.70±1.51(right) and 516.20±3.65 (left). The mean values of Group I male was found to be 500.20±8.51(right) and 513.50±8.29(left) and that of Group II male was found to be 492.30±5.34(right) and 517.20±4.79 (left).The surface area of left coronoid process of Group I male and right coronoid process of Group II male were found to be lower when compared to that of female.

A Comparison of mean mandible surface area between the genders between the groups were performed. The mean values of Group I female was found to be 7195.30±2.11 and that of Group II was found to be 7176.50±2.90. The mean values of Group I male was found to be 7435.20±2.54 and that of Group II was found to be 7517.40±2.01. On comparison of the mean values there were no significant difference observed between the genders.

A Comparison of mean condylar process surface area between the genders between the groups. The mean values of Group 1 female was found to be 391.30±2.45 (right) and 398.40±2.08 (left) and that of Group II was found to be 454.00±3.46 (right) and 439.50±4.36 (left).The mean values of Group I male was found to be 459.00±6.36 (right) and 457.30±6.49 (left) and that of Group II was found to be 457.60±5.29(right) and 495.40±5.69(left). The condylar surface area of Group I females and males were found to be lower when compared with the Group II females and males.

A Comparison of mean coronoid process surface area between the genders between the groups. The mean values of Group 1 female was found to be 495.10±5.19 (right) and 537.80±6.18 (left) and that of Group II was found to be 512.70±1.51 (right) and 516.20±3.65 (left).The mean values of Group I male was found to be 500.20±8.51 (right) and 513.50±8.29 (left) and that of Group II was found to be 492.30±5.34 (right) and 517.20±4.79 (left). The surface area of coronoid process of Group I female left side was found to be higher than that compared to the Group II females. The surface area of coronoid process of Group I male right side was found to be higher than that compared to the Group II males.

DISCUSSION

Bruxism, one of the parafunctional habits with wide ranging deleterious effects. Its etiology is unclear and considered to be multifactorial. The effects of Bruxism vary from merely dental to the more severe changes of the stomatognathic triad. Dental wear features are prominent in Bruxers, which has been analysed and proved in different studies. The changes of surface area in jaw bones in Bruxers have not been evaluated. In this study we have tried to evaluate the changes in the mandible, in those with Bruxism and compared the results with that of non bruxers.

The study was conducted in the Sree Mookambika Institute of Dental Sciences, Kulasekharam, Kanyakumari District. The study involved two groups with 20 subjects in each group. The total sample size was 40. The samples were selected based on the inclusion and exclusion criteria. The subjects were grouped according to the presence or absence of Bruxism based on the pattern recorded on the Bruxchecker^{TM}. Bruxchecker was chosen for the confirmation of Bruxism, as it turned to be the simplest and easiest diagnostic methods for Bruxism.

Once the subject was confirmed to be a bruxer, they were subjected to Panoramic imaging. The Panoramic image was chosen for the study because of its advantages over other digital imaging. The Frankfort horizontal plane was the reference plane used which was easily discernable in the OPG. The use of higher imaging modalities like CT was not considered because of its cost and radiation. Another advantage with OPG was its primary requirement in the diagnostic sequence, and hence avoiding ethical concerns.

The surface area changes of the mandible as a whole, coronoid and condylar process separately were evaluated in both the groups. The Image J software was utilised for the tracings and the measurements.

In this study we used a simple technique to evaluate the Bruxism pattern, more precisely to confirm bruxism. The bruxchecker™ is a simple device that was made use of in many studies for evaluating grinding pattern and subsequently treatment plan accordingly. Kapusevska B et al and Onodera k et al in their studies used bruxchecker for determining grinding pattern and followed by appropriate treatment plan.[89,100]

Image J software was utilised for making the necessary tracings and measurements. Image J is a public domain image processing software that was adapted in many scientific studies for image processing. The software was made use of in various medical aswellas dental researchers for image analysis. Lemos AD et al and Girish V etal and various other researchers carried out their studies using this analytic software.[16,101]

From the outcome of this study, the condylar process in bruxers was found to be reduced in their surface area. The changes in the condylar process and its association with that of parafunctional habits were studied and proved in various literatures. Yamada K et al in a study has evaluated the association between condylar bony changes and parafunctional habits which concludes that the greater the number of parafunctional habit, the higher the risk of developing condylar bony change and deterioration of the temporomandibular joint.[102]

In a study by Nagahara et al in 1999, they have analyzed the biomechanical reactions in the mandible and TMJ during clenching under various restraint conditions. A three-dimensional finite element model of the mandible, including the TMJ, was created for test purposes. The result of the study showed that, under any restraint conditions, displacement was greatest on the surface of the condyle and less

on the articular disc. This substantiates our study results as we saw conspicuous changes in the condylar process.[76]

From the results it was clear that there were decrease in the condylar surface in Bruxers when compared to that of controls and there were a mild increase in the surface area of the coronoid process of the Bruxers than that of nonbruxers. The study conducted by Dias GM had evaluated the presence of degenerative bone changes of the temporomandibular joint in individuals suffering from sleep bruxism and found out positive correlation and also in that it was proved that the degenerative bone disorders was high among women.[96]

In a study, Pizolato et al have evaluated the relation of temporomandibular disorders with bruxism in young adults. The results proves the positive relation of Bruxism with temporomandibular disorders as well as there were evidence that the signs and symptoms were more in women when compared to men. This thus provides a positive correlation with our study too.[84]

The mandibular surface area as a whole did not show any significant difference between bruxers and nonbruxers. However, the surface area of the female mandible was found to be less when compared to that of male mandible. Our study shows no significant change in the surface area of mandible of bruxers and controls but there was significant change in the surface area of the mandible when the genders were compared. The surface area of male was found to be more when compared to female. This is in expected lines with most of the anthropometric studies and corroborates with the results of earlier studies in this field like those by Liu YP et al. [103]

The coronoid process was found to have a marginal increase in its surface area in bruxers when compared to that of non bruxers. The hyperactivity of the masticatory muscle especially the temporalis could be the logical explanation of this hyperplasia. In a study by Kim SM et al postulates a hypothesis that temporalis hyperactivity leads to coronoid hyperplasia.

From clinical experience, the general consensus is that there would be severe changes in the masseter muscle in bruxism. There are a multitude of studies that confirm the role of masseter hypertrophy in the increase in size of mandible mainly at the gonial angle.[105] In our study, there was no obvious change in the surface area of the mandible in bruxers when compared to that of controls. This finding suggests that the masseter activity is of no or less significance in bruxers. But there was increase in the surface area of coronoid process that squarely puts the temporalis muscle in the dock. Temporalis being the muscle for posturing of the mandible. So our contention is that, bruxism, which led to the hyperactivity of temporalis muscle and in turn deposition at the coronoid process. Clinical data suggests that bruxers manifested with headache and neck pain rather than facial pain. These suggest a positive corr elation of the finding that, it is the temporalis that is involved more in bruxism than the masseter muscle. This aspect will need to be studied further with the aid of surface EMG's.

Studies have proved that the contact area during habitual biting can vary according to the activity of the jaw musculature and posture of the cephalus. Forceful masticatory muscle activity yields various tooth loads despite an apparently even distribution of tooth contacts and it may also induce deformations of the dento-alveolar tissues and the supporting skeleton.

In a study by Yoshimi H,K et al*it was stated that sleep bruxism has three pattern's grinding, clenching and tapping. Among which the grinding pattern had the maximum muscle activity when compared to that of other patterns. [106]

There were difference of opinions and findings regarding the masticatory muscle activity in Bruxers. The result of a study by Palinkas etal revealed that SB negatively altered the masticatory muscles functions. Based on the results, the authors concluded that individuals with SB showed decreased EMG activity in the masticatory muscles.[97]

There were other studies that have positive relation with our study. A study conducted by Hoyos JAA et al on the effect of sleep Bruxism on masseter and temporalis before and after selective grinding showed remarkable reduction in the muscle activity after selective grinding. The surface electromyography of temporal muscle showed a statistically significant reduction of action potentials after the selective grinding.[99]

The effects of Bruxism should also be considered in case of rehabilitation like prosthetic management. When prosthetic intervention is indicated in a patient with bruxism, efforts should be made to reduce the effects of likely heavy occlusal loading on all the components that contribute to prosthetic structural integrity.[107]

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 and the sample size selected was limited due to the paucity of time allotted for the study. Hence advanced techniques for assessing muscle activity and volumetric analysis can provide more insight into the bruxer.

CONCLUSION

This is an original study that was carried out to assess the surface area changes in mandible and condylar and coronoid process of Bruxers and nonbruxers. The results showed significant changes in the surface area of condylar and coronoid processes in Bruxers when compared to the controls. The changes in the condylar and coronoid processes in Bruxism is an open area of research. This study was a step made to assess the bony changes in Bruxers which is seldom carried out by other researchers. There were literatures that proves the relation between TMD and bruxism but the changes in the individual bony parts lacks its results. Also in this study, the importance of temporalis muscle in Bruxism was revealed that pay way for more research in this arena.

We hope this study would be a stepping stone for the future studies in this field. We made use of the simple techniques for assessing Bruxism as well as simple imaging modality and also easy and simple image analysing tool. Advanced techniques and modes can be used in future to re-evaluate the results and to establish new outcomes.

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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. 16/07/2016*** titled, ***"Assessment of mandibular surface area changes in bruxers versus controls on panoramic images – a case control study"*** submitted by ***Dr. Lakshmi P. S., II Year MDS, Department of Oral Medicine and Radiology*** has been approved by the Institutional Research Committee at its meeting held on ***1st September 2016.***

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: 1 /Protocol no: 3 / 2016

Protocol title: Assessment of mandibular surface area changes in bruxers versus controls on panoramic radiographic images: a case control study
Principal Investigator: Dr. Lakshmi. P. S
Name& Address of Institution: Department of Oral Medicine and Radiology Sree Mookambika Institute of Dental Sciences,Kulasekharam ☑ New review ☐ Revised review ☐ Expedited review
Date of review (D/M/Y): 14.12.2016 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.

Reneegalangadhar

Signature of Member Secretary (IHEC)

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:** Lakshmi P.S
   Second Year Post Graduate student
   Department of Oral Medicine and Radiology
   Sree Mookambika Institute of Dental Sciences,
   Kulasekharam

2. **Name of the Guide:** Dr. Tatu Joy E MDS
   Professor and Head
   Department of Oral Medicine and Radiology
   Sree Mookambika Institute of Dental Sciences
   Kulasekharam, KanyaKumari District-629161

3. **Name of the Co-Guide:** Dr Shashi Kiran M MDS
   Reader
   Department of Oral Medicine and Radiology.
   Sree Mookambika Institute of Dental Sciences.
   Kulasekharam, KanyaKumari District-629161

4. **Institute:** Sree Mookambika Institute of Dental Sciences,
   V.P.M Hospital complex, Padanilam,
   Kulasekharam,
   Kanyakumari – 629161
   Tamilnadu

5. **Title of the study:** Assessment of mandibular surface area changes in Bruxers versus controls on Panoramic radiographic images: A case control study.

6. **Background information:**

Bruxism is the commonest of the many parafunctional activities of the masticatory system. Opinions on the causes of bruxism are numerous and widely varying.It can occur on sleep aswellas wakefulness. Bruxism was for long considered a major cause of tooth wear. Other effects of bruxism may include tooth movement and tooth mobility, as well as changes in oral soft tissues and jaw bone.Since the exact etiology and manifestations are unclear it is difficult to diagnose Bruxism. In this study we are evaluating the area change that can occur on the lower jaw bone in those with Bruxism and comparing the results with nonbruxers.

7. **Aims and Objectives**:

- To determine the surface area changes of the mandible in Bruxers from Panoramic radiographs.
- To determine the surface area changes of the condylar process in Bruxers from Panoramic radiographs.
- To determine the surface area changes of the coronoid process in Bruxers from Panoramic radiographs.
- To determine the surface area changes of the mandible, condylar process and coronoid process in age and gender matched controls from Panoramic Radiographs
- To compare and contrast the changes between the two groups.

8. **Scientific justification of the study:**

Many studies were carried out to diagnose, manage and evaluate changes on Bruxers. However, there are only few studies that explain the changes of jaw bones. Physiologically functional loads predictably could stimulate more bone formation, while dysfunctional overloads could remove bone, which in turn would shed new light in the dynamics and kinesis of the mandible with regard to parafunction and in turn temporo-mandibular dysfunctions.

9. **Procedure for the study:**

This study will be carried out in the Department of Oral Medicine and Radiology, SMIDS. Individuals satisfying the inclusion and exclusion criteria will be included in the study. Patients with a clinical history suggestive of Bruxism will be taken and a 0.1mm bruxchecker will be customised using a biostar machine. The suspected case will be asked to wear the splint during sleep and will be included or excluded as Bruxer based on the wearing of the splint. Patients identified as bruxers will be subjected to an OPG. The images will be

acquired using Planmeca proline XC Digital Orthopantomograph Machine. The external surface area of the mandible will be measured using "Image J" software.
.

The mandible is traced along the outermost margin's of the mandibular image, and then through the buccal aspect of the alveolar crest .A straight line is drawn across the pterygoid fovea on both sides and the condyle is traced along its outermost margins. A straight line is drawn connecting the deepest point of sigmoid notch on both sides and the coronoid is traced along its outermost margins.The tracings are counterchecked by two experts in the field (Radiologists).The area thus obtained from the "Image J" software. The data of both case and control are entered in to the data sheet. The surface area of the mandible ,condylar process and coronoid process of Bruxers versus controls will be compared. The results will be obtained by the student't' test statistical analysis.

10. Expected risks for the participants: NIL

11. Expected benefits of research for the participants:

The study will help health care practitioners understand the body better in physiological and pathological states 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.

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 it helps in diagnosis and helpful for the society

14. How many people will be in the study? 40

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? 1 year

20. Any other pertinent information? No other information

21. Whom do I contact for further information?

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

Dr. Lakshmi P.S,
Post graduate student,
Department of oral Medicine and Radiology
Sree Mookambika Institute of Dental Sciences
Kulasekharam,
KanyaKumari District-629161
08903116644
lakshmips251985@gmail.com

Place:

Date: **Signature of Principal Investigator**

Signature of the participant

ஒப்புதல் வாக்குமூலம்

முதல் பாகம்

ஆராய்ச்சியில் பங்குபெறுவோருக்கான தகவல் குறிப்பு

அன்பார்ந்த பங்கேற்பாளர்களே,

இந்த ஆராய்ச்சியில் தங்களை ஈடுபடுத்திக்கொள்ள மிகுந்த ஆர்வத்துடன் முழுமனதுடன் கலந்துகொள்ள வந்த வரவேற்பாளர்களை வரவேற்கிறேன். நீங்கள் இந்த ஆராய்ச்சியில் பங்கெடுத்துக் கொள்வதற்கு முன் இந்த ஆராய்ச்சி எதற்காக நடத்தப்படுகிறது என்பதை தெளிவாக புரிந்து கொள்ள வேண்டும். உங்களுக்கு தேவையான அனைத்து விபரங்களும் கீழே கொடுக்கப்பட்டுள்ளது. இந்த ஆராய்ச்சியின் மூலம் ஏற்படும் நன்மைகள் ஏதேனும் ஆபத்துக்கள் மற்றும் அதற்காக மற்றும் எவ்வாறு இந்த ஆராய்ச்சி மேற் கொள்ளப்படும் முறைகளையும் தெரிவிக்கப்பட்டுள்ளது. இதில் கொடுக்கப்பட்டுள்ள விபரங்களை தெளிவாக படித்து புரிந்து கொள்ள வேண்டும். நீங்கள் ஆராய்ச்சியில் பங்கேற்பாளர்களாக ஒப்புதல் வழங்குவதற்கு முன்பு உங்களுக்கு ஏற்படும் அறிவியல் சார்ந்த சந்தேகங்கள் மற்றும் ஆராய்ச்சி சம்பந்தப்பட்ட சந்தேகங்கள் அனைத்தும் இந்த ஆராய்ச்சியின் எந்த காலகட்டத்திலும் நீங்கள் படிவத்தில் குறிப்பிட்ட நபரிடம் கேட்டு தெளிவுப்படுத்திக் கொள்ளலாம்.

1. தலைமை ஆய்வாளர் : டாக்டர். லஷ்மி பி.எஸ்
   தகுதி : முதுகலை மாணவர், (எம்.டி.எஸ்)
   பிரிவு : ஒறல் மெடிசின் & ரேடியோளஜி துறை,
   நிறுவனம் : ஸ்ரீ முகாம்பிகா இன்ஸ்டிட்யூட் ஆப் டென்டல் சயன்ஸஸ்
   இடம் : குலசேகரம் - 629 161

2. வழிகாட்டி : டாக்டர். டாட்டு ஜோய். இ ஙஈந
   தகுதி : பேராசிரியர், துறை மேலாளர்,
   பிரிவு : ஒறல் மெடிசின் & ரேடியோளஜி துறை,
   நிறுவனம் : ஸ்ரீ முகாம்பிகா இன்ஸ்டிட்யூட் ஆப் டென்டல் சயன்ஸஸ்
   இடம் : குலசேகரம் - 629 161

3. இணை வழிகாட்டி : டாக்டர். சசி கிரண், எம், ஙஈந
   தகுதி : ரீடர்
   பிரிவு : ஒறல் மெடிசின் & ரேடியோளஜி துறை,
   நிறுவனம் : ஸ்ரீ முகாம்பிகா இன்ஸ்டிட்யூட் ஆப் டென்டல் சயன்ஸஸ்
   இடம் : குலசேகரம் - 629 161

4. கல்லூரி : ஸ்ரீ மூகாம்பிகா இன்ஸ்டியூட் ஆப் டென்டல் சயன்ஸஸ், படநிலம், குலசேகரம் - 629 161

5. ஆராய்ச்சியின் தலைப்பு :

பல் கடிக்கும் பழக்கம் உள்ளவரிலும் இல்லாதவரிலும் கீழ் தாடையின் மேற்பரப்பில் உண்டாகும் மாற்றங்கள் பனோரமிக் எக்ஸரேபில் மதிப்பிடும் ஆய்வு.

6. பின்னணி தகவல் :

மெல்லும் அமைப்பில் பல்கடிக்கும் பழக்கம் மிக பொதுவானதாகும். பல்கடிக்கும் பழக்கத்தின் காரணங்கள் பல வகைகளாகும், மேலும் அவை மாறுபடுகின்றன. பல்கடிக்கும் பழக்கம் உறக்கத்தில் இருக்கும் பொழுது, விழித்திருக்கும் பொழுதும் ஆகிய இரு சமயங்களிலும் ஏற்படுகின்றன. பல் தேய்மானத்திற்கு பல்கடிக்கும் பழக்கம் ஒரு மிக பெரிய காரணமாக அமைகிறது. பல்கடிக்கும் பழக்கத்தினால் பல் ஆட்டம், பல்லைச் சுற்றியுள்ள மெல்லிய சதைகள் மற்றும் தாடை எலும்புகளில் மாற்றம் ஆகியவை இதன் தாக்கத்தினால் ஏற்படுகின்றன. பல் தேய்மானம் ஏற்படுகின்றன காரணங்களும், அதன் அறிகுறிகளும் மிக தெளிவாக இல்லாதக் காரணத்தினால் பல்கடிக்கும் பழக்கத்தை கண்டுபிடிப்பது சிறிது கடினமாக உள்ளது. இந்த ஆராய்ச்சியின் மூலம் பல்கடிக்கும் பழக்கம் உள்ளவர்களும் மற்றும் இல்லதவர்கள் ஆகிய இருபாலரின் கீழ்த்தாடை எலும்பில் நடைபெறும் மாற்றங்கள் ஒப்பிடப்படுகின்றன.

7. கொள்கள் மற்றும் நோக்கங்கள் :

- பனோரமிக் எக்ஸ்ரேவில் பல் கடிக்கும் பழக்கம் உள்ளவர்களின் கீழ்த்தாடை எலும்பின் மேற்பரப்பை தீர்மானித்தல்.
- பனோரமிக் எக்ஸ்ரோவில் பல் கடிக்கும் பழக்கம் உள்ளவர்களின் கான்டைல் பகுதியின் மேற்பரப்பை தீர்மானித்தல்.
- பனோரமிக் எக்ஸ்ரோவில் பல் கடிக்கும் பழக்கம் உள்ளவர்களின் கொரோனாயிடு பகுதியின் மேற்பரப்பை தீர்மானித்தல்.
- பனோரமிக் எக்ஸரேவில் வயது மற்றும் பாலின ஒற்றுமை உள்ள நபர்களின் கீழ்த்தாடை எலும்பு மற்றும் கான்டைல், கொரோனாயிடு பகுதியிகளில் மேற்பரப்பை தீர்மானித்தல்
- இரு தரப்பினரின் மாற்றங்களை ஒத்துபார்த்தல்.

8. ஆய்வினை பற்றிய அறிவியல் விளக்கம் :

பல் கடிக்கும் பழக்கம் உள்ளவர்களின் மாற்றங்களை ஆய்வுக்காகவும் கட்டுபடுத்துவதற்காகவும் பல்வேறு ஆய்வுகள் மேற்கொள்ளப்பட்டள்ளன. இருப்பினும் தாடை எலும்பின் மாற்றங்களை குறித்துள்ள ஆய்வுகள் மிக குறைவு. உடலியல் ரீதியாக அதிக செயல்பாட்டு செரமங்கள் எலிம்பு உறுவாதலை தூண்டலாம். வழக்கத்திற்கு மாறாக செயல்பட்டு சிரமங்கள் எலும்பு தேய்மானம் தூண்டலாம். டெம்பெரோ மாண்டிபுலார் மூட்டு வழக்கத்திற்கு மாறாக செயல்படுவதினால் கீழ்தாடை எலும்பின் அசைவிலும் இய்கத்திலும் ஏற்படுகின்ற மாற்றத்திற்கான ஒளியாகும். இந்த புதிய ஆராட்சி.

9. ஆய்வின் செயல் முறை :

இந்த ஆராய்சி ஸ்ரீ மூகாம்பிக பல் மருத்துவ கல்லூரியின் ஒறல் மெடிசின் + ரேடியோளஜி பகுதியில் மேற்கொள்ளபடுகிறது. குறிப்பிட்ட நபர்களை மற்றுமே இந்த ஆராய்ச்சியில் ஆட்படுத்தப்பட்டுள்ளது. பல் கடிக்கும் பழக்கமுள்ள நோயாளிகளை கண்டறிந்து அவர்களக்கு பொருத்தமான 0.5 மி.மி பிரக்ஸர் வழங்கப்படுகிறது. சந்தேகத்திற்குரிய நோயாளிகளை இந்த பிரக்ஸர் தூங்கும் போது பயன்படுத்துவதற்கு கேட்டுகொள்ளபடுகிறது. இந்த பிரக்ஸரில் ஏற்படுகின்ற தேய்மானங்களை சோதித்த பின் நபர்களை இந்த ஆராய்ச்சியில் சேற்பதா இல்லயா என்று தீர்மானிக்க படுகிறது. கண்டறியப்பட்ட நோயாளிகளை பனோரமிக் எக்ஸரேக்கு ஆட்படுத்தப்படுகிறார்கள். இமேஜ் ஜெ சோப்ட்வெயர் பயன்படுத்தி இவர்களுடைய கீழ்தாடை எலும்பு மற்றும் காண்டைல், கொறோனாயிடு பகுதிகளின் மேற்பரப்பு அளக்கப்படுகிறது. இரண்டு சோதனை குழுவினருடையும் மேற்பரப்பு ஒத்து பார்க்கப்படுகிறது.

10. ஆய்வில் கலந்து கொள்பவர்களுக்கு எதிர்பார்க்கப்படும் ஆபத்துக்கள்?
இல்லை

11. பங்கேற்பாளர்களுக்கு எதிர்பார்க்கப்படும் பயன்கள்?

இந்த ஆராய்சி உடல் நல மருத்துவருக்கு நோயாளியை உடல் ரீதியாகவும் நோய் நிலையிலும் நன்றாக புரிந்து உடல் நலத்தை பேணிகாக்க உதவுகிறது.

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 நோயிகளை மிகுந்த சிரமத்திற்கு உட்படுத்தாது.

14. இந்த ஆய்வில் எத்தனை பேர் பங்கேற்கிறார்கள்? 40

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

ஆராய்ச்சியாளர் பொருளாதார அளவில் பொறுப்பேற்பார்

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 சம்மதத்தின் பேரில் மட்டுமே பங்கெடுத்துள்ளனர்.

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

19. ஆராய்ச்சியின் எதிர்பார்க்கப்படும் பங்குகால அளவு? ஒரு வருடம்

20. வேறு ஏதேனும் பொருத்தமான விபரங்கள் உண்டா? இல்லை

21. இவ்வாராய்ச்சியைப் பற்றிய விவரங்களை யாரிடம் கேட்டு தெரிந்துக் கொள்வது?

டாக்டர். லஷ்மி. பி.எஸ்
முதுகலை, (எம்.டி.எஸ்)
ஒறல் மெடிசின் & ரேடியோளஜி துறை
ஸ்ரீ மூகாம்பிகா இன்ஸ்டிட்யூட் ஆப் டென்டல் சயன்ஸஸ்
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இடம் :
தேதி :

முதன்மை ஆராய்ச்சியாளரின்
கையொப்பம்

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 രേഖപ്പെടുത്തിയിരിക്കുന്ന വ്യക്തികളോടോ ഫോറം ഒപ്പിടുന്നതിനു മുൻപോ അല്ലെങ്കിൽ ഈ പഠനത്തിന്റെ കാലാവധി തീരുന്നതുവരേയോ സമീപിക്കാവുന്നതാണ്.

1. മുഖ്യ ഗവേഷകൻ	:	**ഡോ. ലക്ഷ്മി പി. 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. ശശി കിരൺ എം, 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. പഠന വിഷയം

പല്ലിറുമുന്നവരിലും അല്ലാത്തവരിലും കീഴ്താട എല്ലിന്റെ ഉപരിതല വിസ്തീർണ്ണത്തിലുണ്ടാകാവുന്ന മാറ്റങ്ങൾ പനോരമിക് എക്സ്റേയിലൂടെ വിലയിരുത്തുന്നു.

6. പഠനത്തിന്റെ അടിസ്ഥാനം ?

ചർവണവ്യവസ്ഥയിൽ പല്ലിറുമുന്ന സ്വഭാവം സർവ്വസാധാരണമാണ്. പല്ലിറുമ്മുന്നതിന്റെ കാരണങ്ങളുടെ അഭിപ്രായങ്ങൾ അനേകവും വ്യാപകമായി വ്യത്യാസപ്പെടുന്നതുമാകുന്നു. പല്ലിറുമൽ ഉറങ്ങുമ്പോഴോ ഉണർന്നിരിക്കുന്ന അവസ്ഥയിലോ സംഭവിക്കാം. പല്ല് തേയ്മാനത്തിന് പല്ലിറുമ്മുന്നത് ഒരു പ്രധാന കാരണമാണെന്ന് ദീർഘ നാളായി

കരുതപ്പെട്ടിരുന്നു. പല്ലിന്റെ വ്യതിചലനവും, ആട്ടവും കൂടാതെ വായിലെ മൃദുപേശികളിലും താട എല്ലുകളിലും ഉണ്ടാവുന്ന മാറ്റങ്ങളും പല്ലിറുമ്മുന്നതിന്റെ ഫലങ്ങളായി കരുതപ്പെടുന്നു. യഥാർത്ഥ രോഗകാരണങ്ങളും പ്രകടനങ്ങളും വ്യക്തമാകാത്തതിനാൽ പല്ലിറുമ്മുന്ന രോഗ നിർണ്ണയം പ്രയാസമാണ്. നമ്മുടെ ഈ പഠനത്തിൽ പല്ലുറുമുന്നവരുടെ കീഴ്താട എല്ലിന്റെ വ്യാപ്തിയിൽ ഉണ്ടാകാവുന്ന മാറ്റങ്ങൾ മൂല്യനിർണ്ണയം ചെയ്യുന്നതോടൊപ്പം അതിന്റെ ഫലങ്ങൾ തിരഞ്ഞെടുത്ത പല്ലിറുമ്മുന്ന സ്വഭാവമില്ലാത്തവരുമായി താരതമ്യപ്പെടുത്തുന്നു.

7. പഠനോദ്ദേശ്യം.

- പനോരമിക് എക്സ്റേയിൽ പല്ലിറുമ്മുന്ന സ്വഭാവമുള്ളവരുടെ കീഴ്താട എല്ലിന്റെ ഉപരിതല വിസ്തീർണം നിർണയിക്കൽ
- പനോരമിക് എക്സ്റേയിൽ വയസ്സും ലിംഗവും സാമ്യമുള്ളവരുടെ ഉപരിതല വിസ്തീർണം നിർണ്ണയിക്കൽ
- ഇരു വിഭാഗങ്ങളുടെ മാറ്റങ്ങളെ താരതമ്യപ്പെടുത്തൽ

8. പഠനത്തെക്കുറിച്ചുള്ള ശാസ്ത്രീയ ന്യായീകരണം

പല്ലിറുമ്മുന്നവരിൽ ഉണ്ടാകാവുന്ന മാറ്റങ്ങളെ നിർണ്ണയം ചെയ്യുന്നതിനും നിയന്ത്രക്കുന്നതിനും വേണ്ടി പല പഠനങ്ങളും നടന്നിട്ടുണ്ട്. എന്നിരുന്നാലും താട എല്ലിൽ ഉണ്ടാകാവുന്ന മാറ്റങ്ങളെക്കുറിച്ചുള്ള പഠനങ്ങൾ വിരളമാണ്. ശാരിരികമായി അധികമായ പ്രവർത്തന ഭാരം എല്ലിന്റെ രൂപപ്പെടുത്തലിനെ ത്വരിതപ്പെടുത്തിയേക്കും, ടെംബറോ മേൻഡിബുലാർ സന്ധി അസാധാരണമാം വിധം പ്രവർത്തിക്കുന്ന അവസ്ഥയിൽ കീഴ്താട എല്ലിന്റെ ചലനത്തിലും ചലനാത്മകതയിലും ഉണ്ടാകുന്ന വ്യതിയാനത്തിലേക്കുള്ള വെളിച്ചമായും ഈ പുതിയ പഠനം.

9. പഠനരീതി

ഈ പഠനം ശ്രീ മൂകാംബിക ഇൻസ്റ്റിറ്റ്യൂട്ട് ഓഫ് ഡെന്റൽ സയൻസിലെ ഓറൽ മെഡിസിൻ & റേഡിയോളജി വിഭാഗത്തിലാണ് നടത്തുന്നത്. നിശ്ചിത വ്യക്തികളെ മാത്രമേ ഈ പഠനത്തിൽ ഉൾപ്പെടുത്തിയിട്ടുള്ളു. പല്ലിറുമ്മുന്ന സ്വഭാവമുള്ള രോഗികളെ കണ്ടറിഞ്ഞ് അവർക്ക് അനുയോജ്യമായ.0.5 എം.എം. ബ്രക്സർ നൽകുന്നു. സംശയാസ്പദമായ രോഗികളോട് ഈ ബ്രക്സർ ഉറങ്ങുന്ന സമയത്ത് ഉപയോഗിക്കുവാൻ ആവശ്യപ്പെടുന്നു. ഈ ബ്രക്സറിലുണ്ടാകുന്ന തേയ്മാന ഘടനകൾ പരിശോധിച്ച് അവരെ ഈ പഠനത്തിൽ ഉൾപ്പെടുത്തണമോ വേണ്ടയോ എന്ന് തീരുമാനിക്കുന്നു. രോഗനിർണ്ണയം ചെയ്തവരെ പനോരമിക് എക്സ്റേയ്ക്ക് വിധേയരാക്കുന്നു. ഇമേജ് ജെ സോഫ്റ്റ്വെയർ ഉപയോഗിച്ച് ഇവരുടെ കീഴ്താട എല്ലിന്റെ ഉപരിതല വിസ്തീർണ്ണം അളക്കുന്നു. രണ്ടു പരീക്ഷണ വിഭാഗങ്ങളുടേയും ഉപരിതല വിസ്തീർണം താരതമ്യം ചെയ്യുന്നു.

10. പഠനം മൂലം പങ്കെടുക്കുന്ന ആൾക്ക് ഉണ്ടാകാൻ ഇടയുള്ള അപകട സാദ്ധ്യത

അപകട സാധ്യത ഇല്ല

11. രോഗികൾക്ക് പ്രതീക്ഷിക്കാവുന്ന ഗുണങ്ങൾ ?

ഈ പഠനം ആരോഗ്യപരിപാലന പരിശീലകരെ ശാരീരികമായും രോഗനിലയിലും രോഗിയുടെ ശരീരത്തെ നന്നായി മനസ്സിലാക്കി ആരോഗ്യത്തെ മെച്ചപ്പെടുത്തുന്നതിന് സഹായിക്കുന്നു.

12. വിവരങ്ങൾ രഹസ്യമായി സൂക്ഷിക്കുമോ ? അതെ

13. എന്നെ എന്തുകൊണ്ട് ഈ പഠനത്തിൽ ഉൾപ്പെടുത്തി ?

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

14. എത്ര ആളുകൾ ഈ പഠനത്തിൽ ഉൾപ്പെടുന്നു ? 40

15. പഠനം മൂലമുണ്ടാകുന്ന ക്ഷതങ്ങൾക്ക് നഷ്ടപരിഹാരത്തിനുള്ള സമ്മതം

പഠനകർത്താവ് ചികിത്സാ ചെലവ് വഹിക്കുന്നതാണ്.

16. ഏതെങ്കിലും വിധത്തിൽ വേദനം ലഭിക്കുമോ ? ഇല്ല

17. എപ്പോൾ വേണമെങ്കിലും എനിക്ക് ഈ പഠനത്തിൽ നിന്ന് പന്മാറാമോ ?

സ്വന്തം താൽപര്യപ്രകാരം കാരണങ്ങൾ നൽകാതെ തന്നെ ഈ പഠനത്തിൽ നിന്ന് എപ്പോൾ വേണമെങ്കിലും പിന്മാറാവുന്നതാണ്. എന്നിരുന്നാലും ഗവേഷണ സംഘത്തോട് പിന്മാറുന്നതിനു മുൻപ് സംസാരിക്കുവാൻ ഞങ്ങൾ നിങ്ങളോട് അഭ്യർത്ഥിക്കുന്നു.

18. ഈ ഗവേഷണത്തിന്റെ ഫലമായി പുതിയ എന്തെങ്കിലും കണ്ടെത്തലുകളുണ്ടെങ്കിൽ അത് എന്നെ അറിയിക്കുമോ? അതെ

19. ഈ പഠനത്തിന്റെ സമയദൈർഘ്യം എത്രയാണ് ? ഒരു വർഷം

20. ഇതിന്റെ ഭാഗമായി എന്തെങ്കിലും കൂടുതൽ വിവരങ്ങൾ ? ഇല്ല

21. കൂടുതൽ വിവരങ്ങൾക്കായി താഴെ പറയുന്നവരെ നിങ്ങൾക്ക് ബന്ധപ്പെടാവുന്നതാണ്.

ഡോ. ലക്ഷ്മി പി. എസ്.
രണ്ടാം വർഷം പോസ്റ്റുഗ്രാജുവേറ്റ്
ഡിപ്പാർട്ട്മെന്റ് ഓഫ് ഓറൽ മെഡിസിൻ & റേഡിയോളജി,
ശ്രീ മൂകാംബിക ഇൻസ്റ്റിറ്റ്യൂട്ട് ഓഫ് ഡെന്റൽ സയൻസ്,
കുലശേഖരം - 629 161.
മൊബൈൽ നമ്പർ : 8903116644
ഇ-മെയിൽ ഐഡി:lakshmips251985@gmail.com

സ്ഥലം: പ്രഥമ അന്വേഷകന്റെ ഒപ്പ്

തീയതി : പങ്കെടുക്കുന്ന ആളിന്റെ ഒപ്പ്

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 mandibular surface area changes in Bruxers versus controls on Panoramic radiographic images: A case control 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:

ஒப்புதல் படிவம்

பாகம் : 2

இந்த ஆராய்ச்சியின் தகவல்கள் அனைத்தும் என்னிடம் தெளிவாக எழுத்துமூலம் விளக்கப்பட்டுள்ளது. இவ்வாராய்சியைப் பற்றி நான் தெளிவாக புரிந்துக் கொண்டுள்ளேன். நான் நானாக முன் வந்து 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 உபயோகப்படுத்திக் கொள்ள சம்மதிக்கிறேன். எனக்கு இவ்வாராய்ச்சியைப் பற்றிய விரிவான தகவல்கள் அடங்கிய படிவம் தரப்பட்டுள்ளது.

நான் பல்கடிக்கும் பழக்கம் உள்ளவரிலும் இல்லாதவரிலும் கீழ்தாடையின் மேற்பரப்பில் உண்டாகும் மாற்றங்கள் பனோரமிக் எக்ஸரேவில் மதிப்பிடும் ஆய்வு என்கிற ஆராய்ச்சியில் பங்கேற்க முழுமனதுடன் சம்மதிக்கிறேன்.

பங்கு கொள்பவரின் பெயர் :

முகவரி :

தொலை தொடர்பு எண் :

பங்கு கொள்பவர்களின் கையொப்பம் / பெருவிரல் சுவடு :

தேதி :

சாட்சியின் கையொப்பம் : தேதி :

முகவரி :

ஆராய்ச்சியாளரின் கையொப்பம்

தேதி :

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.

പല്ലിറുമ്മുന്നവരിലും അല്ലാത്തവരിലും കീഴ്താട എല്ലിന്റെ ഉപരിതല വിസ്തീർണത്തിലുണ്ടാകാവുന്ന മാറ്റങ്ങൾ പനോരമിക് എക്സ്റേയിലൂടെ വിലയിരുത്തുന്ന ഈ 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

DATA SHEET

BRUXERS

S.NO	AGE (years)	GENDER (Male/Female)	SURFACE AREA (mm)				
			Mandible	Condylar process		Coronoid process	
				Right	Left	Right	Left
1.	23	FEMALE	7213	407	430	559	563
2.	21	FEMALE	7201	369	422	484	649
3.	23	FEMALE	7314	401	392	398	443
4.	30	FEMALE	6687	413	407	528	614
5.	26	FEMALE	7393	353	370	557	557
6.	25	FEMALE	7298	353	366	490	509
7.	20	FEMALE	6987	400	386	449	480
8.	22	FEMALE	7200	392	400	452	500
9.	30	FEMALE	7354	423	414	497	514
10.	25	FEMALE	7306	402	397	537	549
11.	23	MALE	7798	493	475	447	437
12.	20	MALE	7104	455	432	555	453
13.	26	MALE	8334	566	501	548	584
14.	21	MALE	6937	463	457	486	500
15.	24	MALE	7817	533	600	686	706
16.	22	MALE	7565	497	496	514	534
17.	23	MALE	7477	393	416	399	467
18.	26	MALE	6884	397	385	400	427
19.	23	MALE	7237	376	384	457	504
20.	26	MALE	7199	417	427	510	523

NONBRUXERS

S.NO	AGE (Years)	GENDER (Male/Female)	SURFACE AREA (mm)				
			Mandible	Condylar process		Coronoid process	
				Right	Left	Right	Left
1.	25	FEMALE	6840	423	419	489	456
2.	23	FEMALE	7275	501	505	490	533
3.	20	FEMALE	7741	442	514	530	528
4.	23	FEMALE	7203	498	467	528	527
5.	21	FEMALE	6731	414	392	502	443
6.	23	FEMALE	6900	417	387	514	523
7.	27	FEMALE	7267	424	435	524	537
8.	20	FEMALE	7234	489	420	512	530
9.	24	FEMALE	7345	476	413	527	528
10.	28	FEMALE	7229	456	443	511	557
11.	22	MALE	7307	405	415	430	458
12.	22	MALE	7656	508	590	436	529
13.	21	MALE	7508	400	504	448	464
14.	23	MALE	7949	565	578	583	620
15.	20	MALE	7594	483	500	553	539
16.	30	MALE	7544	435	496	472	486
17.	26	MALE	7367	412	425	445	479
18.	28	MALE	7453	446	459	517	526
19.	23	MALE	7234	432	476	513	534
20.	20	MALE	7562	490	511	526	537