DECLARATION

TITLE OF DISSERTATION	PREVALENCE OF TEMPOROMANDIBULAR JOINT DISORDERS AMONG PARTIALLY EDENTULOUS PATIENTS
PLACE OF STUDY	K.S.R Institute of Dental Science and Research
DURATION OF THE COURSE	3 years
NAME OF THE GUIDE	Dr. Suman Jaishankar, M.D.S.,
HEAD OF THE DEPARTMENT	Dr. (Capt) S. Elangovan, M.D.S.,

I hereby declare that no part of the dissertation will be utilized for gaining financial assistance for research or other promotions without obtaining prior permission of the Principal, K.S.R Institute of Dental Science and Research, Tiruchengode. In addition, I declare that no part of this work will be published either in print or electronic without the guide who has been actively involved in dissertation. The author has the right to reserve for publish of work solely with prior permission of the Principal, K.S.R Institute of Dental Science and Research, Tiruchengode.

HEAD OF THE DEPARTMENT **GUIDE** **signature of the candidate**

CERTIFICATE BY THE GUIDE

This is to certify that dissertation titled **"PREVALENCE OF TEMPOROMANDIBULAR JOINT DISORDERS AMONG PARTIALLY EDENTULOUS PATIENTS"** is a bonafide research work done by **DR. SOWMIYA L**, in partial fulfillment of the requirements for the degree of **MASTER OF DENTAL SURGERY** in the specialty of **ORAL MEDICINE AND RADIOLOGY**.

Date :

Place :

Signature of the Head of the Department

Dr. (capt) S. Elangovan, M.D.S.,

PROFESSOR

Signature of the Guide

Dr. Suman Jaishankar, M.D.S.,

PROFESSOR

K.S.R INSTITUTE OF DENTAL SCIENCE AND RESEARCH
TIRUCHENGODE

ENDORSEMENT BY THE H.O.D, PRINCIPAL/ HEAD OF THE INSTITUTION

This is to certify that **Dr. SOWMIYA.L**, Post Graduate student (2015-2018) in the Department of Oral Medicine and Radiology, K.S.R Institute Of Dental Science And Research, Tiruchengode, has done this dissertation entitled **"PREVALENCE OF TEMPOROMANDIBULAR JOINT DISORDERS AMONG PARTIALLY EDENTULOUS PATIENTS"** under our guidance and supervision in partial fulfillment of the regulations laid down the Tamil Nadu Dr.M.G.R Medical University for **M.D.S.,** (branch-IX) **Oral Medicine and Radiology** degree examination.

Seal & signature of H.O.D

DR. (capt) S. ELANGOVAN, M.D.S.,

PROFESSOR

Seal & signature of Principal

PROF.DR. G.S. KUMAR, M.D.S.,

PRINCIPAL

K.S.R INSTITUTE OF DENTAL SCIENCE AND RESEARCH
TIRUCHENGODE

ACKNOWLEDGEMENT

First and foremost, I would like to record my gratitude to my guide, **Professor Dr. Suman Jaishankar. M.D.S., Dept of Oral Medicine** for the vision and foresight which inspired me to conceive this project. I sincerely thank Dr. Suman madam for her concern, motivation and support throughout this project. Her unending belief in me was the key element which helped me to bring this work to a successful conclusion. Her immense knowledge and perseverance has always been the guiding force in realizing my goals in time.

I must offer my profoundest gratitude to **Dr. S. Elangovan. M.D.S., Professor and Head of Department of Oral Medicine and Radiology** for his unreserved help and guidance. Sir has always inspired me by his immense knowledge. Sir has taught me to be a good professional and great human being.

I take this opportunity to express my gratitude to **Dr. G.S. Kumar. M.D.S., Principal, K.S.R Institute of Dental Science and Research** for his kind permission and encouragement.

I would like to express my sincere gratitude to my advisors **Dr.Nazragi Mahabob. M.D.S., Dr. Senthil Kumar. M.D.S., Dr. Deepika Rajendran M.D.S., Dr. Gomathi M.D.S.,** for the continuous support, motivation and enthusiasm in my study and research.

I would like to express my heartiest thanks my colleagues, seniors and my juniors for their unyielding support during the period of the study.

Finally I would like to thank my parents for supporting and being with me all through my life.

ALL GLORY AND HONOR TO GOD….

TABLE OF CONTENTS

LIST OF TABLES

LIST OF GRAPHICAL PRESENTATIONS

LIST OF FIGURES

INTRODUCTION

The Stomatognathic System is a functional unit which is characterized by several structures such as the skeletal components (maxilla and mandible), soft tissues (salivary glands, nervous and vascular supplies), dental arches, the temporomandibular joint and masticatory muscles. These structures act in a harmonious relationship to perform different functional tasks (to speak, to break down food into small pieces, and in swallowing). [1]

The temporomandibular joint (TMJ) is considered as one of the most complex joints of the human body and it is classified as compound joint made up of two bones and the disk between the bones, which is considered functioning like a third bone.[2]

Temporomandibular joint disorders is defined as the conditions producing abnormal/ incomplete or impaired function of the temporomandibular joint and/or the muscles of mastication.[1]

Temporomandibular disorders (TMD) are defined by the American Academy of Orofacial Pain as "a collective term that embraces a number of clinical problems which involve the masticatory muscles, TMJ, and the associated structures." [3]

TMD are recognized as one of the most common non-tooth related chronic orofacial pain condition that confront dentist's and health care providers.[4] Epidemiological surveys had reported that 50 to 70% of the population have signs of TMJ disorder at some point during their life, whereas 20 to 25% of the population have symptoms of TMD.[5] Signs and symptoms of TMD generally increase in frequency and severity from the second to fourth decade of life.[4]

In general, it is said that the highest prevalence of TMD was observed in partially edentulous patients compared to completely edentulous patients.[6] The etiology of TMD is multifactorial and that includes trauma, anatomical factors, genetics and occlusion. The most popular theories regarding TMD etiology are the bio psychosocial model that involves a combination of biological, psychological and social factors. The theories of TMD etiology that made the largest impact are related to various types of occlusal imperfections.[7]

Occlusion is the first and most discussed etiologic factor of temporo- mandibular disorders. Costen concluded over -closure was the cause of symptoms in temporomandibular disorders. It has been shown that there is a relationship between the number of teeth in the oral cavity and TMJ changes.[8]

The occlusal factors which are suggested to have relation with TMD are open bite, over-jet greater than 6-7 mm, unilateral lingual cross-bite, retruded contact position/intercuspal position with sliding greater than 4 mm, faulty restorations, ill-fitting prosthesis and five or more missing posterior teeth.[9]

Although the role of occlusion and partial edentulism in the development of temporomandibular joint disorders is controversial, it is considered as contributing by initiating, perpetuating or predisposing to temporomandibular joint disorders.[10]

The common signs and symptoms of TMDs are pain or tenderness in the temporomandibular joint, facial areas, ear region, muscles of mastication, shoulder and neck, clicking, popping or grating sound when opening / closing the mouth or while chewing, catching or locking of the joint with deviation of the mandible on opening / closing the mouth, limitations

in opening or closing the mouth, difficulty / discomfort while chewing, sensation of an uncomfortable bite.[4]

In the last few decades, diagnostic systems, such as the Research Diagnostic Criteria for TMD (RDC/TMD) and the American Academy of Orofacial Pain diagnostic criteria, were developed with the aim of assisting the standardization of the diagnosis and definition of the common subtypes of TMD.[10]

The management for TMD includes multidisciplinary approach that includes patient education and self care, pharmacotherapy, physical therapy, cognitive behavioral intervention and orthopedic appliance therapy.[4]

As the association between partial edentulism and TMD remain controversial and its prevalence is not well documented, we have assessed the prevalence of TMD signs among partially edentulous patients.

AIMS AND OBJECTIVES

AIM OF THE STUDY

The aim of the present study is to estimate the prevalence of temporomandibular joint disorders and its signs among partially edentulous patients.

OBJECTIVES

1. Clinical examination of the partially edentulous patients for TMD signs and to record the symptoms.
2. To predict the age group commonly affected with TMD
3. To evaluate the gender predilection for TMD
4. To evaluate the relationship between period of edentulousnes and TMD
5. To evaluate the common type of partial edentulism associated with TMD

REVIEW OF LITERATURE

TEMPOROMANDIBULAR JOINT

Dorland (1957) [11] described the TMJ as a ginglymoarthrodial joint, a term that is derived from ginglymus, meaning a hinge joint, allowing motion only backward and forward in one plane and arthrodia, meaning a joint which permits a gliding motion of the surfaces.

Gray et al (1995) [12] stated that TMJ is a diarthrodial synovial paired joint which functions in pairs and the joint movement will involve both joint compartments. TMJ comprises mandibular condyle, glenoid fossa, articular eminence, articular disc, capsule (lined by synovial membrane) and ligaments. Each joint involves the articular eminence and glenoid fossa above and mandibular condyle below. The articular disc divides the joint space into the upper and lower compartments.

Haley et al (2001) [13] considered the temporomandibular joint (TMJ) as one of the most complex joints of the body. It is formed by the mandibular condyle fitting in the mandibular fossa of the temporal bone and the articular disk between these permits movement of the joint.

Okeson (2003) [14] classified TMJ as a compound joint made up of two bones and the disk between the bones, a disk considered functioning like a third bone.

TEMPOROMANDIBULAR JOINT DISORDERS

Costen (1934) [8] described that the dysfunctions of the masticatory system comprise a "syndrome" that were centered on the ear and temporomandibular joint. He published the signs and symptoms, the dysfunction of the masticatory system was initially referred as Costen's

syndrome or the temporomandibular syndrome. He developed an integrated and systematic approach ascribing the symptoms to dental malocclusion.

Krough-Poulsen (1966) [15] screened the symptoms of craniomandibular disorders which comprised of limited mouth opening, deviation of the mandible, pain of the musculature and the TMJ, occlusal disharmony, occlusal wear, local and aspecific changes in the periodontal tissues, and tooth mobility.

Laskin et al (1983) [16], at The American Dental Association President's Conference on Temporomandibular Disorders (American Dental Association, 1983) defined TMD as ―a group of orofacial disorders characterised by pain in the preauricular area, TMJ, or muscles of mastication, limitations and deviations in mandibular range of motion, TMJ sounds during jaw function.

Okeson (1996) [17]**,** described temporomandibular disorder (TMD) as ‘‘a collective term embracing a number of clinical problems that involve the masticatory musculature, the temporo mandibular joint and the associated structures, or both’’. A “syndrome” is a set of symptoms which occur together, a symptom complex; while a “disorder” is a derangement or abnormality of function.

Al-Ani et al (2004) [18], described the synonyms for conditions causing pain and dysfunction in the TMJ which includes temporomandibular dysfunction syndrome, pain dysfunction syndrome, facial arthromylagia, TMJ dysfunction syndrome, myofacial pain dysfunction syndrome, craniomandibular dysfunction and myofacial pain dysfunction.

De Leeuw (2008) [3], reported that Temporomandibular disorders (TMD) is a collective term embracing a cluster of related disorders in the masticatory system, with common symptoms

and clinical problems involving muscles, the TMJ, the occlusion, the nervous system, and the associated structures.

ETIOLOGY OF TEMPOROMANDIBULAR JOINT DISORDER

Costen (1934) [8], hypothesized that facial, muscle, and joint pain resulted from pressure applied by the TMJ on articulotemporal and chorda tympani nerves. These pressures were considered to occur because defects in the dental occlusion permitted the mandible to overdose.

Schwartz (1955) [19], recorded the hypothesis that spasm in the muscles of mastication is responsible for the pain in TMD. The masticatory muscles implicated include the masseter, temporal, medial pterygoid, and lateral pterygoid. Others that may be associated with the syndromes include the sternocleidomastoid and trapezius muscles.

De Boever (1979) [20]**,** concluded that the etiology of TMD is a combination of dental, psychological, and muscular factors. He reported five different etiologic theories of TMD, i.e. mechanical displacement theory, neuromuscular theory, psycho-physiological theory, muscular theory and psychological theory.

McCarty (1980) [21], suggested that an injury either directly to the joint or to the head and neck area can trigger a TMJ problem. For example, a heavy blow to the side of the face can cause fracture of the condyle or the disc may be displaced. A whiplash injury during a car accident can stretch or tear tissues and ligaments, displace the disc, and even cause bleeding which leads to the formation of scar tissue, causing decrease in mobility and pain.

Travell (1983) [22], reported that microtrauma is associated with the functional overloading. It has been suggested that some postural habits can create muscle and joint strain

and lead to musculoskeletal pain, including headache. Microtrauma to the TMJ structures produces injury as a result of prolonged, repeated force over time. Harmful loading of masticatory system from parafunctional habit and adverse usage can result in microtrauma.

Kononen et al (1987) [23] and **Pullinger et al (1988)** [24]**,** studied with different designs and found the role of occlusion as an etiologic factor in temporomandibular disorder and it is considered to be a TMD-related or co-etiologic factor.

Parker et al (1990) [25]**,** presented a dynamic model to depict the etiology of TMD. He proposed that there is a balance in the masticatory system between destructive, overloading factors and adaptive factors. Factors such as trauma, health/nutrition, the musculoskeletal structure, coping strategies, and gender might increase or can decrease a patient's adaptability. Life stress, sleep disorders, pain/depression, occlusion and posture were proposed as possible predisposing factors to dysfunction.

Wilson et al (1991) [26], quoted the definition of Somatisation as ―a tendency to experience and communicate somatic distress in response to psychosocial stress and to seek medical help for it. He reported that TMD patients have been found to have increased somatisation scores.

Rugh et al (1992) [27]**,** suggested that psychological factors have a role in the cause or maintenance of TMD and may predispose the condition to chronicity. Categorization of the patients into diagnostic subgroups of TMD suggests that myogenous patients can have more psychological difficulties than patients with arthrogenous TMD.

Carlsson (1994) [28], said that the factors involved in TMD are anatomical, neuromuscular, and psychological and that in some cases trauma, anatomy, and general diseases besides the above factors will confuse the etiologic portrait.

Stohler (1994) [29], noticed that the balance between function and dysfunction is said to be periodic and dynamic. Condylar displacement, internal derangement and osteoarthrosis can be considered either the cause or result of TMD.

McGregor (1996) [30],discussed Alexithymia as psychological characteristics of a patient with psychosomatic diseases. Alexithymia was derived from the Greek for lack, lexis for word, and thymos for feeling), means literally ―no words for feelings. It denotes a deficit in the ability to differentiate emotional states from physical ones and to identify and describe one's feelings, as well as a preference for externally oriented, utilitarian thinking rather than fantasy or introspection. It has been found that alexithymia associates positively with somatization.

Herken et al (2001) [31], concluded that there is no scientific evidence to suggest that TMD can be inherited. There is also great variation in the craniofacial structures and a wide range of "normal" TMJs. As such, a consensus has not been reached on an "ideal" condyle/fossa structure or position and it is unknown if a certain condylar position or anatomical form would cause TMD.

Hedge (2005) [32], in his study discussed the hypothesis on presence of estrogen receptors in women's TMJ changes metabolic functions increasing ligament laxity. Estrogen also increases susceptibility to painful stimuli by modulating the limbic system. In his study it was said that painful symptoms increase by 30% in patients on menopause treatment with estrogen replacement therapy and by 20% in women using oral contraceptives.

Olivo et al (2006) [33], suggested that changes in head posture have been associated with changes in the stomatognathic system, thus head posture is assumed to have an influence on the biomechanical behaviour of the TMJ and its associated structures.

Sharma S et al (2011) [7]**,** discussed the role of occlusion as contributing by initiating, perpetuating or predisposing to TMD. Initiating factors lead to onset of the symptoms and are related primarily to trauma or adverse loading of the masticatory system. In perpetuating factors, behavioural factors like grinding, clenching, abnormal head posture are included. Social factors, emotional factors like depression, anxiety, cognitive factors like negative thoughts and attitudes are discussed.

Chisnoiu AM et al (2015) [34]**,** reported that the etiological factors for TMJ disorders include occlusal abnormalities, macrotrauma and microtrauma, orthodontic treatment, bruxism and orthopedic instability, joint laxity, exogenous estrogen and psychological factors such as stress, mental tension, anxiety or depression. Among these occlusion is the first and probably the most controversial etiologic factor of TMD.

ROLE OF OCCLUSION AND PARTIAL EDENTULISM IN TMD

Posselt et al (1952) [35], quoted that the optimal occlusion is considered to have the maximal occlusion and tooth contact of antagonist jaws. Contact between the teeth occurs at the end-point of mandibular closure when the teeth in the upper jaw meets the teeth in lower jaw, when the mandibular condyle is in the most super anterior position and resting against the posterior slope of the articular eminence with the disc properly positioned.

Agerberg et al (1972) [36],from his study documented that patients with few remaining natural teeth may have higher incidence of TMJ dysfunction signs.

Hannam et al (1977) [37], proposed that electromyographic findings of a number of occlusal aberrations disturbed the harmonious functional patterns of masticatory muscles and TMJ which can be considered a cause in TMD.

Hylander et al (1979) [38], mentioned that the failure of the replacement of missing teeth is justified by osteoarthritis of the joints, unfavorable loading of the joint and pain that can lead to dysfunction of the joint.

Kayser et al (1981) [39], from his study said that when the back teeth are lost, the effect on the stomatognathic system gives rise to contradictory opinions and the loss of posterior teeth is related to TMJ dysfunction.

Mohl et al (1988) [40], from his study stated that the absence of posterior teeth support results in overloading of the TMJ structures and that can lead to abnormal functioning of the joint and disorders.

Seligman and Pullinger et al (1991) [41], noted in his study among partially edentulous individuals with TMJ dysfunction signs were more frequent among females. He also said that the harmful type of tooth contact, called occlusal disturbances, being so common in the non-patient population is difficult to consider one perfect occlusion type as possible.

Carlsson (1994) [28], discussed the concern about missing molar teeth and its role in creating occlusal imbalances. Chewing efficiency is enhanced when there are greater number of chewing units and when the numbers of missing posterior teeth is less than five. The minimum number of posterior chewing units that accounted for the threshold for impaired chewing is three. Chewing force is also affected by gender, age and pain levels of TMD.

Drummond et al (1995) [42], suggested that suitable and desirable dentures fulfill the function of partial dentition, improve masticatory function or appearance, and minimize damage to the remaining teeth or other tissues.

Ciancaglini et al (1999) [43], in his study showed that 60.2% of patients with loss of occlusal support suffer from functional disturbances and/or temporomandibular dysfunction and these findings suggest that occlusal support is a relevant factor in mastication and development of TMD.

Seedorf et al (2004) [44], suggested that loss of posterior occlusal support as it happens in routine oral rehabilitation leads to a noticeable cranial condyle movement during registration, even if the clenching force is low.

Gracia et al (2008) [45], concluded that there is no relationship between TMD and the condition of partially edentulous Kennedy class I and class II, but patient dissatisfaction increased after the second year of edentulousness and temporomandibular joint noise had decreased after replacement of teeth.

Krzemien et al (2013) [46], showed some correlation between the advancement of temporomandibular joint disorder, the range of partial edentulism and abrasion of the residual teeth. In the study, a significant intensification of dysfunction symptoms, restricted condylar path was observed in patients with the largest partial edentulism and significant level of tooth wear of the residual teeth.

Shet et al (2013) [47], concluded that females subjects had a significantly higher prevalence of TMJ dysfunction signs then male subjects. As the span and time of edentulousness, the number of missing teeth and the number of quadrant involved increased, the signs of dysfunction became more prevalent.

Hama AM et al (2016) [48], concluded that there is a relation between TMJ dysfunction and partial edentulism, as well as the span and time of edentulousness. Females had a higher prevalence of TMJ dysfunction signs than males.

Fallahi HR et al (2016) [49], showed that partial edentulism is an important etiologic factor for TMJ disorders. Therefore, it is suggested that proper guidelines be provided for patients in order to replace lost teeth and create a stable occlusion.

Anwar A et al (2017) [50]**,** evaluated the rate of prevalence of myofacial dysfunction among partially edentulous individuals. He concluded that the period of edentulousness is a factor in Myofacial Pain Dysfunction Syndrome.

SIGNS AND SYMPTOMS OF TEMPOROMANDIBULAR JOINT DISORDERS

Greene et al (1969) [51], reported the commonly observed symptom in TMD are sounds during condylar movements. The sounds that occur in the TMJ are diagnosed by listening with a stethoscope while the patient opens and closes his or her mouth. The noises have been described as clicking, popping, and crepitus.

According to **Feine and Lund (1977)** [52], TMD presents clinically with different symptoms including pain, clicking or grinding sounds in the joint; dysfunction and limitation in mouth opening and other movements. The pain is sometimes localised in the joint and/or the masticatory muscles, and at other times radiates to the neighbouring areas to produce earache, headache, toothache and pain in the face and neck.

LeResche and Meisler (1977) [53], discussed the role of gender in TMD, suggesting that TMD is considered to be 1.5-2 times more prevalent in women than in men, and that 80% of the patients treated for this disorder were women. The most prominent gender differences have

been found in women aged 20-40 years, and the lowest among children, adolescents and the elderly.

Tsukert et al (1978) [54], found that TMD sufferers complained of pain or sensitivity within the masticatory muscles, with the regions of the lateral pterygoid, masseter and temporalis muscles being of particular significance.

De Bover (1979) [20]**,** concluded the essential symptoms or signs of TMD are considered to be pain and tenderness in and around the TMJ and in the muscles of chewing, impaired mobility of the mandible, and TMJ sounds that it is considered as a multiple group of fluctuating symptoms.

Magnusson et al (1984) [55]**,** reported a correlation between headache and mandibular dysfunction, and he suggested that headache should be included in the symptom panorama of mandibular dysfuncition.

Mc Namara et al (1995) [56]**,** reported that interaction of morphologic and functional occlusal factors relative to TMD indicated that there is a relatively low association of occlusal factors in characterizing TMD. Skeletal anterior open bite, overjet greater than 6 to 7 mm, retruded cuspal position/intercuspal position slide greater than 4 mm, unilateral lingual crossbite, and five or more missing posterior teeth are the five occlusal features that have been associated with specific diagnostic groups of TMD conditions. The first 3 factors often are associated with TMJ arthropathies and may be the result of osseous or ligamentous changes within the temporomandibular articulation. He concluded that the relationship of TMD to occlusion and orthodontic treatment is minor.

Aaron et al (2000) [57]**,** noted that TMD often co-exists with other craniofacial and orofacial pain disorders. It is considered a sub-classification of musculoskeletal disorders, including arthritis and fibromyalgia.

According to **Michalowicz et al (2000)** [58], the signs and symptoms of TMD are four times more common in women, who seek specialized treatment for this disease three times more frequently than men. Despite the fact that the low prevalence of TMD in men has not been completely elucidated yet, the presence of higher testosterone levels may be plausible explanation.

Okeson (2003) [14]**,** made up three categories of symptoms and signs according to the affected structures: the muscles, TMJ, and the dentition. A symptom is considered to be a complaint reported by the patient and a sign an objective clinical finding diagnosed by the dentist during examination. He said that the number and severity of the patient´s symptoms and the clinically diagnosed signs do not necessarily match.

Hiltunem et al (2003) [59], did a 5 year follow up of signs and symptoms of TMD. He concluded that the risk of TMD signs in the elderly population is low and does not have any association with occlusal support status either with or without removable dentures.

Whyte Ferguson et al (2004) [60], reported the other commonly reported muscle groups in TMD include the digastric, sternocleidomastoid, posterior cervical muscles and the scalene.

Shet et al (2013) [47], concluded that females subjects had a significantly higher prevalence of TMJ dysfunction signs then male subjects. Among the TMJ dysfunction signs deviation and clicking sound were most frequently observed. The masseter muscle was most commonly affected and demonstrated muscle tenderness.

INDICES AND DIAGNOSTIC CLASSIFICATION

Helkimo (1974) [61], gave the Helkimo dysfunction indices. Ai and Di are tools to gather different symptoms and signs into one particular index value. He specified dysfunction by its symptoms: pain, limited function, tenderness, and TMJ sounds. The anamnestic dysfunction index was developed to classify reported symptoms in three grades based on expected severity: Ai 0 = symptom-free, Ai I = mild symptoms (jaw tiredness, TMJ sounds), and A II = severe symptoms (TMJ locking, difficulties in opening wide, jaw pain). The clinical dysfunction index was based on the outcome of a clinical examination that measures range of mandibular movement, function of the temporomandibular joint, presence of pain on movements of the mandible, presence of muscle pain, and/or temporo- mandibular joint pain to palpation. Each variable examined is scored on 3 levels of severity based on defined criteria: no signs of dysfunction (0 points), mild signs of dysfunction (1 point), and severe signs 0f dysfunction (5 points). The sum of the scores can thus range from 0 to 25 points. The index is constructed as an ordinal scale in four grades of severity: 4 points, Di I),–no signs of dysfunction (Di 0), mild signs of dysfunction (1 9 points, Di II), and severe signs of–moderate signs of dysfunction (5 25 points, Di III).–dysfunction (10 - 25 points, Di III).

In 1990 the **American Academy of Orofacial Pain** (AAOP) [62] established the first well-defined diagnostic classification for TMD, revised in 1993. At the same moment multicenter research group established more specific research diagnostic criteria (RDC) for patient questionnaires and clinical findings associated with TMD, using somewhat similar classification. The RDC were developed by an international project team using the concept of a dual-axis classification system. Axis I is a non-hierarchical diagnostic scheme, and the condition can be diagnosed into one of 3 main groups: (1) muscle disorders (2) disc displacements, and (3)

arthralgia, arthritis, and arthrosis. The RDC/TMD Axis II classification system included pain-related disability and psychological status.

TREATMENT

Wenneberg et al (1978) [63], studied the short term effect of intra-articular injection of corticosteroid on temporomandibular joint pain and dysfunction to conclude that intra-articular injections of corticosteroids can be used on a limited basis in cases of severe joint pain when conservative treatment was unsuccessful.

Danzig et al (1983) [64], studied the physical therapy as an adjunct to temporo-mandibular joint therapy as an effective treatment for TMD as it helps relieve musculoskeletal pain, restores normal function and promotes the repair and regeneration of tissues.

Clark et al (1984) [65], evaluated the effectiveness of orthopedic inter-occlusal appliance therapy such as occlusal splints, night guards, orthotics, bruxism appliances and reported 70% to 90% clinical success rates.

Jaffe et al (1985) [66], indicated the use and effectiveness of non-opiate analgesics for mild to moderate acute pain associated with TMD pain and the use of opioid narcotics only for a short term for controlling severe pain.

Okeson (1986) [67], concluded that patients with Temporomandibular disorders can achieve good relief of symptoms with conservative method of non invasive management.

Tura et al (1990) [68], studied the analgesic effect of tricyclic antidepressants and suggested that it can be used for short term in patients with acute muscle pain and sleep disturbances, also about muscle relaxants and their sedative effect.

Nitzan et al (1990) [69], studied the arthoscopic lavage and lysis of the temporo-mandibular joint and said that it is indicated in a very small percentage of TMD patients and for those with specific TMD articular disorders. He concluded that the effectiveness of arthocentesis, lavage through import and export needles with and without steroid and subsequent mobilization rapidly reduces arthoscopic procedures.

Clark et al (1990) [70], said that Temporomandibular disorders are similar to other musculoskeletal and rheumatologic disorders and because little is known about the natural course of TMD or which signs and symptoms will progress to more serious conditions, a special effort to be made to avoid aggressive, irreversible therapy.

de Leeuw et al (1994) [71]**,** stated that both internal derangements and osteoarthritis of the TM joint follow a natural course. They concluded that nonsurgical treatment is as effective as surgical treatment over the long term period. They recommended the use of nonsurgical treatment to reduce the signs, symptoms and allow the process to be more tolerable for the patient.

Kuttila et al (1997) [72], noted that the group with TMD needing active treatment was about 10% and among the older population, the need or demand for treatment seems to decrease with age.

According to **Mc Neil C (1997)** [4], most treatment approaches are reported to be equally effective, a conservative, noninvasive management program is suggested. The emphasis is on a medical multidisciplinary model similar to the one used for other musculoskeletal disorders that involve the patient in the physical and behavioral management for the problem. He concluded that a majority of temporomandibular disorder patients achieve good relief of symptoms with conservative, noninvasive reversible therapy.

Moore and Wood (1997) [73], documented some cases of TMD with the use of Botulin toxin to combat the hypertonicity of muscles and in relieving cases of myopathy.

Simons et al (1998) [74], described the manual therapies including soft tissue techniques, mobilization, exercise and manipulation to reduce the pain and as an adjunct to occlusal treatment and post surgical treatment.

Yoda et al (2003) [75], concluded that non-myogenous cases of TMD can be managed with soft tissue treatments and exercise, without occlusal work.

Westesson et al (2004) [76], with a statistical review suggested that 50% of TMJ disorders are self-limiting, 25% are managed with NSAIDS and muscle relaxants, 20% are treated with oral appliances and 1–2% end up in surgery.

Kalamir A et al (2006) [77], mentioned the treatment modalities for TMD described in the literature such as physiotherapy, chiropractic massage, cognitive behavioural therapy (CBT), biofeedback, stress counselling, acupuncture and other therapies.

MATERIALS AND METHODS

SOURCE OF DATA:

Patients visiting the department of Oral Medicine and Radiology at KSR Institute of Dental Sciences and Research, Tiruchengode, Namakkal district, Tamil Nadu.

METHOD OF COLLECTION OF DATA:

The study protocol was analyzed and approved by the institutional ethical review board. The present cross sectional study was conducted among 460 subjects having partial edentulism for atleast 8 months. The subjects were selected based on the inclusion and exclusion criteria and those who were willing to participate in the study. The need and outcome of the study was explained to the subjects and an informed consent was obtained.

INCLUSION CRITERIA:

a. Subjects in the age ranging from 18 to 60 years
b. Both male and female subjects
c. Subjects having partial edentulism for atleast 8 months or more

EXCLUSION CRITERIA:

a. Subjects having history of trauma, orthodontic treatment, muscle disorders, parafunctional habits
b. Partially edentulous patients with replaced teeth/ prosthesis

c. Partially edentulous patients with multiple edentulous spaces with incomplete replacement of all edentulous spaces.

STUDY DESIGN:

A total of 460 partially edentulous patients were enrolled in the study. The subjects were selected according to the inclusion and exclusion criteria. A self structured, pre-tested questionnaire was used for data collection and it was followed by clinical examination for TMD signs to correlate between partial edentulism and TMD.

PATIENT SELECTION:

Patients visiting the Oral Medicine and Radiology department of KSR Dental College were taken up for the study. Patients were subjected to routine clinical examination. In the routine examination, if missing teeth were observed, they were subjected to detailed examination. Partially edentulous patients with edentulous period of atleast 8 months and those without teeth replacement are included in the study according to the inclusion and exclusion criteria. Initially a detailed history of patient was taken including the demographic data. It was followed by data collection using the questionnaire. The data from the clinical examination were also entered.

QUESTIONNAIRE:

The questionnaire consisted of 12 questions for evaluation of medical history, period of partial edentulism, difficulty in chewing, pain in the TMJ/ facial muscles, limitation in jaw movements, joint sounds and joint locking.

CLINICAL EXAMINATION:

The data obtained with physical examination for mouth opening values using a millimeter scale, deviations in mandibular movements, joint sounds (clicking, crepitation) using a stethoscope, joint locking, condylar luxation and masticatory muscles pain on palpation were recorded in the proforma.

In the intra oral examination, the number of teeth lost and the classification of edentulous area were recorded based on Kennedy's classification of partial edentulism. Pathological migration and supra eruption of the teeth were also noted.

KENNEDY'S CLASSIFICATION OF PARTIAL EDENTULISM

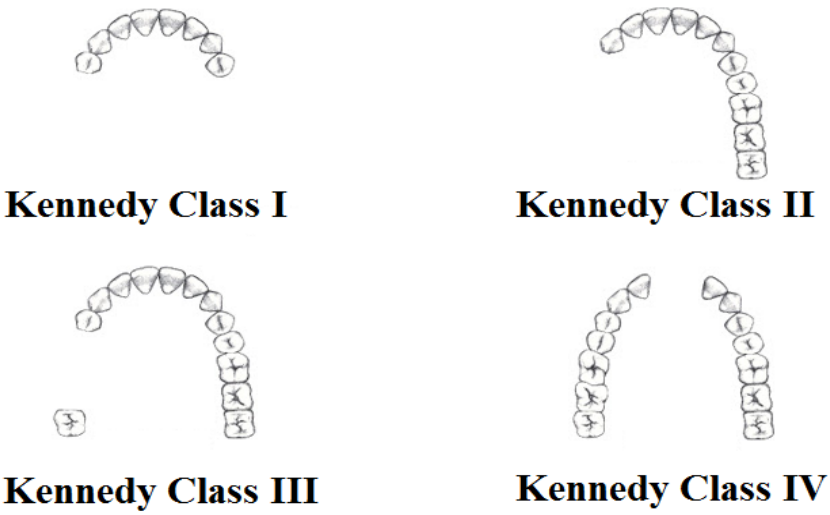


Fig 1 – Kennedy's classification of partial edentulism

ARMAMENTARIUM

CLINICAL EXAMINATION

1. Mouth mirror
2. Probe
3. Divider
4. Tongue blade
5. Metallic millimeter ruler
6. Stethoscope
7. Gloves

Fig 2 - Armamentarium for clinical examination

Fig 3 - Palpation of Temporalis muscle

Fig 4 - Palpation of Masseter

Fig 5 - Palpation of Lateral pterygoid

Fig 6 - Palpation of Medial pterygoid

Fig 7 - Palpation of Non masticatory muscle

Fig 8 – Palpation of TMJ

Fig 9 – Auscultation for joint sounds

Fig 10 – Mouth opening measurements

Fig 11 – Intraoral palpation of Temporalis tendon

STATISTICAL ANALYSIS

The data obtained from the study was entered in Microsoft Excel and statistical analysis was done. The data was analyzed using SPSS software (IBM SPSS Statistics for Windows, Version 22.0). Chi-Square was used to evaluate the relationships between the prevalence of qualitative variables. Significance level was fixed as 5%.

CHI – SQUARE TEST:

When the data is measured in terms of attributes or qualities and it is intended to test whether the difference in the distribution of attributes in different groups is due to sampling variation or not, the Chi square test is applied. It is used to test the significance of difference between two proportions and can be used when there are more than two groups to be compared.

RESULTS

AGE GROUP OF PATIENTS

Partially edentulous patients in the age group of 18-60 years participated in the study and were categorized under four categories.

		N	%
Age (yrs)	< 30 yrs	46	10.0%
	30 - 39 yrs	86	18.7%
	40 - 49 yrs	142	30.9%
	50 - 60 yrs	186	40.4%
	Total	460	100.0%

Table 1.1 Distribution of age among patients included in the study

Table 1.1 shows that partially edentulous patients from the age group of 18 years to 60 years participated in the study and 28.7% of them were below 40 years of age.

GENDER

Both male and female patients who were partially edentulous were included in the study.

		N	%
Gender	Male	192	41.7%
	Female	268	58.3%
	Total	460	100.0%

Table 2.1 Distribution of gender among partially edentulous patients

Table 2.1 shows gender distribution among the participants of this study which indicates that 58.3% of the partially edentulous patients were females.

PERIOD OF EDENTULOUSNESS

Partially edentulous patients with edentulous period more than 8 months were included in the study.

		Gender					
		Male		Female		Total	
		N	%	N	%	N	%
Period of edentulousness	8mth - 1 yr	12	6.3%	20	7.5%	32	7.0%
	1 - 2 yrs	38	19.8%	42	15.7%	80	17.4%
	> 2yrs	142	74.0%	206	76.9%	348	75.7%
	Total	192	100.0%	268	100.0%	460	100.0%

Table 3.1 Distribution of edentulous period in partially edentulous patients according to gender.

Table 3.1 shows that 75.7% of the patients were partially edentulous for more than 2 years. Female patients had a higher edentulous period of more than 2 years (76.9%) when compared to males.

DIFFICULTY IN CHEWING/SPEECH AMONG PARTIALLY EDENTULOUS PATIENTS

		N	%
Difficulty in chewing	Present	266	57.8%
	Absent	194	42.2%
	Total	460	100.0%

Table 4.1 No. of partially edentulous patients with difficulty in chewing the food or with speech

		Difficulty in chewing/speech					
		Present		Absent		Total	
		N	%	N	%	N	%
Kennedy's classification – Maxilla	Kennedy -I	60	30.6%	10	10.6%	70	24.1%
	Kennedy -II	64	32.7%	32	34.0%	96	33.1%
	Kennedy -III	52	26.5%	34	36.2%	86	29.7%
	Kennedy -IV	20	10.2%	18	19.1%	38	13.1%
	Total	196	100.0%	94	100.0%	290	100.0%
Kennedy's classification – Mandible	Kennedy -I	58	26.9%	20	13.3%	78	21.3%
	Kennedy -II	60	27.8%	52	34.7%	112	30.6%
	Kennedy -III	76	35.2%	64	42.7%	140	38.3%
	Kennedy -IV	22	10.2%	14	9.3%	36	9.8%
	Total	216	100.0%	150	100.0%	366	100.0%

Table 4.2 Distribution of difficulty in chewing/speech among various kennedy's class of partial edentulism in the maxillary and mandibular arch.

Table 4.1 and 4.2 shows that increased chewing/speech difficulty is associated with maxiallary Kennedy's class II (32.7.%) and mandibular Kennedy's class III (35.2%) partial edentulism.

KENNEDY'S CLASSIFICATION OF PARTIAL EDENTULISM

The partially edentulous participants were classified according to Kennedy's classification of partial edentulism.

		N	%
Kennedy's classification – Maxilla	Kennedy -I	70	24.1%
	Kennedy -II	96	33.1%
	Kennedy -III	86	29.7%
	Kennedy -IV	38	13.1%
	Total	290	100.0%
Modification space – Maxilla	Present	116	40.0%
	Absent	174	60.0%
	Total	290	100.0%
Kennedy's classification - Mandible	Kennedy -I	78	21.3%
	Kennedy -II	112	30.6%
	Kennedy -III	140	38.3%
	Kennedy -IV	36	9.8%
	Total	366	100.0%
Modification space - Mandible	Present	106	29.0%
	Absent	260	71.0%
	Total	366	100.0%

Table 5.1 Distribution of Kennedy's class of partial edentulism in the maxillary and mandibular arch.

		Age (yrs)									
		< 30 yrs		30 - 39 yrs		40 - 49 yrs		50 - 60 yrs		Total	
		N	%	N	%	N	%	N	%	N	%
Maxilla	Kennedy -I	0	0.0%	4	10.0%	12	14.6%	54	36.0%	70	24.1%
	Kennedy -II	2	11.1%	8	20.0%	36	43.9%	50	33.3%	96	33.1%
	Kennedy -III	8	44.4%	20	50.0%	26	31.7%	32	21.3%	86	29.7%
	Kennedy -IV	8	44.4%	8	20.0%	8	9.8%	14	9.3%	38	13.1%
	Total	18	100.0%	40	100.0%	82	100.0%	150	100.0%	290	100.0%
Mandible	Kennedy -I	2	6.3%	10	13.9%	24	20.3%	42	29.2%	78	21.3%
	Kennedy -II	6	18.8%	20	27.8%	42	35.6%	44	30.6%	112	30.6%
	Kennedy -III	24	75.0%	38	52.8%	42	35.6%	36	25.0%	140	38.3%
	Kennedy -IV	0	0.0%	4	5.6%	10	8.5%	22	15.3%	36	9.8%
	Total	32	100.0%	72	100.0%	118	100.0%	144	100.0%	366	100.0%

Table 5.2 Distribution of Kennedy's class of partial edentulism in various age groups

Table 5.1 shows that in the maxillary arch Kennedy's class II and in the mandibular arch Kennedy's class III was the most prevalent.

Table 5.2 shows that in the maxillary arch presence of Kennedy's class III and IV is 44% and in the mandibular arch, Kennedy's class III is 75% in the age group less than 30 years.

SUPRA ERUPTION IN PARTIALLY EDENTULOUS PATIENTS

		Supra erupted					
		Yes		No		Total	
		N	%	N	%	N	%
Period of edentulousness	8mth - 1 yr	8	25.0%	24	75.0%	32	100.0%
	1 - 2 yrs	14	17.5%	66	82.5%	80	100.0%
	> 2yrs	104	29.9%	244	70.1%	348	100.0%
	Total	126	27.4%	334	72.6%	460	100.0%

Table 6.1 Distribution of supra eruption of teeth among partially edentulous patients

Table 6.1 shows supra eruption present in 27.4% of partially edentulous patients. With period of edentulousness more than 2 years, supra eruption is 29.9%.

PATHOLOGICAL MIGRATION OF TEETH IN PARTIALLY EDENTULOUS PATIENTS

		Pathological migration					
		Yes		No		Total	
		N	%	N	%	N	%
Period of edentulousness	8mth - 1 yr	10	31.3%	22	68.8%	32	100.0%
	1 - 2 yrs	12	15.0%	68	85.0%	80	100.0%
	> 2yrs	90	25.9%	258	74.1%	348	100.0%
	Total	112	24.3%	348	75.7%	460	100.0%

Table 7.1 Distribution of pathological migration among partially edentulous patients

Table 7.1 shows presence of pathological migration in 24.3% of partially edentulous patients.

PARTIALLY EDENTULOUS PATIENTS WITH SELF REPORTED COMPLAINT OF PAIN IN TMJ / MASTICATORY MUSCLES / NON-MASTICATORY MUSCLES OF HEAD AND NECK

	Yes		No		Total	
	N	%	N	%	N	%
Presence of pain	68	14.8%	392	85.2%	460	100.0%
Location: TMJ	28	41.2%	40	58.8%	68	100.0%
Location: Temporalis	36	52.9%	32	47.1%	68	100.0%
Location: Masseter	24	35.3%	44	64.7%	68	100.0%
Location: other structures	24	33.3%	44	64.7%	68	100.0%

Table 8.1 Distribution of pain in the TMJ and other structures among partially edentulous patients

		Pain					
		Yes		No		Total	
		N	%	N	%	N	%
Period of edentulousness	8mth - 1 yr	4	12.5%	28	87.5%	32	100.0%
	1 - 2 yrs	6	7.5%	74	92.5%	80	100.0%
	> 2yrs	58	16.7%	290	83.3%	348	100.0%
	Total	68	14.8%	392	85.2%	460	100.0%
Age (yrs)	< 30 yrs	14	30.4%	32	69.6%	46	100.0%
	30 - 39 yrs	10	11.6%	76	88.4%	86	100.0%

	40 - 49 yrs	20	14.1%	122	85.9%	142	100.0%
	50 - 60 yrs	24	12.9%	162	87.1%	186	100.0%
	Total	68	14.8%	392	85.2%	460	100.0%
Gender	Male	18	9.4%	174	90.6%	192	100.0%
	Female	50	18.7%	218	81.3%	268	100.0%
	Total	68	14.8%	392	85.2%	460	100.0%

Table 8.2 Distribution of location of pain according to period of edentulousness, age, gender

Table 8.1 and 8.2 shows 16.7% of patients with period of edentulousness of more than 2 years presented with self reported pain. Patients under the age group of less than 30 years, 30.4% of them reported pain. Females accounting 18.7% of the total population with self reported pain is shown.

MOUTH OPENING PATTERN

		N	%
Opening pattern	Straight	222	48.3%
	Corrected deviation	154	33.5%
	Uncorrected deviation	84	18.3%
	Total	460	100.0%

Table 9.1 Distribution of mouth opening pattern among partially edentulous patients

Table 9.1 shows that more than 50% of the partially edentulous patients had deviation of the jaw upon mouth opening.

MOUTH OPENING MEASUREMENTS

		N	%
Pain free mouth opening	< 30 mm	0	0.0%
	30 - 35mm	20	4.3%
	36 - 4omm	288	62.6%
	41 - 45mm	144	31.3%
	> 45mm	8	1.7%
	Total	460	100.0%

Table 10.1 Distribution of pain free mouth opening measurements in partially edentulous patients

		Pain					
		Yes		No		Total	
		N	%	N	%	N	%
Maximum mouth opening	30 - 35mm	2	16.7%	10	83.3%	12	100.0%
	36 - 4omm	0	0.0%	60	100.0%	60	100.0%
	41 - 45mm	4	1.3%	302	98.7%	306	100.0%
	> 45mm	2	2.4%	80	97.6%	82	100.0%
	Total	8	1.7%	452	98.3%	460	100.0%

Table 10.2 Distribution of pain on maximum mouth opening measurements in partially edentulous patients

Table 10.1 and 10.2 shows pain free mouth opening, pain upon maximum mouth opening in 1.7% of patients and 1.3% of patients had pain on mouth opening of 41-45 mm.

TMJ NOISE

		N	%
Click	Yes	240	52.2%
	No	220	47.8%
	Total	460	100.0%
Crepitus	Yes	18	3.9%
	No	442	96.1%
	Total	460	100.0%

Table 11.1 Distribution of joint sounds among partially edentulous patients

		N	%
Open/Close/Both	Open	26	10.3%
	Close	98	38.9%
	Both	128	50.8%
	Total	252	100.0%
Rt/Lt/Both	Rt	44	17.5%
	Lt	96	38.1%
	Both	112	44.4%
	Total	252	100.0%

Table 11.2 Distribution of clicking according to opening, closing of mouth and side.

Table 11.1 and 11.2 shows closing click in 38.9% of patients and clicking on both open and close in 50.8% of patients. Clicking on left side is 38.1% and on both right and left side is 44.4%.

		Click					
		Yes		No		Total	
		N	%	N	%	N	%
Age (yrs)	< 30 yrs	34	73.9%	12	26.1%	46	100.0%
	30 - 39 yrs	44	51.2%	42	48.8%	86	100.0%
	40 - 49 yrs	80	56.3%	62	43.7%	142	100.0%
	50 - 60 yrs	82	44.1%	104	55.9%	186	100.0%
	Total	240	52.2%	220	47.8%	460	100.0%
Gender	Male	82	42.7%	110	57.3%	192	100.0%
	Female	158	59.0%	110	41.0%	268	100.0%
	Total	240	52.2%	220	47.8%	460	100.0%
Period of edentulousness	8mth - 1 yr	24	75.0%	8	25.0%	32	100.0%
	1 - 2 yrs	28	35.0%	52	65.0%	80	100.0%
	> 2yrs	188	54.0%	160	46.0%	348	100.0%
	Total	240	52.2%	220	47.8%	460	100.0%

Table 11.3 Distribution of clicking according to different age groups, gender, period of edentulousness

		Click					
		Yes		No		Total	
		N	%	N	%	N	%
Kennedy's classification – Maxilla	Kennedy -I	30	42.9%	40	57.1%	70	100.0%
	Kennedy -II	46	47.9%	50	52.1%	96	100.0%
	Kennedy -III	48	55.8%	38	44.2%	86	100.0%
	Kennedy -IV	20	52.6%	18	47.4%	38	100.0%
	Total	144	49.7%	146	50.3%	290	100.0%
Kennedy's classification – Mandible	Kennedy -I	40	51.3%	38	48.7%	78	100.0%
	Kennedy -II	48	42.9%	64	57.1%	112	100.0%
	Kennedy -III	90	64.3%	50	35.7%	140	100.0%
	Kennedy -IV	18	50.0%	18	50.0%	36	100.0%
	Total	196	53.6%	170	46.4%	366	100.0%
Pain in TMJ/ other structures	Yes	58	85.3%	10	14.7%	68	100.0%
	No	182	46.4%	210	53.6%	392	100.0%
	Total	240	52.2%	220	47.8%	460	100.0%
Opening pattern	Straight	94	42.3%	128	57.7%	222	100.0%
	Corrected deviation	96	62.3%	58	37.7%	154	100.0%
	Uncorrected deviation	50	59.5%	34	40.5%	84	100.0%
	Total	240	52.2%	220	47.8%	460	100.0%

Table 11.4 Distribution of clicking in various Kennedy's class of partial edentulism, patients self report of pain and opening pattern of mouth.

Table 11.3 and 11.4 shows 73.9% of clicking under 30 years of age. Females accounted for 59% of clicking among the total patients with clicking. Clicking was 75% prevalent among partially edentulous patients with 8 months-1 year duration of partial edentulism. In Table 11.4, it is seen that 55.8% incidence of click in Kennedy's class III in maxillary arch and 64.3% clicking in mandibular arch. Among participants 85.3% of patients had click with self reported complaint of pain in TMJ/other structures. Opening pattern was corrected deviation in 62.3% of patients with clicking.

		Crepitus					
		Yes		No		Total	
		N	%	N	%	N	%
Age (yrs)	< 30 yrs	0	0.0%	46	100.0%	46	100.0%
	30 - 39 yrs	2	2.3%	84	97.7%	86	100.0%
	40 - 49 yrs	4	2.8%	138	97.2%	142	100.0%
	50 - 60 yrs	12	6.5%	174	93.5%	186	100.0%
	Total	18	3.9%	442	96.1%	460	100.0%

Table 11.5 Distribution of crepitus among partially edentulous patients in different age groups and period of edentulousness.

Table 11.1, 11.2, 11.3, 11.4,11.5 shows prevalence of TMJ noise among partially edentulous patients, the most common side affected and the relation between TMJ noise and mouth opening/closing movements.

JOINT LOCKING

		N	%
Joint locking	Yes	10	2.2%
	No	450	97.8%
	Total	460	100.0%

Table 12.1 Distribution of joint locking among partially edentulous patients.

		Joint locking					
		Yes		No		Total	
		N	%	N	%	N	%
Reduction	Yes	8	80.0%	0	0.0%	8	80.0%
	No	2	20.0%	0	0.0%	2	20.0%
	Total	10	100.0%	0	0.0%	10	100.0%

Table 12.2 Frequency of reduction among joint locking cases

Table 12.1 and 12.2 shows frequency of joint locking 2.2% among partially edentulous patients and 80% of the cases undergo reduction without physicians help.

PAIN ON PALPATION OF TMJ AMONG PARTIALLY EDENTULOUS PATIENTS

		N	%
TMJ Pain	Yes	54	11.7%
	No	406	88.3%

	Total	460	100.0%
TMJ Pain (Side)	Rt	8	14.8%
	Lt	26	48.1%
	Both	20	37.0%
	Total	54	100.0%

Table 13.1 Distribution of pain on palpation of TMJ among partially edentulous patients and the sides involved.

		TMJ Pain					
		Yes		No		Total	
		N	%	N	%	N	%
Age (yrs)	< 30 yrs	10	21.7%	36	78.3%	46	100.0%
	30 - 39 yrs	8	9.3%	78	90.7%	86	100.0%
	40 - 49 yrs	16	11.3%	126	88.7%	142	100.0%
	50 - 60 yrs	20	10.8%	166	89.2%	186	100.0%
	Total	54	11.7%	406	88.3%	460	100.0%
Period of edentulousness	8mth - 1 yr	0	0.0%	32	100.0%	32	100.0%
	1 - 2 yrs	8	10.0%	72	90.0%	80	100.0%
	> 2yrs	46	13.2%	302	86.8%	348	100.0%
	Total	54	11.7%	406	88.3%	460	100.0%
Gender	Male	10	5.2%	182	94.8%	192	100.0%
	Female	44	16.4%	224	83.6%	268	100.0%
	Total	54	11.7%	406	88.3%	460	100.0%

Table 13.2 Distribution of TMJ pain on palpation in various age groups, period of edentulousness and gender.

		TMJ Pain					
		Yes		No		Total	
		N	%	N	%	N	%
Kennedy's classification - Maxilla	Kennedy –I	6	8.6%	64	91.4%	70	100.0%
	Kennedy –II	12	12.5%	84	87.5%	96	100.0%
	Kennedy –III	10	11.6%	76	88.4%	86	100.0%
	Kennedy –IV	0	0.0%	38	100.0%	38	100.0%
	Total	28	9.7%	262	90.3%	290	100.0%
Kennedy's classification - Mandible	Kennedy –I	8	10.3%	70	89.7%	78	100.0%
	Kennedy –II	16	14.3%	96	85.7%	112	100.0%
	Kennedy –III	20	14.3%	120	85.7%	140	100.0%
	Kennedy –IV	0	0.0%	36	100.0%	36	100.0%
	Total	44	12.0%	322	88.0%	366	100.0%

Table 13.3 Distribution of pain on palpation of TMJ among various class of Kennedy's partial edentulism.

		TMJ Pain					
		Yes		No		Total	
		N	%	N	%	N	%
Pathological migration	Yes	14	12.5%	98	87.5%	112	100.0%
	No	40	11.5%	308	88.5%	348	100.0%
	Total	54	11.7%	406	88.3%	460	100.0%
Opening pattern	Straight	14	6.3%	208	93.7%	222	100.0%
	Corrected deviation	28	18.2%	126	81.8%	154	100.0%
	Uncorrected deviation	12	14.3%	72	85.7%	84	100.0%
	Total	54	11.7%	406	88.3%	460	100.0%
Click	Yes	50	20.8%	190	79.2%	240	100.0%
	No	4	1.8%	216	98.2%	220	100.0%
	Total	54	11.7%	406	88.3%	460	100.0%

Table 13.4 Distribution of TMJ pain with palpation in patients with pathological migration of teeth, mouth opening pattern and patients with clicking.

Table 13.1,13.2,13.3,13.4 shows prevalence of TMJ pain on palpation among partially edentulous patients under different age groups, period of edentulousness, gender, Kennedy's class. It is seen that TMJ pain was present in 11.7% of the patients, more common in females in the younger age group with increased of period of edentulousness in Kennedy's class II and class III partial edentulism along with clicking in 20.8 % of patients.

PAIN ON PALPATION OF MASTICATORY MUSCLES AND SUPPLEMENTAL MUSCLES OF MASTICATION IN PARTIALLY EDENTULOUS PATIENTS

Pain	Temporalis		Masseter		Medial pterygoid		Lateral pterygoid		Supplemental muscles	
Present	44	9.6%	34	7.4%	14	3%	16	3.5%	14	3%
Absent	416	90.4%	426	92.6%	446	97%	444	96.5%	446	97%
Right side	8	18.2%	8	23.5%	2	14.3%	2	12.5%	4	28.6%
Left side	20	45.5%	18	52.9%	6	42.9%	8	50%	8	57.1%
Both sides	16	36.4%	8	23.5%	6	42.9%	6	37.5%	2	14.3%

Table 14.1 shows distribution of pain in various muscles of mastication and supplementary muscles of mastication in the study participants.

Age	Temporalis	Masseter	Medial pterygoid	Lateral pterygoid	Supplemental muscles
< 30 years	17.4%	21.7%	8.7%	8.7%	4.3%
30-39 yrs	16.3%	9.3%	2.3%	4.7%	2.3%
40-49 yrs	8.5%	5.6%	1.4%	1.4%	2.8%
50-60 yrs	5.4%	4.3%	3.2%	3.2%	3.2%

Table 14.2 Distribution of pain in muscles of mastication and supplementary muscles of mastication among partially edentulous patients in various age groups

Period of edentulousness	Temporalis	Masseter	Medial pterygoid	Lateral pterygoid	Supplemental muscles
8 months-1 yr	6.3%	0.0%	0.0%	0.0%	0.0%
1-2 yrs	0.0%	2.5%	0.0%	0.0%	0.0%
>2 yrs	12.1%	9.2%	4%	4.6%	4%

Table 14.3 Distribution of pain in muscles of mastication and supplementary muscles of mastication among partially edentulous patients with different edentulous periods

Gender	Temporalis	Masseter	Medial pterygoid	Lateral pterygoid	Supplemental muscles
Male	3.1%	4.2%	2.1%	1%	2.1%
Female	14.2%	9.7%	3.7%	5.2%	3.7%

Table 14.4 Distribution of pain in muscles of mastication and supplementary muscles of mastication among partially edentulous patients according to gender difference.

Table 14.1,14.2,14.3,14.4 shows that the most common muscles affected among partially edentulous patients are the temporalis and masseter, left side is commonly affected, females in the younger age group with increased period of edentulousness are the vulnerable population.

Kennedy's classification Maxilla	Tempoaralis	Masseter	Medial pterygoid	Lateral pterygoid	Supplemental muscles
Kennedy I	0%	2.9%	0%	0%	0%
Kennedy II	12.5%	8.3%	2.1%	2.1%	4.2%
Kennedy III	16.%3	11.%6	7%	9.3%	4.7%
Kennedy IV	0%	0%	0%	0%	0%

Table 14.5 Distribution of pain in muscles of mastication and supplementary muscles of mastication among partially edentulous patients according to various Kennedy's class of partial edentulism in the maxillary arch.

Kennedy's classification Mandible	Temporalis	Masseter	Medial pterygoid	Lateral pterygoid	Supplemental muscles
Kennedy I	7.7%	5.1%	5.1%	2.6%	5.1%
Kennedy II	7.1%	8.9%	3.6%	3.6%	3.6%
Kennedy III	12.9%	8.6%	1.4%	4.3%	1.4%
Kennedy IV	5.6%	0%	0%	0%	0%

Table 14.6 Distribution of pain in muscles of mastication and supplementary muscles of mastication among partially edentulous patients according to various Kennedy's class of partial edentulism in the mandibular arch.

Pathological migration	Temporalis	Masseter	Medial pterygoid	Lateral pterygoid	Supplemental muscles
Present	10.7%	7.1%	7.1%	5.4%	5.4%
Absent	9.2%	7.5%	1.7%	2.9%	2.3%

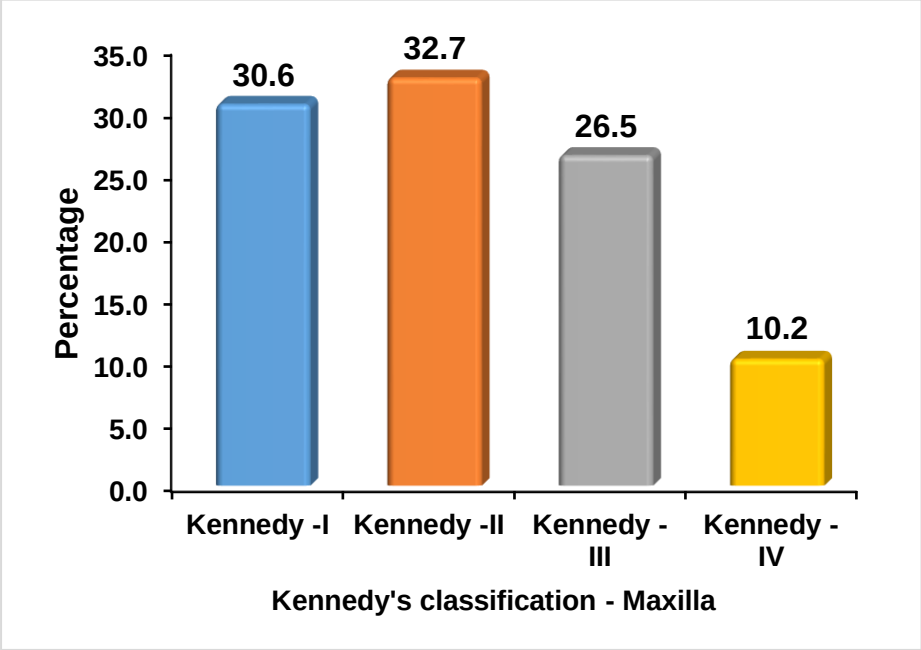
Table 14.7 Distribution of pain in muscles of mastication and supplementary muscles of mastication among partially edentulous patients with pathological migration.

Click	Temporalis	Masseter	Medial pterygoid	Lateral pterygoid	Supplemental muscles
Present	15.8%	13.3%	5.8%	5.8%	5.0%
Absent	2.7%	0.9%	0%	0.9%	0.9%

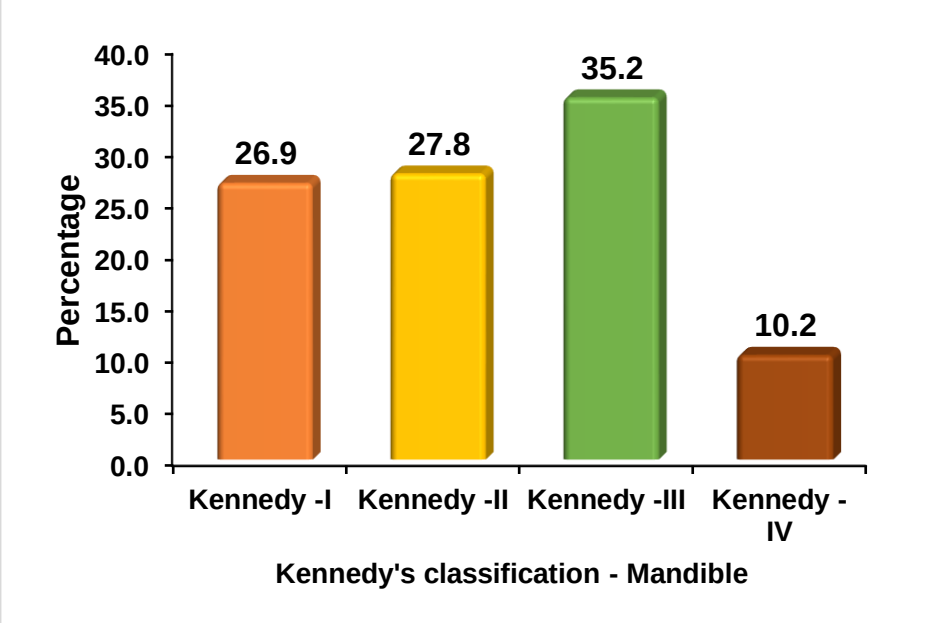
Table 14.8 Distribution of pain in the muscles of mastication and supplementary muscles of mastication in partially edentulous patients with clicking.

Table 14.5, 14.6, 14.7, 14.8 shows that Kennedy's class II, III is the common type of partial edentulism associated with muscle pain and patients with pathological migration of teeth and TMJ clicking had higher distribution of muscle pain.

DIFFICULTY IN CHEWING/SPEECH

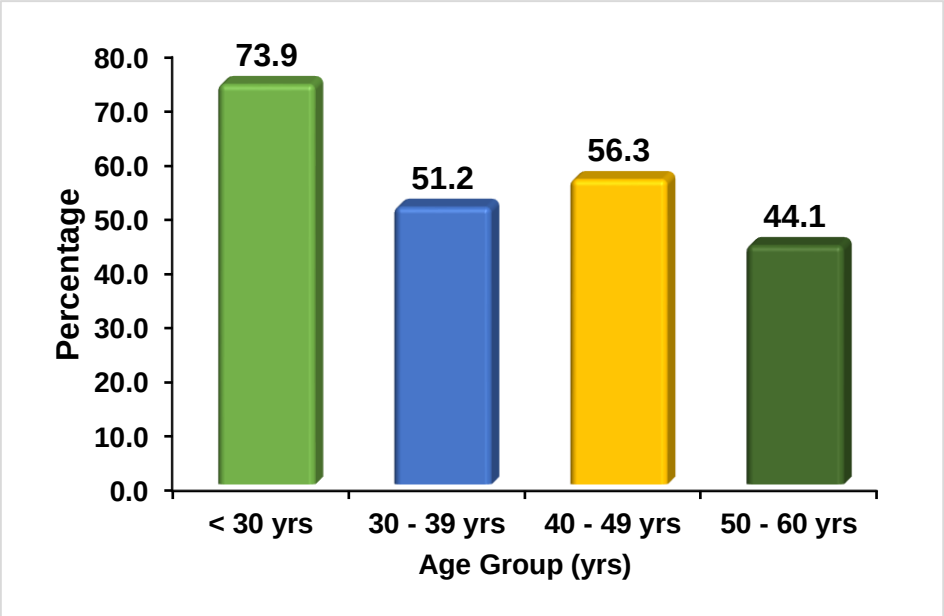


Graph 1: Prevalence of Difficulty in chewing in various Kennedy's class of partial edentulism in the maxillary arch



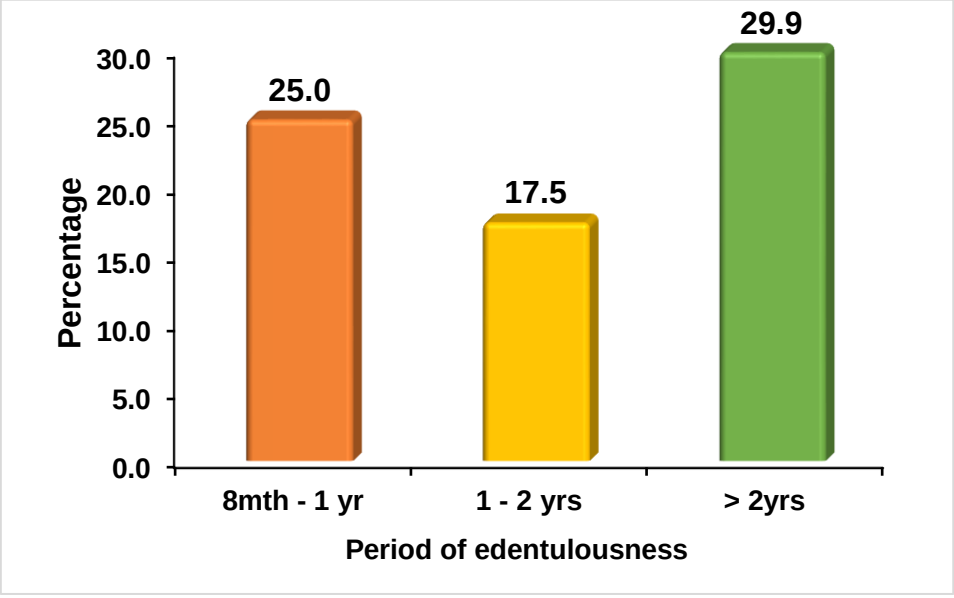
Graph 2: Prevalence of Difficulty in chewing in various Kennedy's class of partial edentulism in the mandibular arch

PRESENCE OF CLICK



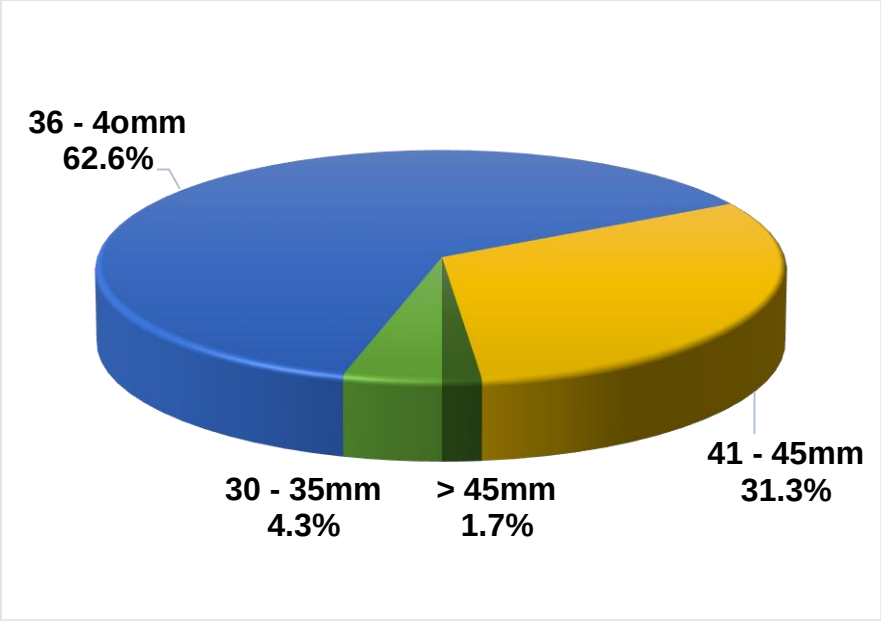
Graph 3: Prevalence of clicking in various age groups

SUPRA ERUPTION OF TEETH



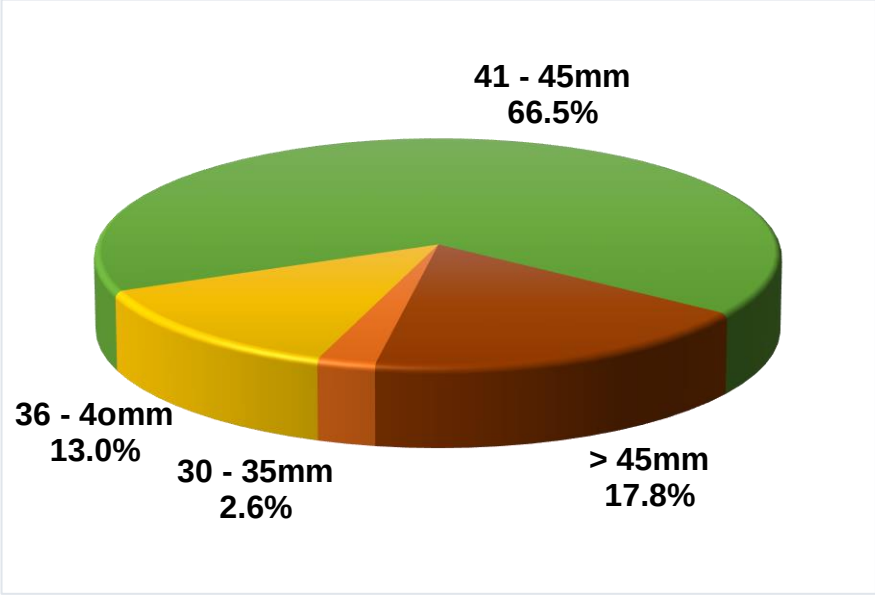
Graph 4: Prevalence of supra eruption of teeth in various edentulous periods

PAIN FREE MOUTH OPENING



Graph 5: Measurements of pain free mouth opening among the patients

MAXIMUM MOUTH OPENING



Graph 6: Maximum mouth opening measurements among the patients

CHI- SQUARE TEST VALUES

	CHI-SQUARE	P- VALUE
Difficulty in chewing in various Kennedy's classification - maxilla	16.408	0.001
Difficulty in chewing in various Kennedy's classification - mandible	10.325	0.016

Table 15.1 P – value evaluation of difficulty of chewing in different Kennedy's classification of partial edentulism in the maxillary and mandibular arch.

	CHI SQUARE	P VALUE
Difference in Kennedy's classification according to age groups - maxilla	54.869	0.001
Difference in Kennedy's classification according to age groups - mandible	43.251	0.001

Table 16.1 P-value evaluation in different age groups and corresponding Kennedy's class of partial edentulousness.

Any P –value <0.05 is considered statistically significant. Table 15.1 and 16.1 shows that there is statistically significant difference in difficulty in chewing and the type of partial edentulism.

Also there is statistically significant difference when relating the class of partial edentulism to age groups.

DIFFERENCE IN CLICKING WITH	CHI SQUARE	P VALUE
Age	14.610	0.002
Gender	11.833	0.001
Period Of Edentulousness	16.615	<0.001
Mouth Opening Pattern	16.794	<0.001
Self Reported Pain	35.079	<0.001

Table 17.1 P- value evaluation in relationship between clicking and age, gender, period of edentulousness, mouth opening pattern, self reported pain.

Table 17.1 shows that there is statistically significant difference when analyzing the relationship between clicking and age, gender, period of edentulousness, mouth opening pattern, self reported pain.

Also significant P-values are obtained when the distribution of self reported pain in the TMJ, other structures with different age groups and gender are evaluated (P-value – 0.017 and 0.006).

DISCUSSION

The temporomandibular disorder (TMD) is defined as a set of functional and pathological conditions affecting the temporomandibular joint (TMJ), masticatory muscles and adjacent components. It is characterized by several signs and symptoms that include facial muscle and joint pain, limitation and / or mandibular deviation in jaw movements, joint noises, headaches and pain in cervical region.[78]

Although there is not a defined etiology for TMD, functional, structural and psychological factors characterize the multifactorial origin of this dysfunction. Some conditions, such as malocclusion which includes partial edentulism and other conditions like parafunctional habits, emotional stress, trauma, sleep disorders, postural abnormalities, systemic factors, are present with particular frequency in patients with TMD signs.[79]

Partial edentulism can lead to several drawbacks to the subjects including clinical challenges and compromised lifestyle. Clinically, partial edentulism results in drifting and tilting of adjacent teeth, supra eruption of opposing teeth, altered speech, changes in facial appearance and TMD. Also, the loss and continuing degradation of the alveolar bone, adjacent teeth and also the supporting structures will influence the difficulty to achieve an adequate restoration in a partially edentulous patient. On the lifestyle compromises, partial edentulism restricts dietary options, which leads to weight loss. Further, it leads to lack of confidence and confined social activities, which may adversely affect the quality of life and lead to depression.[80]

The occlusion is now treated not only as the ratio of contact between teeth, but as a dynamic, morphological and functional relation between all components of the stomatognathic system, presenting a great influence on chewing, swallowing and speech.

There is a huge controversy in literature regarding the association between occlusion and TMD. Some authors have reported high turnout of occlusal factors in signs and symptoms of TMD. It has been documented that patients with only few natural teeth remaining in the oral cavity have higher incidence of TMJ dysfunction signs.[81]

In a recent case-control study by **Selaimen et al., (2007)** he examined the occlusal factors in the aetiology of TMD. The study controlled for sociodemographic factors (employment, age, cigarette and alcohol consumption) and the results confirmed that some occlusal factors (overbite, overjet, number of anterior and posterior teeth and protrusive movements) including the absence of canine guidance, may be considered risk factors for TMD.[82]

In the present study, a total of 460 partially edentulous patients were included and among them 268 (58.3%) were females and 192 (41.7%) were males. **Sapkota B et al., (2013)** observed that females were more edentulous compared to males but at the same time, opt for a higher level of replacement of missing teeth. This may be due to their dependency upon the males for their dental treatment to save the teeth.[83]

Also the TMD signs were more prevalent among female population in this study and this is supported by the study done by **Hama AM et al (2016)**. This has been interpreted as a reflect of biological, psychosocial and hormonal differences between two groups. However, there are other epidemiological surveys that show signs and symptoms of TMJ dysfunction are present in both sexes in equal proportion.[48,47]

Among the participants of this study, more number of patients had missing teeth in the mandibular arch when compared to maxillary arch, the result of which is supported by the study done by **Curtis D et al.,** who explained that greater number of mandibular RPDs was

observed compared with maxillary RPDs and this is probably related to the general pattern of tooth loss.[84]

Prabhu N et al., noted that partial edentulism was more common in the mandibular arch compared to maxillary arch. This is due to the fact that mandibular teeth erupt earlier in the oral cavity which is prone for higher caries rate and higher chance of the tooth to get extracted.[85]

Among the partially edentulous patients included in this study, 57.8% of the patients mentioned that they have difficulty in chewing the food and with speech. This is supported by the study done by **Vadavadagi SV et al.,** where he evaluated for Partial edentulism and its association with sociodemographic variables among subjects attending dental teaching institutions. In his study 384 subjects were included in the study among which 288 were partially edentulous and 53% of them agreed with the difficulties in chewing food and the need to replace the missing teeth.[86]

In this study, in the maxillary arch, Kennedy's class II was the most prevalent (33.1%) when compared to other classes of partial edentulism which is in contrary to the results of the study done by **Khan SU et al.,** in 2016 who evaluated the partial edentulism based on Kennedy's classification among 182 partially edentulous patients where Kennedy's class III was the most prevalent in the maxillary arch. In the present study, Kennedy's class III was the most prevalent in the mandibular arch (38.3%) which is in agreement with the study by **Khan SU et al.,** where it was 36%. The higher prevalence of Kennedy's class II and class III partial edentulism can be related to the general pattern of tooth loss.[87]

Also it was found in this study that greater difficulty with chewing the food was associated with maxillary Kennedy's class I (31%) and class II (33%) and mandibular Kennedy's class III (35%) which can be explained with the importance of posterior teeth in mastication.

In the current study, the younger age group had more maxillary Kennedy's class III and IV partial edentulism and the older age group had more of Kennedy's class I and class II. In the mandibular arch, Kennedy's class III was more prevalent among the younger age group and Kennedy's class I and II was common among the elderly patients. The results are in support with the study done by **Zaigham AM et al.,** where he studied the pattern of partial edentulism and its association with age and gender and he concluded that with an increase in age, there was an increase in Class I & Class II dental arch tendency and a decrease in Class III & Class IV. This is due to the trauma to maxillary central incisors at early childhood, early loss of first molar due to caries may be the reason for higher occurrence of Class III in younger age groups. When age increases, due to further loss of teeth, extension of existing saddle leads to Class I and Class II.[88]

In this study, Kennedy's Class III was also found to be most common incidence in age group less than 30 years and Kennedy's class I and II was common among older age group of 50-60 years.

Among the partially edentulous patients more than 27% of the participants had supra eruption of the teeth and more than 24% of the participants had pathological migration of the teeth. Supra eruption of the teeth was seen to be associated with period of edentulousness and 29.9% of patients with period of edentulousness more than 2 years had supra eruption of teeth.

In the present study, among the partially edentulous patients only 14.8% of them had self reported complaint of pain either in the TMJ or masticatory/non masticatory muscles but

the presence of TMD signs (clicking) were noted in more than 50% of the patients. This result suggests that TMD symptoms are rarer than was actually observed in a clinical evaluation. This inconsistency may be the result of patient's not associating symptoms like mouth opening restriction or pain in the facial area with TMD. **Okeson** calls these symptoms "subclinical" and proves that TMD problem is still belittled by many patients and also clinicians. Among the subjects more of female patients had a complaint of pain in the TMJ or associated structure which can be attributed to limited tolerance of pain and more exposed to psychological disorder.[17]

In this study, there was no significant difference in the relationship between mouth opening pattern and type of Kennedy's classification, period of edentulousness and location of pain. Partially edentulous patients with self reported TMJ or muscle pain had maximum mouth opening of less than 35 mm.

In the present study TMJ clicking was present in 52.2 % of the patients and it was the most common TMD sign. In the study done by **Hama AM et al.,** among 300 partially edentulous patients, clicking was the most common sign 62.7%.[48] The result is also supported by the studies done by **Carlsson GE et al.,** and **Shet RGK et al**. Other signs were TMJ pain, reduced mouth opening, masticatory muscle pain and mandibular deviation. A variety of different causes to TMJ sounds have been suggested e.g., arthritic changes in the TMJ, anatomical variations, muscular incoordination, and disc displacement. Recent researchers related clicking "to a sudden acceleration of condylar and internally displaced disc tissues".[28,47]

In the current study, TMJ clicking was more prevalent (73.9%) in the younger age group of less than 30 years and it was 44% in the age group of 50-60 years. In the study done by **Bonjardin LR et al.,** in which he evaluated the signs and symptoms of temporomandibular

disorders in adolescents, he reported that the dysfunction and palpation index had significantly higher scores in adolescents who reported with TMD symptoms.[89] In the study done by **Al-Khotani A et al.,** where he studied the prevalence of diagnosed temporomandibular disorders among Saudi Arabian children and adolescents, he discussed that TMD conditions in the pre pubertal age is mainly of muscular origin and then with age are complemented with intracapsular disorders.[90]

In this study, patients with self reported pain in the TMJ /muscles of mastication or supplemental muscles had significantly higher scores of TMD signs in the younger age group than among patients in the age group of 50-60 yrs. The results of this study is supported by **Salonen et al., (1990)** who studied the prevalence of signs and symptoms of dysfunction in the masticatory system as a part of an epidemiological survey on oral health. Nine hundred and twenty Swedish subjects were examined and the questions and clinical examination parameters were in accordance with those suggested by Helkimo in 1974. They found that reported symptoms decreased with age, whilst clinical signs increased.[91]

In the present study, clicking was more common in females (59%). Results from the present study indicate that there is a difference between edentulousness in men and in women, with women showing more tooth loss. Since greater tooth loss has been associated with greater severity signs and symptoms of TMD in the present study, it is in accordance with reports from other studies that claim that in adults, signs and symptoms of TMD occur frequently, more often in women than in men.

Clicking was seen to be more prevalent among patients with Kennedy's class III partial edentulism in this study where as in the study done by **Barghi N et al.,** he reported that there was noise in 44.3% of partially edentulous patients (Kennedy Class I and II); with greater

incidence in bilateral edentulous patients, occurring at the end of mouth opening and the beginning of mandible elevation in 55.7% of the cases. In unilateral edentulous patients, clicking is more frequent on the side of the free end. [92]

One of the reasons for the higher prevalence of click in Kennedy's class III partial edentulism in this study, might be the loss of a number of teeth might result in the tilting of the adjacent teeth towards the edentulous area resulting in premature contact giving rise to changes in the position of the condyle in the fossa and TMJ disorders.

The maximum mouth opening was an average of 42.5 mm in 66.5% of the patients, pain free mouth opening was 38.5 mm in 63% of the patients and pain upon maximum mouth opening had a significant score which indicates that there can be limited mouth opening in presence of TMD. This is in contrast to the results of the study done by **Fallahi HR et al**., where the maximum mouth opening in the TMD group was 45.2 mm, with 46.3 mm in the control group, indicating no significant differences between the two groups. On the other hand, 32% and 21% of the subjects in the TMD and control groups, respectively, had limitations in mouth opening, with no significant differences between the two groups.[49]

In the present study, mandibular deviation was present in 51.8% of the patients the result of which is consistent the study done by **Shet RKG et al.,** where it was 49.2% among 250 partially edentulous subjects.[47]

Crepitus was noticed in 3.9% of the partially edentulous patients and it was more prevalent in the older age group with increase in the period of edentulousness. In the study by **Anwar A et al.,** he evaluated 200 patients having partially edentulousness for not less than 5 years and he reported crepitus in 56.5% of patients which indicates that the presence of crepitus increases with increase in edentulous period and with age which can be related to osteoarthritic

changes that occur with age.[50] Several changes affect oral health as age increases like, periodontal tissues are affected by the altered immune response, the oral mucosa loses its epithelial thickness, several conditions affect saliva secretion, the soft tissue changes, loss of teeth affects bite force and bone structure, and adaptation decreases. It is also discernable that age constitutes the predominant factor associated with degeneration of the TMJ, even with other known age-related factors controlled for.

In the present study, joint locking was present in 2.2% of the total subjects examined with reduction in 80% of the joint locking cases. In the study by **Fallahi HR et al.,** joint locking was observed in 5% and 3% of the subjects in the test and control groups, respectively, with no significant difference between the two groups.[49]

In this study pain on palpation of temporalis muscle was present in 9.6% and masseter pain was present in 7.4% of the total subjects the result of which is comparatively low with the study done by **Shet RKG et al**., where temporalis muscle tenderness was present in 22.4% and masseter muscle tenderness was present in 41.9% of patients on palpation.[47]

According to the study done by **Anwar A et al.,** for the prevalence of temporomandibular joint dysfunction (MPDS) among partially edentulous population around Patna, he concluded that there is strong correlation between partial edentulism and MPDS or TMJ dysfunction, since with loss of tooth there is a gradual loss of supporting bone and associated structure and migration of tooth which leads to loss of proper occlusion, these all factors overload the TMJ and associated structure, which may be the reason of this MPDS.[50]

Patients with period of edentulousness greater than 2 years showed increase in signs of TMD with pain on palpation of masseter in 9.2% of patients, temporalis in 12.1%. This is similar to the result of the study done by **Shet RKG et al**., where 250 partially edentulous patients were

included in the study and he explained that the signs of TMD increased with increase in period of edentulousness.[47] It is said that with time pathologic migration of teeth/tooth take place resulting in occlusal inaccuracies, missing posterior teeth which will cause constant overloading of joint moreover, the existence of a unilateral unique molar induced asymmetric overloading in the TMJ disk without posterior contact and all this factors will affect the TMJ leading to TMJ dysfunction in long run.

Both the right and left side muscles were equally affected in this study and it was common in younger age group. TMD conditions in the pre pubertal age are mainly of muscular origin and then with age are complemented with intracapsular disorders.

In the present study, TMJ pain on palpation was present in 11.7% of patients which is more prevalent among females and the pain was common on the left side TMJ. Also the younger age group is commonly affected. In the study by **Osterberg et al.,** he reported lower frequencies of symptoms with increasing age. Symptoms had more commonly been reported by younger and middle-aged individuals than by children or elderly persons. Despite a decrease in reported TMD symptoms by older individuals, an increase in the prevalence of clinical signs with advancing age has been found. It appears that, when pain symptoms are used as the main TMD indicator, the peaking age is lower than when a combination of symptoms and signs signifies the presence of TMD.[93]

In the present study, only 3% of the patients had pain on palpation in the supplemental muscles of mastication and non masticatory muscles of head and neck. Lateral pterygoid pain on palpation was present in 3.5% of patients and medial pterygoid pain was present in 3%. The pain was more common in the left side and among females and in the younger age group. The muscle

pain correlates positively with increased edentulous periods, pathological migration of teeth and other TMD signs like clicking.

According to **Laskin DM**, MPD syndrome is believed to be a stress-related disorder. It is hypothesized that centrally induced increase in muscle tension, frequently combined with the presence of parafunctional habits such as clenching or grinding of the teeth, result in the muscle fatigue and spasm that produce the pain and dysfunction. However, similar symptoms occasionally can result from muscular overextension, muscle over contraction, or trauma. [94]

Women are affected by MPD syndrome more frequently than men, with the ratio in various reports ranging from 3:1 to 5:1. Although the condition can occur in children, the greatest incidence appears to be in the 20- to 40-year age group. Biological factors related to pain modulation by oestrogens, genetic, behavioural, social and psychological factors, such as health consciousness, anxiety and control, have been discussed as possible explanations.[95]

SUMMARY AND CONCLUSION

We started our study with an aim to evaluate the prevalence of temporomandibular joint disorders and its signs among partially edentulous with edentulous period of minimum 8 months. The patients were selected for the study from the Oral Medicine and Radiology department and 460 patients were included in the study according to the inclusion and exclusion criteria. The data collected from each patient was recorded in a self structured questionnaire. Clinical examination was done to check for the TMD signs.

The results were analyzed and it was found that clicking was the most common TMD sign and partially edentulous patients with increased edentulous period had comparatively more TMD signs. Female gender and patients in the younger age group were commonly affected.

CONCLUSION

Partial edentulism can be considered one of the important contributing factor in the etiology of TMD. It is necessary to make the patients understand the importance of replacement of teeth after extraction as it can prevent the occurrence of TMD. We conclude here by emphasizing the need for further research in the field of relationship between partial edentulism and TMD.

BIBLIOGRAPHY

1. The Academy of Prosthodontics, Glossary of Prosthodontic Terms. J Prosthet Dent. 1999;81:101.
2. Gupta S, Gupta R, Garg R. Partial edentulism and Temporomandibular joint disorders. IOSR-JDMS 2014;13(12):60-63.
3. de Leeuw R. Temporomandibular disorders. American Academy of Orofacial Pain. Orofacial pain: guidelines for assessment, diagnosis and management. 2008; 4:131.
4. McNeill C. Management of temporomandibular disorders: Concepts and contraversies. J Prosthet Dent 1997; 77:10-22.
5. Carlsson GE. Epidemiology and treatment need for temporomandibular disorder. J Orofac Pain 1999;13: 232-237.
6. Choy E, Smith DE. The prevalence of temporomandibular distrubence in complete denture patient. J Oral Rehabil 1982;7:331-352.
7. Sharma S, Gupta DS, Pal US, Jurel SK. Etiological factors of temporomandibular joint disorders. National Journal of Maxillofacial Surgery. 2011;2(2):116-119.
8. Costen JB. Syndrome of ear and sinus symptoms dependent upon functions of the temporomandibular joint. Ann Otol Rhino Laryngol. 1934;3:1–4.
9. Pullinger AG, Seligman DA, Gornbein JA. A multiple regression analysis of risk and relative odds of temporomandibular disorders as a function of common occlusal features. J Dent Res. 1993;72:968–79.
10. McNeill C. Craniomandibular disorders: Guidelines for evaluation, diagnosis and management. Chicago: Quintessence; 1990; 25–39.
11. Dorland WA: Medical Dictionary. Philadelphia and London, Saunders Co., 1957.
12. Grey, R.J.M., Davis, Quayle, A. A temporomaandibular disorders - A clinical approach to temporomandibular disorders. Classification and functional anatomy. Br Den J., 1994;176: 429-435.
13. Haley DP, Schiffman EL, Lindgren BR, Anderson Q, Andreasen K. The relationship between clinical and MRI findings in patients with unilateral temporomandibular joint pain. J Am Dent Assoc; 2001; 132: 476-481.

14. Okeson J.P., Management of temporomandibular disorders and occlusion, Mosby, St Luis, 2003.
15. Krogh-Poulsen, W. G., & Olsson, A. Management of the occlusion of the teeth. In L. Schwartz & C. Chayes (Eds.), Facial pain and mandibular dysfunction. Philadelphia: Saunders, 1968.
16. Laskin, D., Greenfield, W., Gale, E., et al., 1982. The president's conference on the examination, diagnosis and management of temporomandibular disorders. In: Laskin, D.G.W., Gale, E., Rugh, J., Neff, P., Alling, C., et al. (Eds.), American Dental Association, Chicago, 1983.
17. Okeson JP, editor. Orofacial pain: guidelines for assessment, diagnosis, and management. Chicago: Quintessence Publishing Co, lnc, 1996.
18. Al-Ani MZ, Davies SJ, Gray RJ, Sloan P, Glenny AM. Stabilisation splint therapy for temporomandibular pain dysfunction syndrome. Evid Based Dent. 2004; 5(3):65-6.
19. Schwartz L. Pain associated with the temporomandibular joint. Journal of the American Dental Association. 1955; 51,934–937.
20. De Boever JA ; Functional disturbances of the temporomandibular joint. In: Zarb GA, Carlsson GE (eds) The temporomandibular joint. Function and dysfunction. Munksgaard, Copenhagen, 1979;193-214.
21. McCarty DJ .American rheumatology--the future of our guild. Antidisestablishmentarianism. Arthritis Rheum. 1980 ; 23(9):969-76.
22. Travell JG, Simons DG: Myofascia[pain and dysfunction: the trigger point manual. Baltimore: Williams & Wiikins, 1983.
23. Könönen M, Nyström M, Kleemola-Kujala E, Kataja M, Evälahti M, Laine P, Peck L. Signs and symptoms of craniomandibular disorders in a series of Finnish children. Acta Odontol Scand 1987;45:109-114.
24. Pullinger AG, Monteriro AA. History factors associated with symptoms of temporomandibular disorders. J Oral Rehabil 1988;15:117.
25. Parker MW. A dynamic model of etiology in temporomandibular disorders. J Am Dent Assoc 1990;120:283-90.
26. Wilson L, Dworkin SF, LeResche L, Whitney CW & Dicker BG. Somatization and diffuseness of clinical pain symptoms. J Behav Med 1991;12: 17-18.

27. Rugh JD . Psychological factors in TMD. In: McNeill C (ed) Current controversies in temporomandibular disorders. Chicago: Quintessence Publishing, 1992; 62-65.
28. Carlsson GE, LeResche. Epidemiology of temporomandibular disorders. In: Sessle BJ, Bryant PS, Dionne RA (eds) Temporomandibular disorders and related pain conditions. Progress in pain research and management.1995; 4 : 221-226.
29. Stohler C. Disk-interference disorders. In: Zarb G, Carlsson G, Sessle B, Mohl N, editors. Temporomandibular joint and masticatory muscle disorders. Copenhagen: Munksgaard, 1992; 271-276.
30. McGregor NR, Butt HL, Zerbes M, Klineberg IJ, Dunstan RH & Roberts TK. Assessment of pain (distribution and onset), symptoms, SCL-90-R Inventory responses, and the association with infectious events in patients with chronic orofacial pain. J Orofac Pain 1996,10: 339-350.
31. Hedge, V. A review of the disorders of the temporomandibular joint. J Indian Prosthodont Soc 2005; 5(2):55-61.
32. Herken H, Erdal E, Mutlu N, Barlas O, Cataloluk O, Oz F, Güray E. Possible association of temporomandibular joint pain and dysfunction with a polymorphism in the serotonin transporter gene. Am J Orthod Dentofacial Orthop 2001; 120(3):308-13.
33. Olivo SA, Bravo J, Magee DJ, Thie NM, Major PW, Flores-Mir C .The association between head and cervical posture and temporomandibular disorders: a systematic review. J Orofac Pain 2006. 20(1):9-23.
34. Chisnoiu AM, Picos AM, Popa S, Chisnoiu PD, Lascu L. Factors involved in the etiology of temporomandibular disorders - a literature review. CJMED 2015 ; 88(4):473-8.
35. Posselt U. Studies in the mobility of the human mandible. Acta Odontol Scand 1952; 10(suppl):19.
36. Agerberg G, Carlsson GE. Functional disorders of the masticatory system. I. Distribution of symptoms according to age and sex as judged from investigation by questionnaire. Acta Odontol Scand 1972 ;30 597-613.
37. Hannam AG, de coe RE, Scott JD. The relationship between dental occlusion, muscle activity and associated jaw movements in man. Arch oral boil 1977; 22:25.

38. Hylander WL. Functional anatomy. In: Sarnat BG, Laskin DM, eds. The temporomandibular joint: a biological basis for clinical practice. 3rd edn. Philadelphia: Saunders; 1979.
39. Kayser A. Shortened dental arches and oral function. J Oral Rehabil., 1981; 8:457-462.
40. Mohl, N.D., Zarb, G.A., Carlsson, G.E., Rugh, J.D. (Eds.) 1988. A Textbook of Occlusion, Chicago, Quintessence Publishing Company 1988.
41. Seligman DA, Pullinger AG. The role of functional occlusal relationships in temporomandibular disorders: a review. I Craniomandib Disord Facial Oral Pain 1991;5:265-79.
42. Drummond JR, Newton JP, Yemm R. Color atlas and text of dental care of the elderly. London: Mosby-Wolfe; 1995.
43. Ciancaglini R, Gherlone EF, Radaelli G. Association between loss of occlusal support and symptoms of functional disturbances of the masticatory system. J Oral Rehabil 1999;26:248-253.
44. Seedorf H, Seetzen F, Scholz A, Sadat- Khonsari MR, Kirsch I, Jude HD. Impact of posterior occlusal support on the condylar position. J Oral Rehabil. 2004; **31**(8): 759-63.
45. Garcia, A. R., Gallo, A. K., Zuim, P. R., Dos Santos, D. M.,Antenucci, R. M. Evaluation of temporomandibular joint noise in partially edentulous patients. Acta Odontol Latino Am., 2008 ;21:21-7.
46. Krzemien J, Baron S. Axiographic and clinical assessment of temporomandibular joint function in patients with partial edentulism. Acta Biomech. 2013; **15**(1): 19-26.
47. Shet R.G.K., Rao, S., Patel, R., Suvvati, P., Sadar, L.R.,Yadav, R.D. Prevalence of temporomandibular joint dysfunction and its signs among the partially edentulous patients in a village of North Gujarat. J Contemp Dent Pract.,2013; 14:1151–55
48. Hama AM, Mahmood DK. Evaluation Of Temporomandibular Joint Disorders In Partially Edentulous Patients. IJDR 2016; 6(7) : 31-33.
49. Fallahi HR, Alikazemi M, Javidi P, Kazemi P. Evaluation of the relationship between partial edentulism and TMJ disorders. Biosci.,Biotech. Res.Asia 2016; 13(3) : 1725-29.
50. Anwar A, Syreen S, Kumar B. Rate of prevalence of temporomandibular joint dysfunction among partially edentulous population around Patna: A Population based study. AIMDR 2017; 3(4): 16-18.

51. Greene, C. S., Lerman, M. D., Sutcher, H. D., & Laskin,D. M. The TMJ pain-dysfunction syndrome: Heterogeneity of the patient population. Journal of the American Dental Association 1969 ; 79 :1168- 1172.
52. Feine JS, Lund JP. An assessment of the efficacy of physical therapy and physical modalities for the control of chronic musculoskeletal pain. Pain 1997;71: 5-23.
53. LeResche L. Epidemiology of temporomandibular disorders: Implications for the investigation of etiologic factors. Crit Rev Oral Biol Med 1997;8:291- 305.
54. Tsukert, A., Rafaeli, B. Muscle Pain Index in relation to pain dysfunction and dizzyness associated with the myofascial pain dysfunction syndrome. New York State Dental Journal 1978 ;46: 742–747.
55. Magnusson T, Enbom L. Signs and symptoms of mandibular dysfunction after introduction of experimental balancing-side interferences. Acta Odontol Scand 1984;42: 129-135.
56. McNamara/A Jr, Seligman DA, Okeson JP. Occlusion, orthodontic treatment, and temporomandibular disorders: a review. J Orofacial Pain 1995;9:73-90.
57. Aaron LA, Burke MM, Buchwald D. Overlapping conditions among patients with chronic fatigue syndrome, fibromyalgia and temporomandibular disorders. Arch Intern Med 2000;160:221-7.
58. Michalowicz BS, Pihlstrom BL, Hodges JS, Bouchard TJ Jr. No heritability of temporomandibular joint signs and symptoms. J Dent Res. 2000;79:1573-1578.
59. Hiltunen, K., Peltola, J.S., Vehkalahti, M.M., Narhi, T., Ainamo, A.A. 5-Year Follow-up of Signs and Symptoms of TMD and Radiographic Findings in the Elderly. Int J Prosthodont 2003; 16: 631-34.
60. Whyte Ferguson, L., Gerwin, R. Clinical Mastery in the Treatment of Myofascial Pain. Masticatory Myofascial Pain. Lippincott Williams & Wilkins, Philadelphia 2004;32–54.
61. Helkimo M., Studies of function and dysfunction of the masticatory system. II. Index for anamnestic and clinical dysfunction and occlusal state, Swed. Dent. J., 1974, 67,101–108.
62. American Academy of Orofacial Pain. Diagnostic classification of temporomandibular disorders. In: Okeson JP (ed) Orofacial Pain: guidelines for assessment, diagnosis, and management. Chicago: Quintessence Pub. Co. Inc.; 1996. pp. 127–41.

63. Wenneberg B, Kopp S. Short term effect of intra-articular injection of corticosteroid on temporomandibular pain and dysfunction. Swed Dent J 1978;2:189-96.
64. Danzig W, Van Dyke AR. Physical therapy as an adjunct to temporomandibular joint therapy. J Prosthet Dent 1983;49:96-9.
65. Clark GT. A critical evaluation of orthopedic interocclusal appliance therapy: design, theory, and overall effectiveness. I Am Dent Assoc 1984;108:359.
66. Jaffe JH, Martin JR. Analgesics and antagonists. In: Goodman A, Gilman L, editors. The pharmacological basis of therapeutics 1985; 7:491-532.
67. Okeson JP, Hayes DK. Long-term results of treatment for temporomandibular disorders: an evaluation by patients. J Am Dent Assoc 1986;112:473-8.
68. Tura B, Tura SM. The analgesic effect of tricyclic antidepressants. Brain Res 1990;518:19-22.
69. Nitzan DW, Dolwick, MF, Heft MW. Arthroscopic lavage and lysis of the temporomandibular joint: a change in perspective. J Oral Maxillofac Surg 1990;48:798-801.
70. Clark GT, Seligman DA, Solberg WK, Pullinger AG. Guidelines for the examination and diagnosis of temporomandibular disorders. J Craniomandib Disord Facial Oral Pain 1989;3:7-14.
71. de Leeuw R, Boering G, Stegenga B, de Bont LG. Clinical signs of TMJ osteoarthrosis and internal derangement 30 years after nonsurgical treatment. J Orofacial Pain 1994;8:18-24.
72. Kuttila M, Niemi PM, Kuttila S, Alanen P, LeBell Y TMD treatment need in relation to age, gender, stress, and diagnostic subgroups. J Orofacial Pain 1998, 12: 67-74.
73. Moore AP, Wood GD. Medical treatment of recurrent temporomandibular joint dislocation using botulinum toxin A. Br Dent J. 1997;183:415–417. doi: 10.1038/sj.bdj.4809523.
74. Simons, D.G., Travell, J.G., Simons, L.S., et al., Travell and Simons' Myofascial Pain and Dysfunction: the Trigger Point Manual. Lippincott Williams and Wilkins, Baltimore, 1998;1: 5–44, 103–164.

75. Yoda, T., Sakamoto, I., Imai, H. A randomized controlled trial of therapeutic exercise for clicking due to disk anterior displacement with reduction in the temporomandibular joint. Journal of Craniomandibular Practice 2003; 21 (1): 10–16.
76. Westesson P. Post Operative TMJ. 2004.
77. Kalamir A, MChiro, Pollard H, GradDC. Manual therapy for temporomandibular disorders: A review of the literature. Journal of Bodywork and Movement Therapies 2007; 11 :84–90.
78. Huang GJ, Leresche L, Critchlow CW, Martin MD, Drangsholt MT. Risk factors for diagnostic subgroups of painful temporomandibular disorders (TMD). J Dent Res. 2002;81(4):284-8.
79. Santos ECA, Bertoz FA, Pignatta LMB, Arantes FM. Avaliação clínica de sinais e sintomas da disfunção temporomandibular em crianças. Rev Dental Press Ortod Ortop Facial. 2006;11(2):29-34.
80. Jeyapalan V, Krishnan CS. Partial Edentulism and its Correlation to Age, Gender, Socio-economic Status and Incidence of Various Kennedy's Classes– A Literature Review. Journal of Clinical and Diagnostic Research : JCDR. 2015;9(6):14-17.
81. BORDIN, Thaisa B et al. Prevalence Of Signs And Symptoms Of Temporomandibular Disorders (TDM) In Patients Wearing Bimaxillary Complete Dentures, Removable Partial Dentures And In Students With Natural Dentition. Acta Odontol. Latinoa. 2013; 26: 173-180 .
82. Selaimen C, Jeronymo JC, Brilhante DP, Lima EM, Grossi PK, Grossi ML. Occlusal risk factors for temporomandibular disorders The Angle Orthod. 2007;77(3):471-7.
83. Sapkota B, Adhikari B, Upadhaya C, et al. A Study of Assessment of Partial edentulous patients based on Kennedy's classification at Dhulikhel Hospital Kathmandu University Hospital. Kathmandu Univ Med J. 2013;44(4) 325-27.
84. Curtis DA, Curtis TA, Wagnild GW, Finzen FC. Incidence of various Classes of removable partial dentures. J Prosthet Dent. 1992;67:664-67.
85. Prabhu N, Kumar S, D'souza M, Hegde V. Partial Edentulousness in a rural population based on Kennedy's classification: An Epidemiological study. J Indian Prosthodont Soc. 2009;9(1):18-23

86. Vadavadagi SV, Srinivasa H, Goutham GB, Hajira N, Lahari M, Reddy GTP. Partial edentulism and its association with sociodemographic variables among subjects attending dental teaching institutions, India. J Int Oral Health 2015; 7(Suppl 2):60-63.
87. Khan SU, Rehman B, Khan M. Evaluation of partial edentulism based on Kennedys classification and its relation with age, gender and arches. JKCD. 2016;7(1).
88. Zaigham AM, Muneer MU. Pattern of partial edentulism and its association with age and gender. Pakistan Oral and Dental Journal. 2010;30(1):260-63.
89. Bonjardim L.R., Gavião M.B.D., Pereira L.J., Castelo P.M., Garcia R.C.M.R. Signs and symptoms of temporomandibular disorders in adolescents. Braz. Oral Res. 2005;19(2):93–98.
90. Al-Khotani A, Naimi-Akbar A, Albadawi E, Ernberg M, Hedenberg-Magnusson B, Christidis N. Prevalence of diagnosed temporomandibular disorders among Saudi Arabian children and adolescents. The Journal of Headache and Pain. 2016;17:41.
91. Salonen, L.; Helldén, L. & Carlsson, G. E. Prevalence of signs and symptoms of dysfunction in the masticatory system: an epidemiologic study in an adult Swedish population. J. Craniomandib. Disord., 1990; 4(4):241-50.
92. Barghi N, Aquilar T, Martinez C, Woodall WS, Maaskant BA. Prevalence of types of temporomandibular joint clicking in subjects with missing posterior teeth. J Prosthet Dent 1987; 57:617-620.
93. Österberg T, Carlsson GE, Wedel A, Johansson U. A crosssectional and longitudinal study of craniomandibular dysfunction in an elderly population. J Craniomandib Disord 1992;6:237-246.
94. Laskin DM: Etiology of the pain-dysfunction syndrome. J Am Dent Assoc 1969; 79:147.
95. G. Carlsson, T. Magnusson, and A. Wedel, “Survey of patients seen at a department of Stomatognathic Physiology,” Swedish Dental Journal 1976; 69: 115.

ANNEXURE I

QUESTIONNAIRE

Patient name :

Age :

Sex : Male / Female

Occupation and Income :

Medical history :

Period of edentulousness : a) 8 months- 1 year b) 1-2 years c) more than 2 years

Difficulty / pain while chewing : a) present b) absent

18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38

Type of Kennedy's classification

Maxillary arch :

Mandibular arch :

Pathological migration :

Supra eruption of teeth :

Location of self reported pain

a)None b) TMJ right/left c) Temporalis d) Masseter e)Medial pterygoid

f) Lateral pterygoid g) supplemental muscles of mastication h) non-masticatory muscles

Mouth opening pattern a) straight b) corrected deviation c) uncorrected deviation

Mouth opening movements

Pain free mouth opening …… mm

Maximum mouth opening ……...mm Pain a) present b) absent

TMJ noise during movements

Click open/ close right/ left

Crepitus open /close right / left

Joint locking yes / no with reduction / without reduction

Pain with palpation

a) TMJ right / left
b) Temporalis right / left
c) Masseter right / left
d) Medial pterygoid right / left
e) Lateral pterygoid right / left
f) Supplemental muscles right / left
g) Non masticatory muscles right / left

ANNEXURE II

INFORMED CONSENT FORM

Prevalence of Temporomandibular joint disorders among partially edentulous patients

Name: age/sex: OP no: date:

Address:

I, …….. aged …….. have been informed about my role in the study.

1. I agree to give my personal details like name, age, sex, address, previous dental, medical history and other details required for the study to the best of my knowledge.
2. I will co-operate with the dentist for my intra and extra oral examination.
3. I will follow the instructions given to me by the dentist during the study.
4. I permit the dentist to take intra and extra oral photographs as required for the study.

In my full consciousness and presence of mind, after understanding all the procedures in my own language, I am willing and give my consent to participate in the study.

Name of the patient: Name of the investigator:

Signature/ thumb impression Signature

ANNEXURE III

ஒப்புகை வாக்குமூலம்

..... ஆகிய நான் மேற்கூறிய ஆராய்ச்சி படிப்பின் வழிமுறைகளைத் தெளிவாகப் புரிந்து கொண்டேன். மேலும் நான் இந்த ஆராய்ச்சிப் படிப்புக்கான வழிமுறைகளை மேற்கொள்வதற்கும், அதன் பரிசோதனை முடிவுகளை தெரிந்து கொள்ளவும் முழுமையாக அனுமதிக்கிறேன்.

.....

நோயாளியின் கையொப்பம் தேதி.....

நான் மேற்கூறிய ஆராய்ச்சிப் படிப்பிற்கான விதிமுறைகள் மற்றும் அது குறித்த நோயாளியின் சந்தேகங்களையும் தெளிவாக விளக்கியுள்ளேன்.

.....

மருத்துவரின் கையொப்பம் தேதி.....

ANNEXURE IV

INSTITUTIONAL ETHICAL COMMITTEE

KSR INSTITUTE OF DENTAL SCIENCE & RESEARCH

KSR Kalvi Nagar, Tiruchengode-637 215, Tamilnadu.
Phone : 04288-274981, Fax : 04288-274761,
email : ksrdentalcollege@yahoo.com

Chairman
Dr. P. PONMURUGAN, Ph.D.,
Prof. & Head Dept. of Biotechnology
KSR College of Technology,
KSR Kalvi Nagar, Tiruchengode.

Member Secretary
Dr. G.S. KUMAR, MDS.,
Principal,
KSR Institute of Dental Science & Research,
KSR Kalvi Nagar, Tiruchengode.

Members

Dr.G.Ayyappadasan,Ph.D.,
Biotechnologist

Mr.A.Thirumoorthi,M.A.B.L.,
Human Activist

Dr.R.Renuka,M.D.S.,(Perio),M.Sc.,
Family Counsellor

Dr.K.Sivakumar,MDS.,(Cons.Dent.)

Dr.Suman, M.D.S.,(OMDR)

Dr.Sharath Ashokan,MDS.,(Pedo)

Dr.G.Rajeswari,Ph.D.,(Biochemistry)

Dr.K.Karthick,MDS.,(Cons.Dent.)

Mr.V.Mohan,M.Sc.,M.Phil.,(Physicist)

Mr.A.P.S.Raja,B.A.,
(Layperson)

Ref.: 109 /KSRIDSR/EC/2015 **Date : 21.12.2015**

To

Dr.L.Sowmiya ,
Postgraduate Student,
Dept. of Oral Medicine & Radiology,
KSR Institute of Dental Science & Research,

*****

Your dissertational study titled "PREVALANCE OF TMJ DISORDERS AMONG PARTIALLY EDENTULOUS PATIENTS" presented before the ethical committee on 16th Dec. 2015 has been discussed by the committee members and has been approved.

You are requested to adhere to the ICMR guidelines on Biomedical Research and follow good clinical practice. You are requested to inform the progress of work from time to time and submit a final report on the completion of study.

Signature of Member Secretary
(Dr.G.S.Kumar)
PRINCIPAL,
K.S.R. INSTITUTE OF DENTAL,
SCIENCE & RESEARCH,
K.S.R. KALVI NAGAR,
THOKKAVADI POST,
TIRUCHENGODE - 637 215.

CERTIFICATE - II

This is to certify that this dissertation work titled **PREVALENCE OF TEMPOROMANDIBULARJOINT DISORDERS AMONG PARTIALLY EDENTULOUS PATIENTS** of the candidate **Dr. L.SOWMIYA** with registration Number **241527402** for the award of **MASTER OF DENTAL SURGERY** in the branch of **ORAL MEDICINE AND RADIOLOGY.** I personally verified the urkund.com website for the purpose of plagiarism Check. I found that the uploaded thesis file contains from introduction to conclusion pages and result shows 3 percentage of plagiarism in the dissertation.

Guide & Supervisor sign with Seal.