TEMPOROMANDIBULAR JOINT DISORDERS AMONG PATIENTS TREATED IN THE DEPARTMENT OF ORAL AND MAXILLOFACIAL SURGERY AT MUHIMBILI NATIONAL HOSPITAL

By

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CERTIFICATION

The undersigned certify that they have read this dissertation and hereby recommend for acceptance by the Muhimbili University of Health and Allied Sciences a dissertation titled ***Temporomandibular joint disorders among patients treated in the department of Oral and Maxillofacial Surgery at Muhimbili National Hospital,*** in (partial) fulfillment of the requirements for the degree of Master of Dentistry (Oral Surgery) of Muhimbili University of Health and Allied Sciences.

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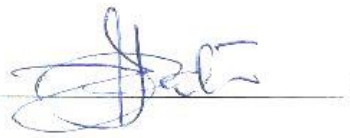
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Dedication

I would like to dedicate this study to my family who have been with me and by my side in every step of my struggle and who always believe in me and supported me in every moment to complete this work. Without your assistance I would not have come this far. I hope you always know how important you are to me.

Abbreviations

CBT	Cognitive behavioral therapy
CCG	Costochondral graft
COX2	Cyclooxygenase-2
EDS	Ehler-Danlos syndrome
EMG	Electromyogram
FBN1	Fibrillin-1
HFM	Hemifacial microsomia
IM F	Intermaxillary fixation
IV	Intravenous
MHz	Megahertz
mm	Millimeter
MNH	Muhimbili National Hospital
MIO	Maximum interincisal opening
MO	Mouth opening
MPDs	Myofascial pain dysfunction syndrome
MUHAS	Muhimbili University of Health and Allied Sciences
NSAIDs	Nonsteroid anti-inflammatory drugs
PTIPI	Proplast-Teflon Interpositional Implant
TENS	Transcutaneous electrical nerve stimulation
TMD	Temporomandibular dysfunction
TMJ	Temporomandibular joint
TMJD	Temporomandibular joint disorder

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Abstract

Background

Temporomandibular joint disorders (TMJD) are the most common debilitating conditions of the stomatognathic system. Although they exist in the community they are not mentioned in the literature as an endemic health problem. Their prevalence does not seem to be clear enough for the health system in Tanzania to give them priority as other health problems.

Study setting: The study was done in the department of Oral and Maxillofacial Surgery at Muhimbili National Hospital (MNH).

Objective: To determine the occurrence of temporomandibular joint disorders (TMJD) among patients treated in the department of Oral and Maxillofacial Surgery at MNH.

Study Design: A descriptive prospective cross sectional hospital based study.

Study population: In and out patients with TMJ disorders attending treatment in the department of Oral Surgery.

Study duration: The study was conducted over a period of six months from September 2009 to February 2010.

Methods and materials: All out patients who attended at the Oral Surgery department and those admitted in wards 23 and 24 with TMJDs and had consented were included in the study. The patients were interviewed using a structured questionnaire. Physical examination was done and findings were recorded on a special clinical form. The study was conducted over a period of six months from September 2009 to February 2010.

Results:

Among 4661patients who attended at the Oral Surgery department during the study period, 61 (1.3%) patients suffered from TMJDs. The age of patients ranged from 4 to 80 years, with a mean age of 35 +/-18.5 years and a male: female ratio of 1:2.

TMJ-ankylosis was the most prevalent disorder comprising 36.1% of the total TMJD patients. In this disorder the 11-20 years age group was the most (31.8%) affected. It was noted that the prevalence declined with increase in age whereby 6 (27.3%) were in the 21-30 years age group. TMJ ankylosis showed a gender predilection whereby females were the most affected accounting for 13 (59.1%) compared to 9 (40.9%) males with a female to male ratio of 2:1. Associated factors were trauma due to fall in 11 (50%) of the patients and infections to the joint in 8 (36.4%) patients. Major clinical features were limited opening of the mouth in 100% of the patients. About 14 (63.6%) of the patients presented with poor oral hygiene. Facial disfigurement was observed in 20 (90.9%) of the patients. X-ray revealed obliteration of the joint space in all the patients. Surgical treatment was provided to 18 (81.8%) and recurrence was found in 6 (33.3%) of the patients.

Myofascial pain dysfunction syndrome (MPDs) was the second most (32.8%) prevalent TMJD. Forty percent of the patients were in the 21-30 years age group and 5 (25%) patients in the 31-40 years age group. The prevalence of signs and symptoms was lower in age groups below 20 years and above 40 years. Masticatory muscle tenderness was the major clinical feature in all patients, while clicking sound on mouth opening and closing was present in 15 (75%) of the patients. Radiographs of the joints of all the patients were normal. Medications (NSAIDs and antidepressants) were provided to all patients however, 2 (10%) of patients who were partially

edentulous, missing posterior teeth were provided with prosthesis in addition to medications. Eighty percent of the patients improved while signs and symptoms persisted in 2 (10%) patients and the remaining 2 (10%) could not avail themselves for follow up.

TMJ dislocation was observed in 19 (31.1%) patients. Females were 11 (57.9%) while males were 8 (42.1%) with male to female ratio of 1.4:1. The most affected age groups were those in 21-30 years age group who comprised of 7 (36.8%) patients followed by the 31-40 years age group with 4 (21.1%) patients. Yawning was the commonest associated factor in 10 (52.6%) of the patients. All patients had the condyles displaced anterior to the articular eminence. Chronic recurrent dislocation was observed in 12 (63.2%) of the patients, acute TMJ dislocation in 5 (26.3%) patients and chronic TMJ dislocation in 2 (10.5%) of the patients. The mean duration of the dislocation before seeking treatment ranged between 2 days to 9 months. Clinically all patients had open mouth while 13 (68.4%) had pain in the joint region and 7 (36.8%) had difficulty in speaking. Radiographic examination revealed displacement of the condyles anterior to the articular eminence in 100% patients. Closed reduction was done in 17 (89.5%) of the patients, open reduction was provided to 2 (10.5%) of the patients and there was no recurrence reported.

Conclusion:

The temporomandibular joint disorders that were seen in this study occurred at a rather low prevalence of about 1.3%. TMJ ankylosis, MPD and TMJ dislocation were the only TMJDs found. TMJ ankylosis which was the commonest TMJD was mainly a result of trauma and infection. The treatment rendered to these patients was surgery (condylectomy alone or condylectomy and coronoidectomy) with a very low recurrence rate. MPD was mainly associated

with bruxism, trauma and loss of posterior teeth contact. Patients presented with complaints of pain and tenderness around the region of the masticatory apparatus which was occasionally referred to the head and neck region. The treatment was mainly medication. Anterior dislocation was the only type found in the patients with TMJ dislocation. The commonest cause of TMJ dislocation was excessive mouth opening. Closed manual reduction was the main treatment modality provided in majority of the cases. However, long standing dislocations required surgical manipulation under general anesthesia.

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1. INTRODUCTION AND LITERATURE REVIEW

1.1 Background

The temporomandibular system consists of two fundamental components: the temporomandibular joint and the associated neuromuscular system. Pathologies of the temporomandibular joint (TMJ) and associated muscles of mastication are jointly termed as temporomandibular disorders (TMDs). Temporomandibular joint (TMJ) is a ball and socket hinge synovial joint which connects the lower jaw (mandible) to the temple bone (temporal) on the sides of the skull, located anterior to the tragus of both ears. The left and right joints both allow the jaw to move up and down as well as side to side during chewing, yawning, and speaking. This is unique in the human body, as no other structure uses two joints to move one bone. TMJ is an important joint in the body because of its profound influence on other aspects of the body, and it is the most used joint in the human body [1-5]. Each temporomandibular joint has a rounded ball like end of the lower jaw (condyle) which can move within a space on the temporal bone called a fossa. Separating these two bones is a pad of fibrous cartilage called articular disc. Each articular disc acts as a cushion and is attached to the condyle moving with it to prevent the bones from rubbing together during function. This is a fibro-cartilage composed of dense fibrous connective tissue devoid of blood vessels or nerve fibers. In the sagittal plane it can be divided into three zones namely the central area or intermediate zone, which is the thinnest, and anterior and posterior zones both of which are considerably thicker than the intermediate or central zone [6,7]. Stabilizing the joint are ligaments which are composed of collagen fibers and act predominantly as restraints to motion of the condyle and the disc. There are three functional ligaments that support the joint; these are: the collateral ligaments, capsular ligaments,

temporomandibular ligaments, and two accessory ligaments; the sphenomandibular and stylomandibular. The energy that moves the joint is provided by muscles of mastication which form parts of TMJ; these include the paired masseter, medial and lateral pterygoids, and temporalis muscles. Contraction of these muscles closes the mouth. Translation of the condylar head onto the articular eminence during mouth opening is produced by contraction of the lateral pterygoid, assisted by the suprahyoid muscles[8,9]. Temporomandibular joint is among the most frequently used human joints. Like any other joint, it is predisposed to wear and tear as well as local and systemic disease conditions which may consequently lead to a dysfunction commonly termed as TMJ disorders[9]. Laskin et al. urged a change in nomenclature that would clearly separate the muscular disorders from intracapsular TMJ pathology. They suggested the use of the term myofascial pain dysfunction syndrome (MPD) for muscular conditions. As the result of the contributions from Schwartz et al. and Laskin et al. there was a gradual acceptance by some clinicians that patients experiencing pain and dysfunction could have a joint problem, a muscle problem or both [9,10]. From these views TMJDs were categorized as either acquired or congenital in origin.

1.2 Acquired temporomandibular joint disorders

Most of temporomandibular joint disorders are acquired and occur during life time of a patient. These affect a large number of people compared to congenital disorders [11,12]. Trauma, infections, neoplasia, emotional stresses and occlusal disharmony are the most common causes of acquired temporomandibular joint disorders [13-15]. As described by Pow et al. (2001) acquired TMJD is grouped into nonarticular and articular categories. Nonarticular disorders include muscle disorders such as myofascial dysfunction, muscle spasm, myositis and psychogenic. These

include conditions such as acute muscle strain and spasm, myofascial pain and dysfunction (MPD), chronic conditions such as fibromyalgia, and less commonly, myotonic dystrophies and myositis ossificans[10,11]. Articular disorders, often accompanied by internal derangement, include noninflammatory and inflammatory arthropathies, growth disorders, and connective tissue disorders[8].

Noninflammatory articular disorders include chondromalacia (softening of the cartilage), temporary or permanent disc displacement, degenerative changes within bone and cartilage often with bone formation and remodeling, fibrosis, crystal deposition disorders (gout) and avascular necrosis[16].

Inflammatory arthropathies are primarily due to such conditions as rheumatoid arthritis, juvenile rheumatoid arthritis, ankylosing spondylitis, psoriatic arthritis[16].

Acquired TMJDs have been associated with different causes which include trauma, infections, neoplasms, emotional stress and occlusal disharmony[14-17].

1.2.1 Trauma

Trauma to the mandible in most cases may cause internal derangement of the disc whereby the disc moves in and out of its correct location making a clicking or popping noise as it moves. In few cases, the disc is permanently out of position. The patient's range of motion in the jaw will be limited and without intervention may progress into TMJ ankylosis[16,17].

1.2.2 Infections

An infection of the temporomandibular joint as part of generalized systemic infections is rare, although localization of a systemic pathogenic organism in the mandibular joint may occur[16]. Infection may reach the joint from a penetrating wound or from adjacent structures such as the external ear canal, fractured ramus and condyle of the mandible. Others include: infection from retromolar area, parotid gland, pterygoid fossa and odontogenic infections[15,18].

1.2.3 Neoplasms

Benign and malignant tumors of the tissues that comprise the mandibular joint are uncommon but may arise within the bone of the mandibular condyle, articular fossa, from the joint capsule or the articular disc [1-5]. Thoma et al. (1979) reported that benign and malignant tumors of the temporomandibular joint have presented signs and symptoms referable to those of the temporomandibular joint syndromes[1].

Benign tumors may cause enlargement or complete distortion of the joint structures, clicking, jaw deformities and malocclusion[1,2,7]. Malignancies of the TMJ are usually the result of direct extensions or metastasis of primary lesions from adjacent structures particularly the parotid gland[1]. Primary malignancies of the TMJ have been reported as intrinsic tumors of the condyle, disc, synovium and cartilaginous lining. These include chondrosarcoma, synovial sarcoma and fibrosarcoma of the mandibular joint capsule[1,7]. The most common lesions to metastasize to the condyle are adenocarcinomas of the breast, kidney and lungs[7].

1.2.4 Emotional stress

The concept of psychophysiology of stress in the etiology of myofascial pain syndrome relies on the fact that emotional tension or stress influences the amount of muscle activities. In establishing causal relationship some studies have revealed that an individual exposed to various stresses commonly demonstrates increased muscle hyperactivities[17,18]. Manifestation of these in muscles of mastication lead to parafunctions of the jaws culminating in form of bruxism and jaw clenching. These tend to put excessive tension to the joint than it can withstand causing fatigue and pain in the TMJ and in muscles of mastication leading to TMJ disorders[18].

1.2.5 Occlusion

The literature reports that individuals with position of the mandible in which maximum intercuspation of opposing teeth occurs, have been associated with less TMJ disorders when compared to individuals with lost relationships [17]. There is general agreement that occlusal forces at the intercuspal position are best directed toward the long axis of teeth and are absorbed evenly by the cranium. Poor development of the jaws, reduced number of contacting teeth in the intercuspal position, loss of posterior teeth, deep over-bite, improper dental restoration, and poor fitting dentures have been reported to unevenly distribute occlusal forces to stomatognathic system and to the cranium exposing an individual to the development of TMJD[12].

1.3 Congenital conditions associated with TMJ disorders

Congenital disorders are the least frequent causes of temporomandibular joint disorders. These conditions occur during intrauterine fetal life or as developmental anomalies of the

stomatognathic system and cranium[12]. Some of these congenital anomalies predispose an individual to TMJ disorders, such as joint hypomobility and recurrent chronic dislocation[1,7].

1.3.1 Hemi facial microsomia (HFM)

The condition is characterized by aplasia or hypoplasia of the mandibular ramus and or the condyle[1]. Kazanjian in his study on this condition reported microsomia in over 70% of patients with agenesis of the ramus[13]. Asymmetric mandibular growth is the earliest skeletal manifestation of HFM and plays an important role in progressive deformity of the ipsilateral and contralateral facial skeleton. However, it is reported to be associated with TMJ hypomobility, jaw deviation and articular disc displacement with reduction[19].

1.3.2 Unilateral condylar hyperplasia

Congenital hemifacial hyperplasia is a rare unilateral enlargement of the craniofacial soft and/or bony tissues. Most conditions of hyperplasia have unknown causes. Theories for the pathogenesis include vascular abnormalities altered neurotrophic influence, endocrine abnormalities and hyperplasia of neural crest cells[19]. Enlargement of the condyle is accompanied by mandibular elongation which characteristically produces asymmetry, deviation of the jaw toward the unaffected side; patient complains of difficulty in chewing and inability to occlude the teeth on the affected side and limited interincisal opening width[1,19].

1.3.3 Ehlers –Danlos syndrome (EDS)

EDS comprise a clinically and genetically heterogeneous group of disorders that result from some defect in synthesis or structure of fibrillar collagen[1,2]. It is an inherited connective tissue

disorder, manifesting by hyperelasticity of the skin, blood vessels and hypermobility of the joints predisposing the patient to recurrent chronic dislocation of the TMJ[2,7].

1.3.4 Marfan's syndrome

Marfan syndrome results from an inherited defect in an extracellular glycoprotein called fibrillin-1 which is the major component of microfibrils found in extracellular matrix. These fibrils form a scaffold on which tropoplastin is deposited to form elastic fibers which provide support to various tissues in the body. It is believed that mutation occurs in the FBN1 gene, on chromosome 15q21.1 as the cause of this disease[1,7]. This consists of arachnodactyly, disproportionate skeletal growth and other skeletal anomalies. Among the skeletal disorders is weakness of the joint capsules with hyperextensibility of the joint and chronic recurrent dislocations.

1.3.5 Other diseases

The effects of various systemic disorders upon the tissues comprising the mandibular joint have been reported in different studies[1,2,7]. Conditions like renal rickets (secondary hyperparathyroidism) may result in impairment of growth of the mandible and the condyle by calcification of the joint following calcium deposition within the joint region and the mandible. Gouty involvement of the mandibular joint is accompanied by limited joint movements and usually the patient complains of pain during mandibular function [2,7].

1.4 Literature review

Worldwide TMJ disorders have been intensively studied and literatures show that the disorders are more prevalent in females of middle age and postmenopausal group [20,21]. In America most of TMJ disorders are acquired and are caused by trauma, whereby fall and motor accident being the

leading causes associated with intracapsular joint injury[7]. Between 65% and 85% of people in the United States experience some symptoms of TMJD during their lives, and approximately 12% experience prolonged pain or disability that results in chronic symptoms. Although the prevalence of one or more signs of mandibular pain and dysfunction is high in the population, only about 5% to 7% have symptoms severe enough to need treatment [20,21]. Signs and symptoms of masticatory-muscle and joint dysfunction have also been observed in children [22-24]. In Sweden, prevalence of TMJD signs and symptoms are reported to be 12% with no difference between men and women, whereby muscle related disorders accounted for 8% and disc related 10% [25].

In Singapore, about 31.4% of patients with TMJ disorders have muscle related disorders and 15.1% have disc displacement disorders [26]. Studies indicate that TMJD are most prevalent in the 20 to 40 years age group and women are predominantly affected [25,26]. The reason why women make up the majority of patients presenting for treatment is still unclear. In a community- based study, a greater likelihood of developing TMJD was found if oral contraceptives were used and in women over 40 years of age [27,28]. In Sao Paul Brazil, 2.7% of patients who were attended at the oral and maxillofacial department had temporomandibular joint disorders. The most prevalent conditions were myofascial pain dysfunction (MPD) 70.9% and dislocation (luxation) 22.5%. No cases for temporomandibular joint ankylosis were reported and women of the child bearing age were affected most [29]. Up to 7% of the subjects were diagnosed with temporomandibular joint disorders with both genders exhibiting similar distributions of temporomandibular joint disorders. Among the TMJ disorders myofascial pain dysfunction syndrome has significantly higher frequency in girls than in boys [30,31]. Nilsson et al. noted that the prevalence of myofascial pain

among the adolescents in Sweden was 4.2% and the risk was high with increase in age. A significant difference was noted between boys 2.7% and girls 6.0% [32].

1.4.1 Age

Age has been seen as a risk factor for developing temporomandibular joint disorders especially between 20-40 years of age [17,33,34]. Poveda Roda et al. reported that approximately 7% of young adults aged 12-18 years had signs and symptoms of TMJ disorders [35]. Conti et al. in his study found a prevalence of 11.29% in adolescents with mean age 18.8years [36]. Widmalm et al. reported the overall average of TMJDs to be 11.7%, at the age of 10–16–year–old [37]. Magnusson et al. studied children aged 11–15 years and revealed that signs and symptoms of TMJDs increased as the age increased. He found prevalence's of 35%, 61%, and 66% at the ages of 7, 11 and 15years, respectively [38].

1.4.2 Sex

There is significant difference in overall prevalence of TMJ disorders between males and females. The disorders are more common in females [17,39]. Pedroni et al. observed that 73% of Brazilian female college students with mean age of 21.9 years had TMJ disorders when compared to 27% males of the same age groups [40]. Gender preponderance was also observed in a study done in Italy by Bellintani et al. in children who had juvenile idiopathic arthritis (JIA). It was found that 72 children who had JIA had also TMJ disorders whereby 69.4% were females and 30.6% were male [41]. Marklund et al. reported that the prevalence of TMJ disorders' signs and symptoms was 12% in Swedish population with no differences between females and males [42]. Gesch et al. documented a prevalence of 49.9% signs and symptoms of temporomandibular joint

disorders in urban and rural population in German with no differences between females and males [39]. These findings were similar to those reported in Tanzania by Mazengo et al. [43].

1.4.3 Myofascial pain dysfunction (MPD)

MPDs are a group of complex problems of the muscles of mastication. The disorder most reported among the TMJ disorders usually occur because of unbalanced activity, spasm, or overuse of the jaw muscles [34,43]. The prevalence of MPD is estimated to be 75.8% worldwide [20]. Marklund et al reported a prevalence of 19% among the dental students in Sweden [25]. Pedroni et al. found that the prevalence of MPD among Brazilian students was 53.21% [40]. However, Otuyemi et al. in his study found that the prevalence of MPD among the Nigerian population was 62.8% [42] while a prevalence of 40% MPD was reported by Mazengo et al in adult Tanzanians [43].

Etiology

The etiology of MPD is unclear; some MPD patients' complaints have been associated with systemic diseases primarily affecting the function of masticatory muscles[44]. However, trauma, emotional stress, bruxism, occlusal abnormalities and internal joint derangement such as disk displacement disorders have been implicated[43,44].

Trauma

While assessing the functional occlusion, Bell, et al. suggested that occlusal interference may be considered as an etiologic factor of MPD [45]. An individual with history of previous head and neck injury as well as in patients with previous mandibular condyle fracture may characteristically present with MPD [45].

Bruxism

Bruxism, refers to a non-functional grinding and clenching of the teeth. Injury to the TMJs can develop from this constant grinding of the teeth due to excessive forces to the ligaments, disc, and articulating surfaces of the joints [45]. Other nonfunctional oral habits comprise biting foreign objects, (e.g. nails) and tongue thrusting. Glaros et al. induced MPD like symptoms (myalgia and arthralgia), in 3 out of 10 previously asymptomatic individuals, by encouraging jaw clenching via increasing electromyogram-biofeedback. These participants were compared with a control group of 10 who were asked to decrease the electromyogram readings, and who consequently did not develop pain [46]. A recent study by Manfredini et al. found that bruxism has a well-built relationship with myofascial pain dysfunction [47].

Malocclusion

Occlusal disharmony has been implicated as a causal factor in development of MPD [48]. Over-closure due to teeth loss causes the mandible to be mal-aligned, resulting in joint disturbances. This mal-alignment alters the position of the condyle in the fossa, which tends to "overload" the joint [47]. Several studies on MPD patients have suggested an association between molar loss and pain, clicking and progression to locking [9,17]. A study by Gesch et al. analyzed an association between morphologic occlusion with factors of functional occlusion and subjectively perceived symptoms of MPD, subjects yielding a response rate of 68.8% [49].

Stress

Stress is described as the nonspecific response of the body to any demand [19]. Usually, many people release stress manifesting by increased masticatory muscles hyperactivity by either

grinding or clenching their teeth. Injury to the TMJ's can develop from this constant grinding of the teeth from excessive forces created to the ligaments, disc and articulating surfaces of the jaw joints predisposing the patient to the development of MPD[43,44]. Stressful life events have been more frequently reported in groups of MPD patients than in the non-affected. These patients exclusively presented with muscle-related symptoms. It is worthy of noting that bruxism and teeth clenching are parafunctions of the jaws mainly caused by stressful life events leading to increased masticatory muscles hyperactivity with consequences of myofascial pain[50,51].

Psychiatric illness

Anxiety and other affective disorders, particularly depression, somatoform disorders, and personality disorders may be more frequent in groups of TMJDs patients than in control groups[50,51]. The etiological and pathological mechanisms linking the multiple symptoms of TMJDs and these comorbid conditions are unclear; however, in general they may involve abnormal responses of common homeostatic mechanisms, i.e. processes that are engaged to return the body to original set points after a disruptive stressor [52]. In one of US studies on MPD found out that 40% of individuals who satisfied the diagnostic criteria at least one had personality disorder, the most common being obsessive-compulsive disorder[53].

Clinical presentation

MPD is typically seen in young women, often in the third or fourth decade of life and is second to headache as a cause of facial pain[19]. A study done in USA revealed that out of 164 patients referred to dental clinics for chronic head and neck pain, 55% had myofascial pain [39]. Presenting symptoms are often unilateral chronic pain in the muscles of mastication radiating to the face,

jaw or neck and jaw muscle stiffness. It was found out that 26% of the patients may report at least one symptom, and 40% may present with one sign [39]. Patients present with limited movement or locking of the jaw, pain and clicking in the jaw joint when opening or closing the mouth. Clinically the patient looks normal, but physical examination reveals diffuse tenderness in muscles of mastication, limited mouth opening, joint sounds when opening the mouth and the teeth frequently have wear facets. Patients may complain of fatigue, tension, aching, discomfort, soreness, tenderness, or cramping in jaw muscles. Radiographs of the joint are usually normal[36,45].

Diagnosis

Diagnosis of myofascial pain dysfunction depends on patient's history whereby the patient may present with facial pain in front of the ears, headaches, sore jaw muscles, a clicking sound when chewing, a grating sensation when opening and closing the mouth, and temporary locking of the jaw usually, the temporomandibular joint itself is not painful [32]. Radiographs of the TMJ are extremely helpful in the diagnosis of intra-articular, osseous, and soft tissue pathology. In many cases radiographs of the joint are normal[36,45].

Treatment

Although the cause of MPD can arise from several different sources, initial treatment is frequently aimed at nonsurgical methods of reducing pain and discomfort, decreasing inflammation in muscles and joints, and improving jaw function. In most cases, MPD and disc displacement disorders, a non invasive treatment phase may provide significant reduction in pain and improvement in function. Treatment strategies for MPD are diverse and each patient is

treated in a different way depending on the distinctiveness of the problems[39]. Treatment include home care practices, splint therapy, occlusal adjustment, analgesics and psychotropic medication, surgery, education/cognitive therapy[7,39,40].

Homecare practices

Commonly used homecare measures may include avoidance of excessive chewing, change to a diet of soft consistency, limited talking, and avoidance of wide yawning. Physical therapy such as local application of ice for acute pain or heat for low-grade chronic pain, muscle massage, hot showers, and passive or active jaw exercises have been recommended[39,40].

Splint therapy

Splint provides a short-term assistance with muscular and joint pain. Baldissara et al. provided valid evidence on the possibility of applying these splints in the treatment of craniomandibular disorders[50]. He found that acrylic splints were efficient in reducing muscle and joint pain in up to 87% of studied patients. Anterior repositioning splints are an interocclusal device that encourages the mandible to resume an anterior position than centric occlusion. The reduction in pain may be due to the forward positioning of the disc, allowing the retrodiscal tissue space to repair from inflammation[39].

Occlusal adjustment

Occlusal adjustment involves repositioning the mandible in a centric position by prosthodontic or orthodontic means and/or occlusal equilibration. However, only one small study which investigated MPD and its association with abnormal condyle-disc relationship, reported significant reduction in painful symptoms and locking for up to three years after occlusal

correction by prosthodontic and/or orthodontic therapy[50,51]. The study by Wahlund et al. also established evidence that adults with MPD benefited more from the occlusal adjustment and this treatment was superior when compared with relaxation therapy[51].

Analgesia and psychotropic medication

Pain, and possibly inflammation, may be controlled by non-steroidal anti-inflammatory drugs (NSAIDs) but do not appear to have any renowned trials for their efficacy in MPD[26]. A recent study found a combination of NSAIDs and mouth opening exercises over four weeks to produce objective improvement in 60% of patients with disc displacement without reduction compared with 33% improvement in no-treatment control group. Dothiepin hydrochloride a psychotropic drug in daily doses of 25–225 mg can significantly ease the painful symptoms of MPD[20]. A study on Australian patients found out that both occlusal splint therapy and dothiepin therapy were necessary to reduce MPD symptoms in those patients with depression, whilst non-depressed patients responded poorly to splint therapy alone and had an intermediate response to dothiepin alone. Other suggested agents include amitriptyline, trifluoperzine hydrochloride, fluphenazine, nortriptyline and flupenthixol in resistant cases[52]. Diazepam 2–5 mg up to three times daily may reduce the pain of MPD, and clonazepam has been found to reduce painful TMJ, head and neck symptoms at nocturnal doses of 0.25–1 mg. Alprazolam a much more potent anxiolytic than diazepam, has been found to increase mandibular movement by decreasing local pain and muscle tenderness[52].

Surgery

The outcome of three different surgical treatments for internal derangement of (TMJ). discoplasty, discectomy without replacement, and discectomy with replacement of the disc with a Proplast-Teflon interpositional implant (PTIPI) were compared whereby the decrease of symptoms after surgery was reported by 77%, 94%, and 83% of the patients, respectively. Different surgical modalities have been suggested in the management of MPD[50,52].

Arthrocentesis

Arthrocentesis is defined as a lavage of the joint by flushing of the affected joint with a sterile solution such as Lactated Ringer's Solution [53]. It is a relatively simple surgical procedure that allows expansion of the joint space, lysis of adhesions and lavage via blind input and outflow syringes inserted in upper and lower joint spaces. The effect of TMJ arthrocentesis is to lubricate the joint surfaces and reduce inflammation. Nitzan reported the findings from 68 patients who presented with symptoms of severe MPD. Overall, arthrocentesis was successful in 94.1% of patients[53].

Arthroscopy

This is a surgical procedure involving placement of a small canula into the superior joint space, an arthroscope with a light source is then inserted through the canula into the superior joint space[53]. The arthroscope is connected to a video camera and monitor, which allow excellent visualization of all aspects of the glenoid fossa and superior aspect of the disc. Disc manipulation, disk detachment release, posterior band cautery, and suture techniques can be done to reposition or stabilize displaced disc. Arthroscopic surgery has been used to treat a variety of

TMJ disorders, including internal derangements, hypomobility as a result of fibrosis or adhesions and hypermobility[53].

Disc– repositioning and repair surgery

The indication for these procedures is anterior disc displacement that has not responded to nonsurgical treatment and that most frequently results in persistent painful clicking joints. In this operation the displaced disc is repositioned into a more normal position by removing a wedge of tissue from the posterior attachment of the disc and suturing the disc back to the correct anatomic position. In some cases the disc is so severely damaged that the remnants of the disc tissue must be removed. Discectomy without replacement is one of the earliest surgical procedures for the treatment of severe TMJ internal derangements[54]. In advanced internal joint pathology, the disc may be severely damaged and perforated but may have adequate remaining tissue so that a repair can be accomplished[53].

Condylotomy

The Condylotomy is a surgical division of the condyle without removal of a portion, and it is usually accomplished through the articular surface of a condyle, it is completed in a manner similar to the vertical ramus osteotomy. In this type of operation the intended goal is that the proximal muscles attached to the condyle will passively reposition the condyle, resulting in a more favorable relationship between the condyle, disc, and the fossa. This technique has been used to treat disc displacement with or without reduction and dislocation[25,54].

Total joint replacement

In some cases, joint pathology results in destruction of the joint structures so that reconstruction or replacement of components of the TMJ is necessary. In situations such as severe degenerative joint diseases, a severe case of ankylosis, neoplastic pathology, and posttraumatic destruction of the joint components often constitutes major indications for arthroplastic procedures[7]. Surgical techniques may involve replacement of the condyle or fossa but most commonly include both elements[7]. Costochondral arthroplasy was first introduced by Gillies in 1920 with a promising result and since then a number of authors have recommended autogenous costochondral grafts for congenital dysplasia, ankylosis, osteoarthrosis, neoplastic diseases, and posttraumatic dysfunction of the TMJ[25,34].

The advantages of costochondral grafting are the biological and anatomical similarities to the condyle, low morbidity and regeneration of donor site, and a demonstrated growth potential in juveniles. In spite of the ideal intrinsic and adaptive growth characteristics of the costochondral junction, there are also difficulties associated with rib grafting, the most commonly encountered being pneumothorax and hemothorax, pain, infections, uncontrolled and unpredictable growth[25,34].

Other treatment modalities

Acupuncture therapy, dry needling and trigger point injections may provide some reduction in local pain and tenderness[26].

Ultrasound is a therapeutic modality that has been used by physical therapists. The therapeutic ultrasound is in the frequency range of about 0.8-3.0 MHz. The sound waves that pass through

the skin cause a vibration of the local tissues. Ultrasound has been shown to cause increases in tissue relaxation, local blood flow, and scar tissue breakdown. The effect of increase in local blood flow can be used to help reduce local swelling and chronic inflammation[53].

Transcutaneous electrical nerve stimulation (TENS). A TENS is a device which utilizes electrical current delivered through electrodes placed on the surface of the skin to decrease the patient's perception of pain by inhibiting the transmission of afferent pain nerve impulses and/ or stimulating the release of endorphins [48,52]. TENS has been used in the treatment of patients with MPD[48].. Electromyography (EMG) has been extensively used in conjunction with relaxation and biofeedback therapy[54]. The effectiveness of EMG biofeedback in the treatment of MPDs has been evaluated in 13 studies, where 70% of the patients required no further treatment, were symptom-free, or were substantially improved following EMG biofeedback therapy; compared with 35% of patients who received placebo treatment[54].

Education/Cognitive-behavioral therapy

Cognitive Behavioral Therapy (CBT) aims at enabling individuals to better manage their difficulties by applying empirically researched principles of thoughts, feelings and behaviors. Cognitive behavioral CBT has been found to be effective in reducing pain and disability in MPD [55].

1.4.4 Dislocation

Temporomandibular joint (TMJ) dislocation is defined as an excessive forward movement of the condyle beyond the articular eminence, with complete separation of the articular surfaces and

fixation in that position [29]. Dislocation is reported to be common in patients aged between 9 and 85 years and peak age incidence between 20 and 29 years[57,58].

The resultant spasms prevent the condyle from returning to the mandibular fossa [16,59]. Confusion exists regarding the meaning of the terms subluxation and luxation or true dislocation. Subluxation refers to an incomplete or partial anterior dislocation of the mandibular condyle from the glenoid fossa; this hypermobility is best distinguished from dislocation by the patient's ability to self-reduce the condyle [59,60].

Luxation (true dislocation) is a condition in which a joint is displaced from its articulations and requires manipulation by another individual to return to its normal position[59]. Furthermore, (TMJ) dislocations may be subdivided into acute, chronic recurrent or chronic persistent dislocations[59].

Acute dislocation is a nonself-reducing sudden severe displacement of the head of the condyle from the glenoid fossa. This may be caused by a blow on the lower jaw, forceful opening of the mouth during yawning, drugs like phenothiazine derivative and prochlorperazine. These drugs are used as tranquilizers and antiemetics but also have a subcortical motor effect in some individuals leading to abnormal muscle hyperactivity and predisposing the patient to TMJ dislocation[56,59].

Chronic recurrent dislocation is a recurrent displacement of the condyle from the glenoid fossa, which can be self reduced or non-self reduced[58,59]. Chronic dislocation can result from acute dislocation and may be due to laxness of the joint ligaments, leading to chronic recurrent

dislocation. Chronic dislocation may be the result of changes in the condyle, including flattening of the articular surface, or the articular eminence may become excavated[56].

Habitual dislocation. The term should be reserved for repeated episodes of dislocation, where there is abnormal anterior excursion of the condyle beyond the articular eminence, but the patient is able to manipulate it back into normal position[56,58,59]. The condylar head moves unassisted, forward and backward over the articular eminence. This condition can be due to shallow glenoid fossa, flatness of articular eminence and laxity of the joint ligament[58,59].

Etiology

The most frequent pathologic factors involved in dislocation of the TMJ are trauma, excessive mouth opening, TMJ ligaments laxity, and masticatory muscles disorders [57,58]. The dislocation occurs more frequently in people with general joint laxity and in patients with internal derangement of the TMJ or with occlusal disturbance[57]. The condyle may catch when opening widely and, upon closing, it returns with the jumping motion accompanied by a sound caused by movement of the condyle over the articular eminence. TMJ dislocation may follow endotracheal intubation, and oral procedures requiring excessive mouth opening predisposing the patient to TMJ dislocation[56,60]. In addition, certain drugs used in the treatment of psychiatric conditions have been reported to cause TMJ dislocation due to their extra pyramidal effects. These include phenothiazines (used in the treatment of schizophrenia), haloperidol, and thiothixene[52]. Adekeye et al. found that chronic dislocations may result from untreated TMJ acute dislocations whereby the condyle remains displaced for an extended time period[60]. Recurrent dislocation could be due to variety of causes including TMJ ligament laxity, shallow glenoid fossa, flat articular eminence, flat or short condyle, Marfan's and Ehlers-Danlos Syndromes[1,27]. A retrospective study of 96

cases of temporomandibular joint dislocation by Ugboko et al. in Nigeria revealed that excessive mouth opening while yawning was the commonest cause accounting for 45.8% of dislocations, followed by road traffic accidents in 13.5% of the patients. Ten patients (10.4%) had underlying systemic diseases, the commonest being epilepsy (4%)[60].

Clinical presentation

The patient is usually unable to close the mouth and there is excessive salivation, difficult in speaking and a depression may be noted in the preauricular area[60]. Palpation of the TMJ reveals one or both of the condyles trapped in front of the articular eminence and tenderness of the muscles of mastication is elicited[59].

Diagnosis

In making a diagnosis of mandibular dislocation, a detailed history and roentgenographic examination of the joints should be carried out[59,61].

Anterior dislocation. Is the most common whereby the condyle becomes locked forward suddenly by spasm of the temporal, medial pterygoid and or masseter muscles, resulting in protrusion of the mandible and open bite. The chin is directed downward and forward, patients experience pain and difficult in eating and speaking, they become panicky and may salivate excessively. Preauricular prominences are apparent and, if the dislocation is unilateral, the mandible deviates to the unaffected side. Frequently the patient provides a history of sudden, severe pain in the region of the joint, followed by an inability to close and, when unilateral, an inability to move the mandible toward the affected side. In the area of the joint, there is tenderness, edema, and limitation of motion[59].

On X- rays, the condyle is usually anterior to the articular eminence. This may be found unilaterally or bilaterally and can be observed in lateral projections[60,61]. The degree of anterior displacement of the condyle depends on osseous anatomy, muscular activity, and limitations imposed by the joint ligaments. Differential diagnosis must include condylar fractures[61].

Treatment

Treatment is directed to reduction of pain and restoration of jaw function. A variety of non surgical and surgical therapeutic approaches designed to limit the forward excursion of the condylar head have been applied. Non-surgical treatment include; manual reduction, intra-capsular injection of sclerosing solutions and scarification of the temporalis tendon. Surgical treatment includes; lateral pterygoid myotomy, bone grafting augmentation or application of a well-designed alloplastic impediment with vitallium mesh or titanium plates and reduce the eminence, thereby permitting free movement of the condyle[62].

Non-surgical management of TMJ dislocations

Manual reduction

Acute dislocation of the mandible is the commonest condition that causes the jaw to lock in the open position. This can lead to painful inflammation in the articular capsule and can inhibit swallowing and eating. Most patients with acute locking of the jaw have a history of episodic locking, a noticeable click with chewing, or a habit of teeth clenching[58]. If the patient is unable to reduce the displacement by laterally moving the mandible and opening the mouth wide, manual reduction should be attempted. Manual reduction of the disk can usually be achieved by inserting the thumb into the patient's mouth, grasping under the chin, and simultaneously pushing down on

the posterior teeth and pulling up on the chin. The mandibular condyle will be distracted downward, allowing the disk to move posteriorly into place[58]. The patient's head should be stabilized, either by an assistant or headrest in a dental chair. A local anesthetic or intravenous benzodiazepine may be used to decrease pain and relax severe spasm before manual reduction. Chronic or long-standing dislocations that have persisted for more than one month are difficult to reduce manually. In a review study, Gottlieb found that only three of 24 long-standing cases were successfully reduced by manual manipulation[61]. Another review also reported that four out of 24 cases of long-standing dislocations were successfully reduced manually[59].

Surgical management

Various techniques have been proposed for surgical management of TMJ dislocation, but the most common are eminectomy and condylectomy to free all condylar movements, inferiorly down fracture of the zygomatic arch and articular eminence augmentation to limit the condylar path. Therefore, surgical techniques can be divided into two categories[62]:-

1. Surgical operations that limit the condylar path.

2. Surgical operations that enhance the condylar path.

Surgery that limits the condylar path

This is a surgical procedure performed through a vertical osteotomy of the zygomatic arch and lowered the proximal segment, which then served as an obstacle to anterior condylar excursions. Augmentation of the articular eminence can be done by Iliac or calvaria bone graft[62,63]. The use of sclerosing solutions was first described by Schultze whereby hypermobility

was treated by injecting sodium psylliate into the periarticular tissues bilaterally to induce periarticular fibrosis and tightening of the joint [62]. Injecting 0.5 per cent sodium tetradecyl sulfate into the pericapsular area every two to six weeks produces fibrosis and subsequent limitation in condylar movement. Jacobbi-Hermanns reported a 75% success rate in treating chronic subluxations (habitual dislocation) with sclerosing Solutions [63]. Autologous blood injection to the TMJ as a treatment of chronic recurrent TMJ dislocation has been described in literature. Schultze treated 16 patients by injecting autologous blood to the affected TMJ twice a week for 3 weeks followed by immobilization via intermaxillary fixation for 4 weeks. He reported that at a one-year follow-up, 10 patients were symptom free [65]. Jacobbi-Hermanns published her experience with 19 patients who received only 1 autologous blood injection and had intermaxillary fixation for 14 days. At 18 months follow-up, 17 patients were symptom free [65]. Most recently, Hasson reported his experience by successfully treating 3 patients while Kato et al. successfully treated 1 of their patients [66,67]. Vladimir et al. in Czech conducted a study on autologous blood injection in treating 20 patients who had chronic recurrent dislocation and 5 patients who had habitual TMJ dislocation. He reports, one week after the first autologous blood injection, 64% patients denied TMJ dislocation and 36% patients continued to dislocate. Therefore, of the 25 patients initially treated, 20 (80%) patients were successfully treated with 1 or 2 injections at the 1-month follow-up. The remaining 5 patients were treated for the third and last time with bilateral autologous blood injections but continued to dislocate and 20% required open TMJ surgery [68].

Laskin describes a technique involving a myotomy of the temporalis muscle, performed through an intraoral incision, for the treatment of three patients with prolonged dislocations[69]. He felt that

these dislocations were prolonged due to the shortening of the temporalis muscle fibers, and that the liberation of these fibers would help reduce the dislocation. However, later results involving lateral pterygoid myotomy indicated that the use of Silastic sheeting as an interpositional material did not prevent lateral pterygoid muscle reattachment, because the fibers reattached to the pseudo capsule formed around the material [69].

Surgical techniques that enhance the condylar path

Riedel, in 1883, was the first to report the surgical treatment of TMJ dislocation. His technique involved a unilateral excision of the condyle (condylectomy). It was subsequently described by Myrhaug, who introduced a procedure in which the entire eminence was removed to completely eliminate any interference to condylar movement. Other surgical procedures for the treatment of recurrent dislocations have included discectomy and closed condylotomy [62,66].

1.4.5 Ankylosis of the temporomandibular joint

Ankylosis is defined as the fusion of joint surfaces by bone, fibrous tissue or both combinations known as fibro- osseous ankylosis [70,71]. The limitation of mandibular movement varies from slight interference to complete inability to open the jaw. The movement is also restricted in protrusion and lateral excursion with varying degree, depending on the extent and type of the joint involvement [70,71].

Classification

Kazanjian was the first to classify TMJ ankylosis. In his articles he classified ankylosis into two types [13]. The first type is extra-articular also called false ankylosis in which the ankylosis resulted from pathologic conditions outside the joint causing the limitations in opening the mouth. The

findings in radiographs may reveal normal-appearing TMJ and joint spaces [72]. The second type is intra-articular or true ankylosis; this is a condition that produces fibrous or bony adhesions between the articular surfaces of the mandibular condyle and glenoid fossa[72].

TMJ ankylosis may also be classified according to the type of tissue involved (bony, fibrous or fibro-osseous tissue) and the degree of fusion (complete or incomplete) [73,74]. Sawhney, classified ankylosis into type I, in which the condyle is present and there are only fibrous adhesions; type II, in which there is bone fusion, the condyle is remodeled, and the medial pole is intact; type III, in which there is an ankylotic block, the mandibular ramus is fused to the zygomatic arch, the medial pole remains intact; and type IV, in which there is true ankylotic block and the anatomy is deranged because the ramus is fused to the skull base[73].

Intracapsular ankylosis

The hypomobility of the joint is usually followed by a progressive joint involvement with destruction of the articular disc, flattening of the fossa, thickening of the condyle, fibrous tissue formation and fixation[73]. The mandible becomes continuous with the temporal bone, the condyle becomes hypoplastic, resulting in disorientation of the joint structures[75,76].

Extra capsular ankylosis

Sometimes the joint becomes splinted by cicatricial soft tissues or a bony mass outside the joint capsule. Conditions such as muscle contracture, extremely long coronoid process impeding joint movements, fibrosis of joint ligaments which is common following inflammation or trauma and malunion of fractured condyle(s) may result in mandibular hypomobility [74,77].

Etiology

Various factors that may cause TMJ ankylosis include; trauma, local or systemic inflammatory conditions, neoplasms and infections[75].

Trauma

The most common cause of TMJ ankylosis is trauma. Traumatic injury to the facial region may be associated with fracture of the head of condyle(s) and bleeding into the joint area[70,71]. Trauma can be due to direct impact to the chin or to the side of the face and surgical intervention in the joint. Poorly reduced or unreduced fractured head of the condyle and bleeding into the joint space sets up a matrix for development of fibrosis as a result of inflammatory reaction hindering jaw movement. Fibrotic mass may undergo calcification following physiologic remodeling carried out by osteoblasts leading to bone formation uniting the articular surfaces to form TMJ ankylosis[78-80]. Studies done by Su-Gwan, Roychoudhury et al., Topazian and El Mofty revealed that 85.5%, 86% and 29-98% respectively of the causes of TMJ ankylosis were due to falls and road traffic accidents[81-84]. In their study Keqian Zhi et al. reported that, among patients with ankylosis due to falls and road traffic accident 52.4% were females and 47.6% were males[85]. Birth injury has also been reported to cause TMJ ankylosis[83,86].

Infections

The second most common cause of TMJ ankylosis is infection[70,71]. Local or systemic infection; such as otitis media, mastoiditis, severe dental infection and hematogenous spread of tuberculosis, gonorrhea, and scarlet fever have been implicated in causing TMJ ankylosis. Some systemic diseases such as ankylosing spondylitis, rheumatoid arthritis, were reported as possible

etiologic factors in less than 10% of the cases[79]. Topazian reported that about 10% to 49% of the TMJ ankylosis cases in his study were due to infection in head and neck area[75]. Ellen Wen-Ching Ko et al. reported that 15.6% of patients with TMJ ankylosis were due to middle ear or dental infection, while 2.2% were due to chronic arthritis and 15.6% of patients had TMJ ankylosis from unknown causes[83]. Pogrel et al. found out that local or systemic infection was the cause of TMJ ankylosis in 53% of patients, followed by systemic disease, such as ankylosing spondylitis and rheumatoid arthritis[84].

Clinical presentation of TMJ ankylosis

The impairments of orofacial function include limited chewing ability, alterations in speech, compromised oral hygiene and dental care, restricted airway, and decreased posterior dental eruption. Patients present with the following clinical features: inability to open the mouth, in a growing patient there may be facial asymmetry due to underdeveloped mandible and mandibular midline deviation towards the affected side[85,86]. The degree of mandibular recession depends on the severity, unilateral or bilateral joint involvement, age of onset, and duration of TMJ ankylosis[73].

The mandibular morphology is severely influenced in terms of size and shape with marked antegonial notch, enlarged coronoid process, reduced vertical ramus height on the affected side; and flattened mandibular body and ramus on the non-affected side[79]. Infants or children, in whom ankylosis has developed, have severe facial deformities due to the effect on condyles which are the growth centers for the mandible[86]. X- ray findings depend on the cause, duration, and age of onset of ankylosis and may include gross deformation of the condyle, the fossa and the articular

eminence. It is often possible to find that the joint space is reduced or completely obstructed with radiolucency, radiopacity or both. Sometimes in fibrous ankylosis the head of the condyle appears normal or may be replaced by amorphous bone materials attached to the base of the skull above and to the neck of the condyle below. In bony ankylosis, total obliteration of the joint space by a bone mass may occur. Diagnosis is aided by history of trauma or infection in the past followed by progressive hypomobility of the jaw. Patient describes difficulty in eating, talking and maintaining oral hygiene. Lack of or reduced mandibular motion may be palpated easily by placing a finger into each external auditory canal over the joint anterior to the tragus[85].

Treatment

Management of TMJ ankylosis is through surgical intervention as soon as the condition is recognized[70,72]. Early surgery can minimize the severity of the restriction of facial growth especially in children whose mandibular growth centers are in mandibular condyles. Further, early surgical interventions tend to correct aesthetic abnormalities that could develop if the ankylosis would be left untreated[71]. A number of treatment modalities for TMJ ankylosis have been described in the literature, including simple arthroplasty, interposition arthroplasty, using temporal muscle fascia, ear cartilage or alloplastic material and reconstruction of the joint using acrylic, titanium or autogenous material prostheses[70,79]. There is, however, no consensus in the literature about the best treatment in these cases; results have varied and recurrence rates are still high, which is a major problem when treating this condition [87,88]. Costochondral graft is the preferred biological material for TMJ reconstruction in children because it may allow additional mandibular growth [38,70,79].

Surgery

Condylectomy. Condylectomy is the surgical procedure which is performed to remove the condyle(s). The condyle is horizontally resected to allow free movement between the ascending ramus and the glenoid fossa. It is advised that during condylectomy a gap of 1-1.5 cm should be created between the glenoid fossa and ascending ramus to prevent reankylosis. However it has largely been abandoned in the surgical repertoire for the treatment of internal derangements of TMJ because of problems of reduced condylar mobility, mandibular deviations, and reankylosis [79,80]. Autogenous grafts such as costochondral, iliac crest or cononoid process grafts or alloplastic materials such as articular prostheses may be used[80]. Costochondral grafts are the most widely accepted; they are biologically compatible and functionally adaptable[76,78]. The growth potential of this type of graft makes it the material of choice in children[80]. Problems with costochondral grafts include fractures, reankylosis, donor site morbidity, and variable graft growth. The interpositional arthroplasty with temporal muscle flap is indicated by several authors[75,79-81].

Total joint replacement

In the joint reconstruction technique, following the resection of the ankylosis block, the structure that is compromised is restored to establish the vertical height and the condylar structure, aiming to improve function. A number of alloplastic materials have been developed to avoid these problems, such as acrylic resin, synthetic fibers and full titanium joints. Alloplastic joints make it possible to reproduce more closely the natural joint anatomy, restoring the vertical height, decreasing surgery time, and reducing the rate of recurrences[79,80]. Kaban et al. described a protocol for the treatment of TMJ ankylosis. This protocol is ideal for treating ankylosis; it consists of: aggressive resection, ipsilateral coronoidectomy, contralateral coronoidectomy if

needed, interposition with temporal fascia or cartilage, reconstruction of the ramus with a costochondral graft, rigid fixation, movement as soon as possible, and aggressive physical therapy [87].

2. PROBLEM STATEMENT

Temporomandibular joint disorders (TMJ) are among diverse human diseases, and present with a wide spectrum of clinical characteristics. Worldwide, many people suffer from these disorders, some of whom are significantly left with permanent disabilities. Untreated or unsuccessfully treated temporomandibular joint disorders have worse outcome. When it occurs in a child, it can have devastating effects on future growth and development of the jaws. Furthermore, in many cases it has a profoundly negative influence on the psychosocial development of the patient, because of the obvious facial deformity, which worsens with growth. The role of gender in temporomandibular disorders is consistent with most studies suggesting that the condition is prevalent in women aged 20-40 years than in men of the same ages. However, the prevalence is lower among children, adolescents and elderly of both genders. There is lacking data on the magnitude, etiology, clinical and radiographic features, and treatment outcome among patients with temporomandibular joint disorders in Tanzania. This study, therefore, provides current information on the prevalence, associated factors, clinical pattern, treatment and treatment outcome of TMJ disorders in patients seen in the Oral and Maxillofacial Surgery department at MNH.

3. RATIONALE OF THE STUDY

Existing studies on temporomandibular joint disorders have demonstrated a high prevalence of TMJ disorders with signs and symptoms in subclinical and clinical degrees. Little is known on the magnitude and pattern of occurrence of temporomandibular joint disorders among Tanzanian population. Late medical care seeking behavior, in addition to ignorance and poverty, renders the management of temporomandibular joint disorders difficult and sometimes unsuccessful.

Moreover, the available treatment options for temporomandibular joint disorders are inaccessible for majority of the population due to few health institutions providing required care. Even for those who manage to access the available treatment options, the treatment outcome is yet to be documented. This study will add current information on the existing knowledge on temporomandibular joint disorders among Tanzanian patients. The information is also essential in facilitating early diagnosis, and hence early intervention, rising awareness of the problem to the community by providing relevant health education. Also, this study is a partial fulfillment for academic requirement for Masters' degree in Oral and Maxillofacial Surgery.

4. OBJECTIVES OF THE STUDY

4.1 BROAD OBJECTIVE

To determine the prevalence, associated factors, clinical pattern, and treatment outcome of temporomandibular joint disorders among patients attending treatment in the Oral and Maxillofacial Surgery department at Muhimbili National Hospital (MNH).

4.1.1 SPECIFIC OBJECTIVES

1. To determine the prevalence of TMJ disorders among patients attending treatment in the Oral and Maxillofacial Surgery department at MNH.
2. To determine the risk factors associated with TMJ disorders among patients attending treatment in the Oral and Maxillofacial Surgery department at MNH.
3. To determine the clinical and radiographic features of the temporomandibular joints in the patients attending treatment in Oral and Maxillofacial Surgery department with TMJ disorders.
4. To determine the management modalities and treatment outcome in patients with TMJ disorders attending treatment in Oral and Maxillofacial Surgery department at MNH.

5. MATERIALS AND METHODS

5.1 Study area

The study was conducted in the department of Oral and Maxillofacial Surgery at Muhimbili National Hospital in Dar es Salaam. MNH is the largest National Referral Centre in Tanzania, and the only one providing specialized oral and maxillofacial services where most of oral and maxillofacial patients are referred to from all over the country.

5.2 Study design

This was a descriptive cross- sectional hospital based study.

5.3 Study duration

The study was conducted over a period of six months from September 2009 to February2010.

5.4 Study population

All patients who attended at the Oral Surgical clinic and those admitted in wards 23 and 24 with TMJDs and had consented were included in the study. The patients were interviewed using a structured questionnaire. Physical examination was done and findings were recorded on a special clinical form.

5.5 Sampling method

Convenient sampling method was used. All patients with temporomandibular joint disorders were recruited.

5.6 Clinical examination

Patients were physically examined while seated in the dental chair: artificial and natural light used for illumination. The head and neck, ears and oral cavity were examined. Palpation of masticatory muscles, masseter, temporalis, the pterygoids to elicit tenderness was done. Joints were examined for clicking and crepitation during mouth opening, closing or both. Presence of abnormal teeth wear facets, missing teeth, restorations and prosthesis, malocclusion and trismus were recorded. Different radiographic views were taken to assist in establishing the diagnosis.

5.6.1 Inclusion criteria

All patients who had temporomandibular joint disorders and who consented were included.

5.6.2 Exclusion criteria

All patients with temporomandibular joint disorders who declined to consent were excluded. All patients who were unable to close their mouths due to mandibular fractures were excluded. Patients presenting with neurological disorders and history of previous or existing symptoms of cardiovascular accidents, were excluded from the study; because pain due to these conditions may present in the facial region mimicking MPD hence confounding the results.

5.6. 3 Diagnostic criteria

All patients were diagnosed to have MPD only if they presented with the following signs and symptoms as described by Okeson[5]. Diffuse masticatory muscle tenderness, masticatory muscle pain aggravated by jaw function. Presence of clicking sound in the joint region on mouth opening and/ or closing and muscle fatigue, especially of the masticatory muscles provides index of

suspicion for MPD. Impaired jaw movements, masticatory muscle dysfunction related to emotional tension, occlusal interferences, teeth loss, postural deviation are diagnostic criteria for MPD. Presence of joint pain without radiological evidence of pathological process is characteristic of MPD.

TMJ-Dislocation was diagnosed when the patient had inability to close the mouth, preauricular depression, mandibular protrusion, tension and spasms of mastication muscles, excessive salivation, difficult in speaking and pain in the TMJ region. Radiographs confirming displacement of the condyle from the glenoid fossa, not associated with mandibular fracture were used as one of diagnostic criteria.

Habitual dislocation may be indistinguishable from luxation radiographically. In classic cases, the condylar position is anterior to the articular eminence when the mouth is opened wide. This radiographic observation is sometimes referred to as elapsio prearticularis, a term used to describe an obstructed, painless subluxation that ultimately reduces to a normal condyle-fossa relationship. However, there was no patient encountered with habitual TMJ dislocation.

TMJ-ankylosis was diagnosed when there was inability to open the mouth, limited chewing ability, alterations in speech, compromised oral hygiene and dental care, restricted airway and decreased posterior dental eruption. Presence of facial asymmetry, chin deviation to the affected side, elongation and flatness on the nonaffected side with roundness or fullness on the affected side when observed from front raised suspicion of TMJ ankylosis. A lateral profile with a reduced mandibular projection with "bird face deformity" also led to a provisional diagnosis of ankylosis. Radiograph revealing reduced or obstruction of joint space, bony thickening in the

preauricular area of the affected TMJ, marked antegonial notch, elongated coronoid process, reduced vertical ramus height on the affected side; and flattened mandibular body and ramus on the non-affected side were considered highly suspicious of TMJ ankylosis.

5.7 Data collection

Data were collected using structured questionnaires whereby patients' history and physical examination were done and findings recorded on a special clinical form. During consultation the patients were informed of the study and requested to give consent for participation. Only those who consented participated and those who declined to participate were not denied treatment or other rights as patients. If the patients had any questions, they were allowed to ask at this point.

5.7.1 Questionnaire

Structured questionnaires were used to collect data. The data collected included; demographic data (age, gender, marital status, occupation and level of education), main complaints, duration, site affected, signs and symptoms, reasons for consultation and if patient have had previous treatment of the same problem.

5.8 Treatment

Medications were prescribed for patients who had tenderness of masticatory muscles, pain aggravated by jaw function and deviation of the jaws on mouth opening. NSAIDs, muscle relaxants, antidepressants, jaw rest and diet modifications were advised. Manual / closed reductions of dislocated joints were done to a patient seated in a dental chair upright position with a head supported by an assistant. Gloved hands with thumbs rolled with gauze inserted on occlusal surface in molar ramus area of the lower jaw while the rest of the fingers placed on the

skin below the body of the mandible bilaterally, the operator standing infront of the patient, applying a downward and backward pressure to relocate the dislocated condyle(s) back into the fossa. Patients were instructed to avoid wide mouth opening beyond which the dislocation could occur. for others intermaxillary wire fixation was done for 3 days to prevent re-dislocation. After 3 days wires were removed and follow-up visit established once per week for 3 weeks. Surgical reduction was done under general anesthesia whereby the dislocated joints were reduced without performing condylectomy. This was done through preauricular incision made by scapel, followed by blunt dissection using periosteal elevator used to dissect the soft tissues lateral to the joint advancing anteriorly until the mandibular notch was felt. Engaging the periosteal elevator into the notch pushing the mandible down and posteriorly with an assistant supporting the lower jaw and pushing downward and posteriorly the condyles were returned back into the glenoid fossa and intermaxillary fixation done to maintain the condyles in articular fossa for 3 days.

For patients with TMJ ankylosis surgical treatment was provided under general anesthesia. Tracheostomy was done to all patients because they could not open the mouth to allow nasal tracheal or oral intubation. Preauricular incisions were applied to approach and expose the joint(s). Gap arthroplasty by condylectomy was the main treatment. The resection was started using a surgical bur or electrical saw and then completed with chiesel: free jaw movements were achieved and intraoperative interincisal width measured. Mouth opening exercises started 3-5 days post operation using wooden blocks and chewing sugarcane carried out 4-5 times a day. Mouth opening width was measured at the end of each session. Mouth opening exercises were carried out for 3 weeks before and continued after discharge.

5.9 Treatment outcome

Patients were followed up for a minimum period of three months. The follow up schedule was three weeks, one month and three months post treatment. During this follow up period temporomandibular joint disorders' signs and symptoms were assessed.

TMJ- ankylosis was assessed for recurrence whereby maximum mouth opening width was measured and recurrence was deemed when maximum mouth opening width was less than 10 mm.

Myofascial pain dysfunction. Pain in the joint area, masticatory muscles tenderness, headache, neck pain, clicking sound, crepitations, jaw deviation upon opening or closing the mouth were assessed. Treatment outcomes were classified into 4 categories as improved, no change, deteriorated and discontinued.

TMJ-dislocation. Patients who were treated by manual reduction, treatment outcome was assessed by recurrences and pain in the joint area. Those who were treated by surgery, the outcome was assessed by recurrence, mouth opening width, and presence of pain in the joint area.

5.10 Statistical analysis

SPSS version 13.0 computer program was used to analyze the data (SPSS Inc. Chicago Illinois).

5.11 Ethical clearance

The ethical clearance was obtained from MUHAS Research and Publications committee and permission sought from MNH. Written informed consent was obtained from each patient.

5.12 Patient management, confidentiality and ethical issues

All patients included in this study were treated diligently and the information collected was highly confidential. Any information obtained from the patients related to their illnesses remained confidential and was not in any form disclosed to other people or institution without discretion of the beholder. Invasive procedures inherent with treatment modality were described and discussed with the patients, alternative treatment modalities relevant to the patient's illness outlined rendering the patient to make free and uninfluenced choice.

6. Results

A total of 4661 patients comprising of 2018 (43.3%) males and 2643 (56.7%) females were treated in the oral and maxillofacial clinic at MNH during the study period. Out of these, 61 (1.3%) patients who included 23 (37.7%) males and 38 (62.3%) females with a male to female ratio of 1:2 had temporomandibular joint disorders and these were recruited in the study. A majority of 22 (36.1%) patients had TMJ ankylosis, followed by 20 (32.8%) with MPD and 19 (31.1%) patients with TMJ dislocation (Table1).

6.1 TMJ-ankylosis

Out of 22 (36.1%) patients with TMJ ankylosis, 9 (40.9%) were males and 13 (59.1%) females with M: F= 1:1.4. Seven (31.8%) patients with TMJ ankylosis were in the 11-20 years age group, 6 (27.3%) in the 21-30 years age group and 4 (18.2%) were below 10 years of age (Table 1).

Associated factors

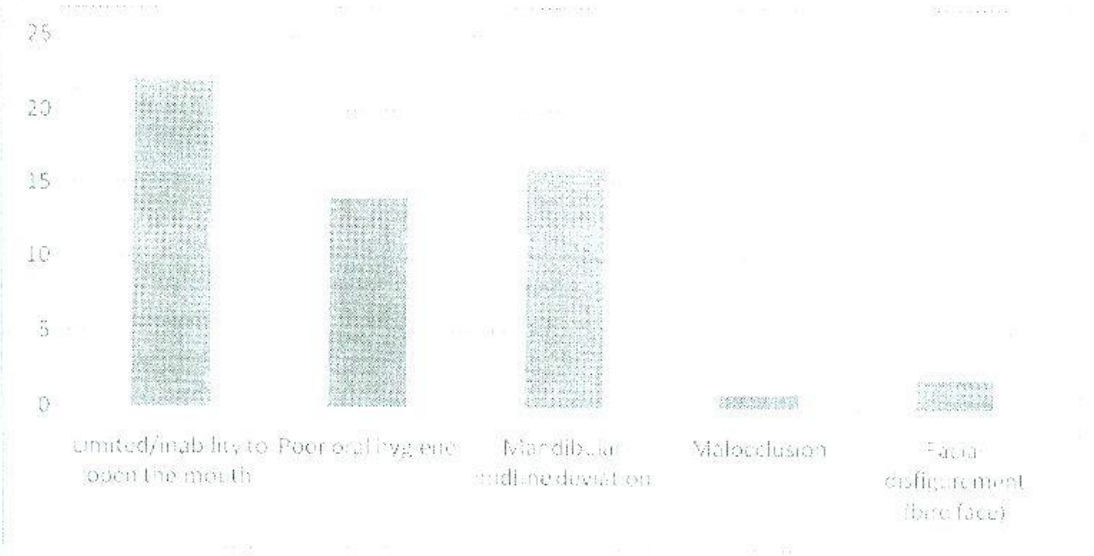
There were 11 (50%) patients comprising of 6 (54.5%) females and 5 (45.5%) males who had suffered trauma. Eight (36.4%) patients who had suffered infection, 5 (38.5%) were females and 3 (33.3%) were males. Two (9.1%) patients had tumor invasion in the TMJ. The commonest associated factor in patients below 20 years of age was trauma, while infection was commonest in the 21-30 years age group (Table 2).

Major presenting signs and symptoms

All patients with TMJ ankylosis presented with different levels of limited opening of the mouth. Sixteen (72.7%) patients had interincisal opening width ranging from 0 to10 mm and 6 (27.3%) had interincisal opening width between 11-15 mm. Fourteen (63.6 %) patients presented with

poor oral hygiene. Facial disfigurement was observed in 20 (90.9%) patients, 18 (90%) of whom had deviation of mandibular midline and the rest 2 (40.9%) had bird face appearance (Figure 1).

Figure 1. Distribution of signs and symptoms in patients with TMJ ankylosis



Types and categories of ankylosis

Twenty four TMJs belonging to 22 patients were ankylotic whereby 20 (90.9%) patients had unilateral ankylosis and 2 (9.1%) had bilateral ankylosis. Nine (37.5%) joints of 9 (40.9%) patients had fibrous ankylosis while 15 (62.5%) joints of 13 (59.1%) patients had osseous ankylosis. Among the patients with ankylosis, types I and II ankylosis were found in 18 (75%) joints of 9 (40.9%) patients in each type, while types III and IV ankylosis were present in 6 (25%) joints of 2 (9.1%) patients in each type, comprising of 4 (16.7%) joints and 2 (8.3%) joints respectively.

Treatment modalities

Surgical treatment was provided to 18 (81.8%) patients. Seven (31.8%) patients with ankylosis type IV underwent both condylectomies and coronoidectomies. Condylectomy without coronoidectomy was done in 11 (50%) patients, of whom 7 (63.6%) had fibrous ankylosis, and 4 (36.4%) type II and III osseous ankylosis. Of the two (9.1%) patients who had tumor invasion into temporomandibular joints one died, and the other was referred to Ocean Road Cancer Institute for oncological management. Two (9.1%) patients had their treatment postponed (Table 3).

Treatment outcomes

In 7 (31.8%) patients who had both condylectomy and coronoidectomy intraoperative mouth opening width ranged from 35 mm to 40 mm. Out of these 3 (42.9%) patients had a maximum interincisal width of <10 mm three months post operation. Eleven (50%) patients who underwent condylectomy only had intraoperative mouth opening width of between 33 mm to 40 mm, and recurrence was noted in 2 (33.3%) patients, with maximum interincisal width of < 10 mm (Table 4).

6.2 Myofascial pain dysfunction

Twenty (32.8%) patients comprising of 14 (70%) females and 6 (30%) males (M: F=1:2.3) aged between 24 and 80 years with a mean age of 45.75 years had myofascial pain dysfunction syndrome. Out of the 20 patients, 8 (40%) belonged to the 21- 30 years age group, 5 (25%) patients to the 31-40 years age group and 3 (15%) patients belonged to the 41-50 years age group (Table 1).

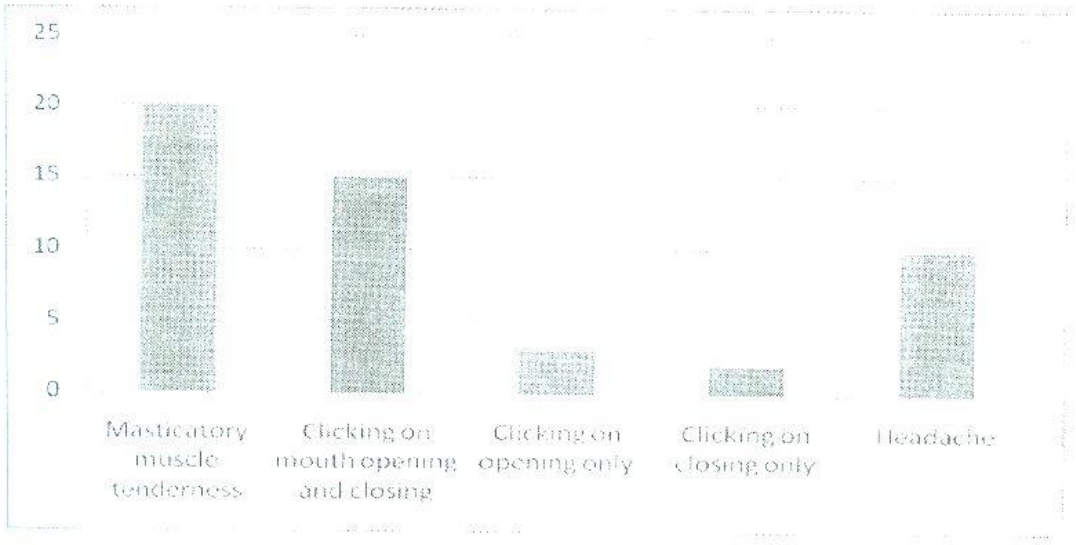
Associated factors

The factors most associated with MPD included bruxism in 8 (40%) patients, followed by trauma in 7 (35%) patients and malocclusion in 2 (10%) patients, and day time teeth clenching in 2 (25%), (Table 2).

Major presenting signs and symptoms

Duration of signs and symptoms ranged from 1 month to 7 years with the mean period of 2.6 years. Seven (35%) patients reported with limited mouth opening with a maximum interincisal opening width of less than 30 mm. The remaining 13 (65%) patients had mouth opening width of more than 30 mm. About 15 (75%) patients had both clicking sounds and crepitations during mouth opening and closing. Two (10%) patients reported clicking sounds during opening only 2 (10%) patients during closing only. All patients had masticatory muscle tenderness, while 4 (20%) had pain radiating to the neck patients and 10 (50%) patients had headache (Figure 2). Radiological examination showed no TMJ abnormalities in all patients.

Figure 2. Distribution of signs and symptoms in patients with MPD



Treatment

A total of 17 (85% patients were put under acetyl salicylic acid 600 mg (analgesics) taken 8 hourly per day, diazepam 5 mg-10 mg (muscle relaxants) taken orally twice a day, and amitriptyline 25 mg (antidepressant) taken at night. All these were prescribed for a period of three weeks prior to initial evaluation. Two (10%) patients were provided with removable partial dentures and 1 (5%) patient was advised on diet modification in addition to the above medications (Table 3).

Treatment outcomes

Five (25%) out of 17 patients who were solely under medications had improvement. Muscle tenderness and jaw deviation on mouth opening were also significantly reduced. Additional course of diazepam 5 mg and amitriptylin 25 mg was given for another one month. Eleven (55%) patients had persistent signs and symptoms after completion of the first course of medication although they had slight improvement in jaw deviation on mouth opening. These were further kept under diazepam 5 mg and amitriptyline 25 mg taken at night.

Carbamazepine 200 mg was added taken twice daily together with acetyl salicylic acid 600 mg or diclofenac tablets 50 mg 8 hourly for one month. Two (10%) patients reported no improvement and were counseled during follow-up and put under acetyl salicylic acid 300 mg or diclofenac 50 mg tablets (NSAIDs) taken 3 times a day orally. Additionally, amitriptyline 25 mg and carbamazepine 200 mg taken once daily during bed time for 3 months were given. Two 12.5% patients did not appear for follow up.

6.3 TMJ-dislocation

A total of 19 (31.1%) patients comprising of 8 (42.1%) males and 11 (57.9%) females with male to female ratio of 1:1.4 had TMJ dislocation. Their age ranged from 4 to 80 years with a mean age of 37.9 (+/- 16.6.). Fifteen (78.9%) patients had bilateral TMJ dislocations and 4 (21.1%) had unilateral dislocations (Table1). The age group 21 -30 years was the most affected with 7 (36.8%) patients followed by the 31-40 years age group with 4 (21.1%) patients (Table2). There was no patient who presented with habitual dislocation.

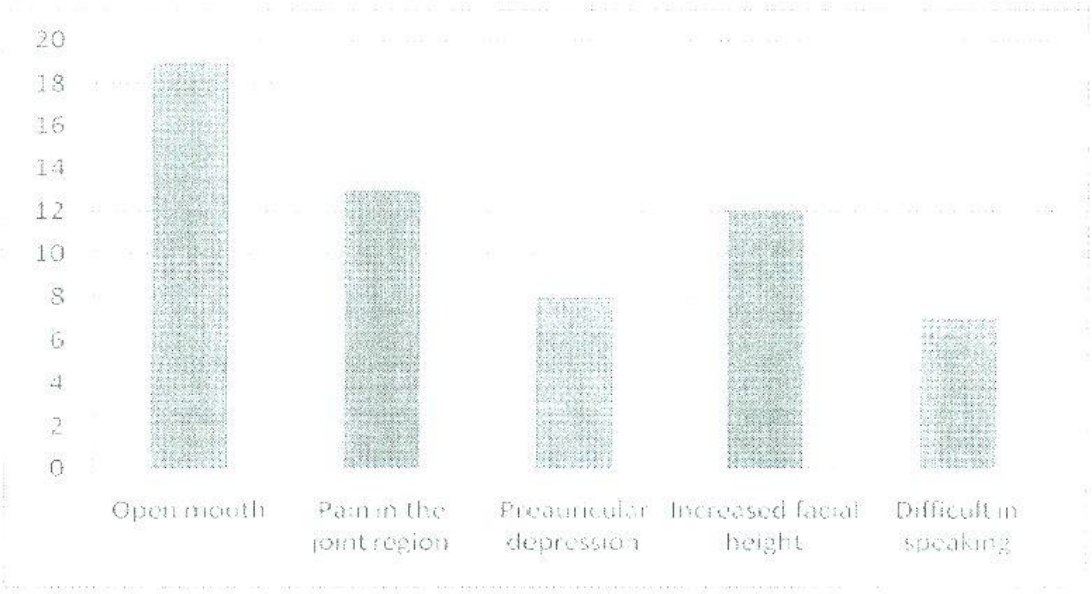
Associated factors

The commonest associated factors observed included yawning in 10 (52.6%) patients, followed by dislocation during dental procedures 3 (15.8%) patients, spontaneous dislocation in 3 (15.8%) patients, laughing in 2 (10.5%) patients and trauma in 1 (5.3%) patient (Table 2).

Major presenting signs and symptoms

Clinically all 19 (100%) patients presented with open mouth and had a mean interincisal opening width of 23 mm. Thirteen (68.4%) patients had pain in joint regions, 8 (42.1%) presented with marked depression anterior to the tragus of the ear, 12 (63.2%) had increased vertical facial height and 7 (36.8%) patients had difficult in speaking. Duration of the dislocation on presentation ranged from 2 days to 9 months, with a mean duration of 35.5 days (Figure 3).

Figure 3. Distribution of signs and symptoms in patients with TMJ-dislocation



Types of dislocation

All patients had anterior dislocations. Five (26.3%) patients had acute dislocation, 12 (63.2%) had chronic recurrent dislocation and 2 (10.5%) patients had chronic dislocation. About 3 (25%) patients had chronic recurrent dislocations with 2-4 episodes of dislocation while 9 (75%) had their TMJ dislocated more than four times.

Treatment modalities

Seventeen (89.5%) patients were treated by closed manual reduction and only 2 (10.5%) patients required surgical open reduction (Table 3).

Treatment outcomes

Recurrence was reported in 3 (15.8%) patients during the third to fourth week after closed reduction. All patients had a mean interincisal mouth opening width of 38.6 mm.

7. Discussion

This hospital-based study on TMJDs was carried out at Muhimbili National Hospital which is the largest referral hospital in the country providing specialized oral and maxillofacial surgical services. Therefore, it was expected that since patients attending for treatment at this hospital were coming from different parts of the country, the results would to a large extent reflect the real situation on TMJDs in Tanzania. The results of this study could therefore be used to decide on carrying out a community based study on TMJDs.

A prevalence of 1.3% of TMJDs that was found in this study was lower than that of other studies which reported prevalence of between 2.7% [29] and 12% [20,25,35]. The low prevalence as was found in this study could be due to the fact that unlike the other studies that were community based which covered a wider population these results are based only on hospital patients who attended treatment at the MNH. Also the slow progression nature of TMJDs, ignorance, traditional beliefs and low socioeconomic status could be among the reasons for non-reporting for treatment by some patients hence the low prevalence observed. The most commonly encountered TMJ disorders were TMJ ankylosis, myofascial pain dysfunction and TMJ-dislocation. It was generally observed that the patients most affected were aged between 20 and 50 years, with only few below 20 years or above 50 years. This study also revealed that females were more affected than males with a F: M ratio of 2:1. This concurs with what has been reported by Rieder et al [34].

TMJ ankylosis was the commonest TMJ disorder encountered in this study. The prevalence of TMJ ankylosis was 0.5% and mostly affected patients aged between 10 and 30 years with a higher preponderance for females (Table 1). Similar findings have been reported by Erol, but

these slightly differed from those reported by Chidzonga (1999) whose patients were mostly aged between 21 and 30 years[71,81]. The difference in the findings of these studies might be attributable to the fact that trauma or infections could have occurred earlier during childhood. A joint injury may not be noticed immediately and may remain symptomless because pain is uncommon.

The main causes of TMJ ankylosis in the present study were trauma 50% and infection 36.4%. Similar findings have been reported in other studies[71,80]. There were 9 patients who developed TMJ ankylosis due to trauma during childhood but it was not possible to establish from the history whether the trauma was from birth injury or a fall. Seven of these children had a 2-6 years' duration of ankylosis before presenting to hospital while the other 2 had duration of more than six years. Such a delay might have been attributable to the fact that in our societies children are mostly taken care of by either their elders (fellow children, brothers or sisters) close relatives or baby sitters. So the incidences of trauma might not be reported or might be only reported superficially therefore parents in most cases fail to determine the possible consequences of the injury. These complications of injury become apparent to parents only when the features of ankylosis in form of limited functioning or abnormal facial appearance have developed and become noticeable. Sociocultural factors might also have contributed to the delay because some of the patients first consult traditional healers for considerable period of time before deciding to come to hospital after failing to get relief.

Ten patients had facial deformities in the form of facial asymmetry with mandibular midline deviation and bird face appearance; these were mainly patients who had ankylosis for a longer duration (Figure 5). Unilateral ankylosis and level of mandibular midline deviation differs according to severity, duration and age of an individual patient. Bilateral ankylosis tends to result

in development of a bird face which is the result of bilateral growth failure of the mandible due to destruction of the growth centers in the affected condyles. However, patients might have suffered some injury to the joints, but not necessarily develop bird face because this depends on severity of the injury. Infection of the TMJ was the second most commonly observed risk factor for the occurrence of ankylosis. This was also reported by others[71,74,80]. Infection of the TMJ most commonly occurs secondary to contiguous spread from otitis media or mastoiditis. It may also result from hematogenous spread in conditions like tuberculosis, gonorrhea or pneumonia and systemic causes[75,80,81].

In this study the source of infection was due to odontogenic cause following tooth extraction. Odontogenic infection commonly occurs in the mandible compared to the maxilla. Such infections are most often sequelae of grossly carious teeth that are not treated until pulpitis progresses to periapical abscess. The process of ankylosis formation leading total loss of movement is painless and takes time (months to years) coupled with the fact that the sufferers are mainly young children, by the time patients report for medical care they can only provide a vague or partial history of the whole process.

Infection as a predisposition to TMJ ankylosis was seen mostly in females than in males. There seems to be no clear explanation for this, however, the possibility of the general health of the affected individuals contributing to the resultant infection and hence ankylosis cannot be ruled out. Topazian (1964) has also reported infection as one of the causes of TMJ ankylosis[75].

Panoramic radiographs revealed increased bone density in the joint, with complete loss of the joint space in osseous ankylosis. In fibrous ankylosis, however, it revealed reduced joint space

with mixed radiopacities and radiolusences. Nevertheless, this radiographic view did not provide adequate details regarding the ankylosis as far as movements were concerned. The panoramic view was supplemented by transcranial mouth open and mouth closed view which was good in showing the extent of movements. CT scan was another useful imaging that was also used in some few cases. Early diagnosis and treatment are crucial if the worst sequelae of this condition are to be avoided. Optimal results can be achieved only after a complete assessment and development of the long term treatment plan. The effective treatment of TMJ ankylosis requires detailed preoperative evaluation of the type and extent of the deformity for precise surgical treatment planning.

A variety of techniques for the treatment of TMJ ankylosis have been described. These includes gap arthroplasty, interposition arthroplasty using temporal muscle fascia, ear cartilage or alloplastic material[70,79]. Others include, autogenous costochondral graft (CCG) and free vascularized whole-joint transplants. Several prosthetic options for TMJ reconstruction exist, which include; silastic sheet materials, condylar prosthesis, custom glenoid fossa implants, articular eminence implants, and mandibular reconstruction plates with condylar heads[80,87]. There is, however, no consensus in the literature about the best treatment in these cases; results have varied and recurrence rates are still high, which is a major problem when treating this condition[18]. In this study only gap arthroplasty was done with a gap of about 1.5-2 cm. This gap was more than 1 cm because several studies have reported that a gap arthroplasty of 1 cm or less is associated with reccurrences[71,75]. This treatment modality was resorted to because most of the patients preferred it more than any other for varied reasons. The most important reason to this group of patients' preference of this treatment modality was the fact that it entailed undergoing

only one operation. After the initial period of post operative exercises the patient would hardly need any further treatment. In fact majority of the patients came from low social economic class families and would not manage to comply with other sophisticated treatment regimens that would require substantial initial monetary input followed by constant follow-up visits.

During surgery it is important to create a gap of equal dimension both laterally and medially, so that the possibility of reankylosis due to osteophyte bone formation and eventual contact is avoided. Intraoperative interincisal opening widths ranging between 3.5 cm and 4 cm were achieved in all patients. Similar intraoperative mouth opening width was also reported by Vasconcelos et al.[79]. It was observed that this gap was enough to prevent recurrence provided light mouth opening physiotherapy was initiated on the third postoperative day. Such mouth opening exercises were carried at least 3 times per day for the first three days before initiating aggressive mouth opening exercises. Some authors prefer to wait 5 to 7 days for pain and edema to subside and initial healing of soft tissues to take place before implementing physical therapy, since early mandible mobilization may cause bleeding and hematomas, which would delay healing[79]. In this study such complications were not encountered. It was necessary to perform both condylectomy and coronoidectomy in patients who had type IV ankylosis because condylectomy alone could not suffice to achieve a desirable maximum intraoperative mouth opening width of more than 3 cm. Type IV was noted in patients who had a long standing duration of ankylosis of not more than 4 years. Type IV ankylosis is the one in which there is true ankylotic block and the TMJ anatomy is deranged because the ramus is fused to the skull base.

It was also noted that type IV was associated with elongated coronoid process usually growing under the zygomatic arch and shortened temporalis muscle fibers that limit the movement of the

mandible after condylectomy alone despite the gap. Therefore doing both condylectomy and coronoidectomy frees obstacles that could prevent maximum intraoperative mouth opening. It was observed that condylectomy alone was adequate in types II and III ankylosis when a gap of 1.5 – 2 cm was maintained because it sufficed to achieve an intraoperative mouth opening width of more than 3 cm. However, it was also noted that the duration for type II and III ankylosis was less than 4 years.

From this finding it was revealed that the treatment modality was also determined by the duration of the ankylosis. The causes of TMJ hypomobility are not only trauma and infection as it has generally been reported in a wide variety of literature, but also tumors within and around the joint which can produce a profound destruction of the joint structure either by pressure compression, erosion, fibrous or by osseous deposition. In the current study two patients had tumors invading the joints, one had mucoepidermoid carcinoma of the parotid gland and another had a soft tissue tumor which was suspected to be chondrosarcoma possibly arising from the articular disc of the joint. These tumors had marked joint space obstruction with subsequent joint movement limitations.

Early treatment of ankylosis once diagnosed is strongly recommended[87]. However, in some patients this may not be possible because of various reasons. A 4 years old boy could not be treated because parents refused to allow the patient to undergo CCG. Another 33 years old female patient was not ready to undergo surgery. Ignorance and cultural beliefs are in most instances the underlying reasons behind such unfortunate decisions by the patients or those who take care of them. Due to short duration of follow ups in this study, it was difficult to conclude on long term outcomes. The most important outcomes were the change in the patients' quality of life

following improved function, few recurrences, diet consistency, improved oral hygiene and MIO. The recurrence of 18.2% reported in this study was lower than that of 53% reported by Topazian when gap arthroplasty was carried out[75]. The low rate of recurrences obtained in this group of patients could be due to the wide gap which was created and mouth opening exercises that were started early postoperatively than in other studies[71,75]. Furthermore, the recurrences which were observed were mostly due to non compliance in some of the patients to consistently perform postoperative mouth opening exercises regimen. The most frequent problems that were encountered during surgery for the treatment of ankylosis were limited mouth opening during intubation necessitating the patients to undergo tracheostomy, and intraoperative bleeding. Injury to branches of facial nerves and injury to the parotid gland are other potential complications, which however, were not encountered in this study.

Myofascial Pain Dysfunction (MPD) encompasses the most common non-infective pain conditions of the orofacial region. In this study it was revealed that MPD predominated in females mostly in the 21-40 years age group. This concurs with findings from other studies[4,30]. Reasons that have been advanced as to why females are more affected by MPD include the fact that MPD is associated with emotional stress which is believed to be higher in females compared to males. Le Resche associated the MPD with hormonal changes and the use of exogenous hormones, especially women using contraceptives for family planning. It is also true that females seek health consultations more often than males[27]. The diversity of MPD prevalence in different studies is attributed to differences in the age groups, the sample sizes and composition of the study population[4,9].

The results of this study revealed that about 65% of the patients showed clinically detectable tenderness in the muscles of mastication. These findings are consistent with those in other studies where tenderness was reported as the commonest sign[2,7]. It was found out that 40% of patients with positive masticatory muscle tenderness also had TMJ sounds (Figure 2). In his study Conti et al. (1996) also noted an association between joint sounds and joint tenderness [36]. It was also observed that despite the severe tenderness of the masticatory muscles and reduced mouth opening the articular surfaces of the joint and joint spaces were normal. These findings correlate with similar results from other studies[28,30].

Parafunctional habits especially teeth grinding were found to be an associated factor for the development of MPD as it was noted in 40% bruxists. Nevertheless, the prevalence of teeth grinding is difficult to determine, since quite often the patients are unaware of having the disorder which can lead to under or overestimation of the magnitude of the problem[1]. Thirty five per cent of patients with MPD in this study had history of trauma which they associated with their current conditions. Whiplash injuries have been reported in the literature to be a contributing factor in the development of signs and symptoms for MPD[21]. In this study malocclusion was not observed to be an etiological factor for MPD. Similar observation was also reported Le Resche[21].

Treatment modalities described in the literature for this disorder include medication using analgesics, anti-inflammatory, muscle relaxants and antidepressants. Others are occlusal splints, physiotherapy, behavioral-cognitive treatment, hypnosis, transcutaneous electrical nerve stimulation and acupuncture. Surgery should be considered only if all conservative treatments

were unsuccessful [3,5]. In this study about 90% of patients were put on medications, and were followed up for a period of three months. There was remarkable improvement of signs and symptoms of MPDs. Medications used in this study were Non-steroid anti-inflammatory drugs, including acetyl salicylic acid and diclofenac tablets. Muscle relaxants (diazepam tablets) and antidepressants (amitriptyline and carbamazepine tablets) were also used in some patients.

Treatment outcomes were classified into 4 categories namely: improved, no change, deteriorated and discontinued. No patients with deterioration of symptoms were observed, while 16 (80%) patients were assessed as improved, 2 (10%) patients were assessed as no change, and they were referred for psychotherapy and 2 (10%) patients absconded. It was also observed that there was little improvement of signs and symptoms when analgesics (NSAIDs) and muscle relaxant (diazepam) were used alone. Remarkable but gradual improvement was obtained when the above medications were combined with amitriptyline (antidepressant). This suggests that no single drug is superior and can be used alone in the treatment of MPD.

TMJ dislocation was the third most common TMJD observed in this study. It was revealed that, TMJ dislocation occurred more in the 21 – 40 years age groups than in the other age groups. The reason could be that there may be some asymptomatic TMJ disorders that predispose to dislocations (e.g. laxity of joint ligaments). These findings are similar to the findings of Ugboko who in his study reported that the peak incidence of TMJ dislocation was in the 20-29 years age group. The present study showed that TMJ dislocation was more prevalent in females compared to males which are similar to what was reported by Noorl-Wahab[63], but different from the findings of Ugboko (2005) who reported that males dominated[60].

Excessive mouth opening while yawning was the commonest 52.6% cause of TMJ dislocation irrespective of the clinical subtype. These findings are in accordance with findings in other studies[59,61]. TMJ dislocation that has been observed to occur during tooth extraction 15.8% could be a result of undue forces applied to the mandible when extracting lower wisdom teeth, or the use of inappropriate techniques. The use of over sized forceps when extracting the lower posterior teeth necessitating excessive mouth opening by the patient or exerting excessive amounts of force during extraction of mandibular teeth without proper support of the jaw with the left hand often results in TMJ dislocation[60,62].

Spontaneous TMJ dislocations were found in patients who had a history of using antipsychotic medications and antiepileptic drugs. This observation could be attributable to the fact that some drugs used in the treatment of psychosis and epilepsy have extra pyramidal effects which could contribute to TMJ dislocation[12,61,63]. In all TMJ dislocations observed in this study the condyle was anterior to articular eminence; this could be cause-related because the majority was due to excessive mouth opening. Failure to close the mouth, severe pain and difficult in speaking were the most common signs and symptoms in acute TMJ dislocation because the condyle becomes locked anterior to the articular eminence (Figure 4). This locking action is maintained in this position by spasm of masticatory muscles.

Muscular spasms are accompanied by severe pain and difficult in speaking and chewing.

The study revealed that despite the inability to close the mouth, the pain and difficult in speaking and eating patients stayed long before reporting for treatment. Some reported after 1 to 2 days but others after 1 to 9 months of dislocation. Similar to the other aforementioned conditions ignorance, cultural beliefs and social-economic reasons were behind such delays. Lack of

expertise in the primary centers (dispensaries, health centers and district hospitals) is another major problem facing majority of the patients. Delays of referrals from the lowest centers to the district hospital with its cost implications in most instances are the reason behind delays in reporting at the maxillofacial center (MNH).

Closed reduction was done in all patients with acute TMJ dislocation with success. Delayed treatment of acute TMJ dislocation predisposes the patient to chronic dislocation which can no longer be treated by closed reduction. Conservative approaches to management remain quite effective despite of the duration and clinical subtype. Open reduction was necessary in 10.5% of the patients after closed method had failed; however, the condyles were not resected. The best choice of surgical technique should be determined by proper clinical evaluation and the need to avoid or minimize postoperative morbidity. Three patients, all males, reported recurrences after closed reduction. However, closed reduction was repeated followed by IMF using rubber traction which was removed 7 days later without any further recurrence. Therefore in spite of the closed or open reduction, IMF may be necessary to stabilize the muscles in position to avoid recurrences. Literature has documented the application of IMF but do not mention specific period after which the IMF should be released[63]. In this study no patient reported back because of recurrences. No patient with habitual TMJ dislocation was encountered in this study.

8. Conclusion

The temporomandibular joint disorders that were seen in this study occurred at a rather low prevalence of about 1.3%. TMJ ankylosis, MPD and TMJ dislocation were the only TMJD found. TMJ ankylosis which was the commonest TMJD was mainly a result of trauma and infection.

Patients with TMJ ankylosis presented with limited mouth opening, poor oral hygiene and facial disfigurement. The treatment rendered to these patients was surgery (condylectomy or condylectomy and coronoidectomy). The rate of recurrence was low.

MPD was mainly associated with bruxism, trauma and loss of posterior teeth contact. Patients presented with complaints of pain and tenderness around the region of the masticatory apparatus which was occasionally referred to the head and neck region. The treatment was mainly medication. Anterior dislocation was the only type of TMJ dislocation found in these patients. The commonest causes of TMJ dislocation were excessive mouth opening when yawning. Closed manual reduction was successful in majority of the cases and there was no case of habitual dislocation. However, long standing dislocations required surgical manipulation under general anesthesia.

9. Recommendations

Although the prevalence of TMJDs is low, they still remain a health problem which needs creation of public awareness. Strengthening primary health facilities and capacity building to the existing health service providers on early diagnosis and treatment is necessary in order to reduce adverse sequelae of TMJD.

Table 1. Distribution of patients with TMJ disorders according to age and sex

TMJ-disorders	Age groups and Sex																Total	%
	1-10		11-20		21-30		31-40		41-50		51-60		61-70		71-80			
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F		
Myofascial pain dysfunction	0	0	0	2	3	5	1	4	2	1	0	2	0	0	0	0	20	32.9
TMJ dislocation	0	0	0	1	4	3	1	3	2	1	1	1	0	1	0	1	19	31.1
TMJ ankylosis	1	3	2	5	4	2	1	2	0	1	0	0	0	0	1	0	22	36.0
Total (N)	1	3	2	8	11	10	3	9	4	3	1	3	0	1	1	1	61	100

Table 3. Distribution of types of treatment provided according to TMJ disorders

Disorders	Medicine		Occlusal adjustment		Closed reduction		Surgery						Others		Total
							Open reduction		Condylectomy & coronoidectomy		Condylectomy				
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	
Myofascial pain Dysfunction	6	12	0	1	0	0	0	0	0	0	0	0	0	1	20 (32.8%)
TMJ dislocation	0	0	0	0	8	9	0	2	0	0	0	0	0	0	19 (31.1%)
TMJ ankylosis	0	0	0	0	0	0	0	0	2	5	5	6	2	2	22 (36.1%)
Total	6	12	0	1	8	9	0	2	2	5	5	6	2	3	61 (100%)

Table 4. Treatment outcomes for patients with TMJ ankylosis

No.	Age	Sex	Unilateral or bilateral	Treatment provided	Preop. MIO	Intraoperative MIO	Postoperative MIO 3 weeks	Follow up 3 months
1.	20	F	Unilateral (right)	Surgery	< 10 mm	39 mm	35 mm	39 mm
2.	31	M	Unilateral (right)	Surgery	< 5 mm	44 mm	40 mm	41 mm
3.	10	F	Unilateral (left)	Surgery	<10 mm	39 mm	39 mm	37 mm
4.	9	F	Unilateral (right)	Surgery	<10 mm	38 mm	30 mm	10 mm
5.	22	F	Unilateral (left)	Surgery	<8 mm	40 mm	33 mm	30 mm
6.	29	F	Unilateral (left)	Surgery	<20 mm	42 mm	40 mm	39 mm
7.	13	F	Unilateral (left)	Surgery	<10 mm	40 mm	36 mm	34 mm
8.	12	M	Unilateral (right)	Surgery	20 mm	41 mm	40 mm	41 mm
9.	21	M	Unilateral (right)	Surgery	<10 mm	45 mm	32 mm	36 mm
10.	12	F	Bilateral	Surgery	0 mm	37 mm	30 mm	8 mm
11.	25	M	Unilateral (left)	Surgery	<10 mm	45 mm	39 mm	42 mm
12.	18	F	Unilateral (right)	Surgery	11 mm	38 mm	28 mm	30 mm
13.	28	M	Unilateral (left)	Surgery	<10 mm	46 mm	35 mm	42 mm
14.	13	M	Unilateral (right)	Surgery	<10 mm	38 mm	34 mm	6 mm
15.	7	F	Unilateral (right)	Surgery	<5 mm	30 mm	25 mm	28 mm
16.	34	F	Unilateral (left)	Surgery	<8 mm	45 mm	32 mm	36 mm
17.	15	F	Unilateral (left)	Surgery	<15 mm	36 mm	33 mm	33 mm
18.	47	F	Unilateral (right)	Referred	<20 mm	-	-	-
19.	75	M	Unilateral (right)	Referred	<9 mm	-	-	-
20.	22	M	Bilateral	Surgery	<10 mm	43 mm	31 mm	12 mm
21.	33	F	Unilateral (right)	Postponed	<10 mm	-	-	-
22.	6	M	Unilateral (right)	Postponed	0 mm	-	-	-

Preop-preoperation, intraop-intraoperative, postop-postoperation MIO –maximum interincisal opening width, physith-physiotherapy. Patients number 18,19,21 and 22 were not treated.

Figure 4A. A 38 years old female patient with a two week duration bilateral TMJ dislocation

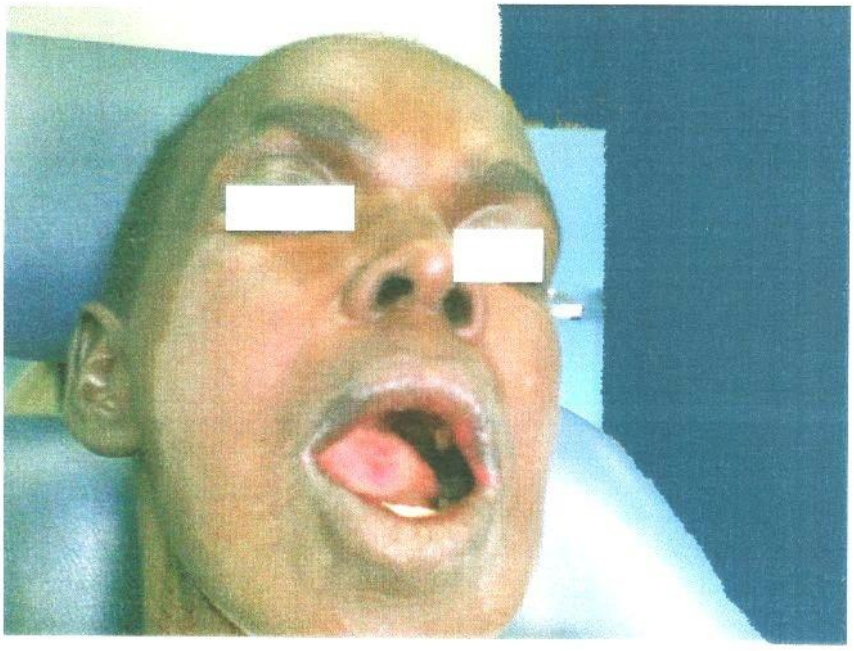


Figure 4B. Radiological appearance of TMJ dislocation in the patient in Fig. 4A

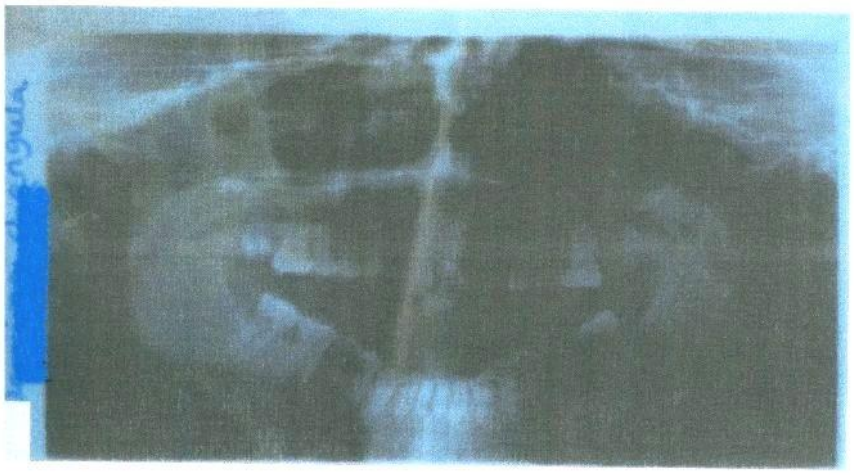
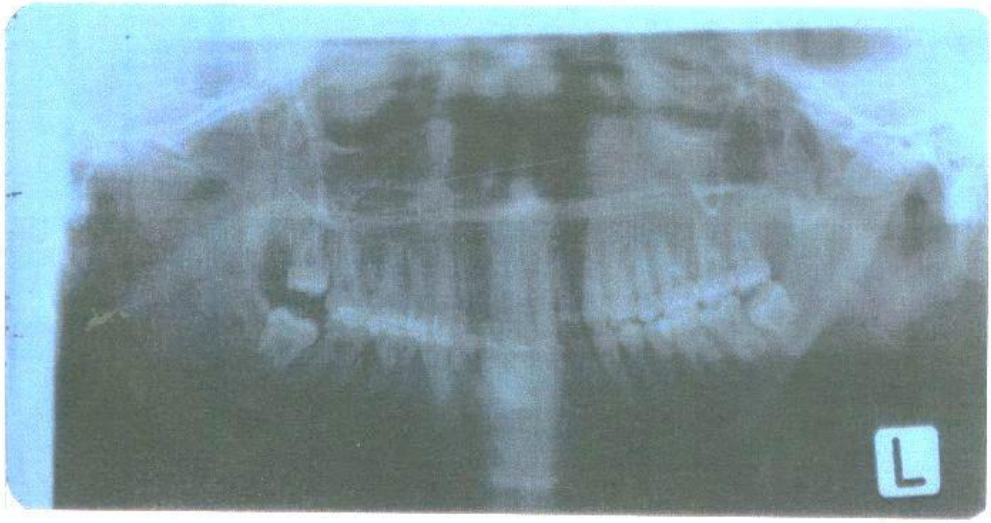


Figure 5A. A 34 years old female patient with unilateral (left) TMJ ankylosis



Figure 5B. Radiological appearance of TMJ ankylosis in the patient in Fig. 5A



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11. Appendices

Appendix 1

11.1 Questionnaire

1. Name of the patient/ questionnaire ID No---------- H hospital registration No----------

2. Gender (male/female) ---------- Marital status---------- Occupation-------

3. Age of the patient in years------ Level of education 1=Not attended school 2=Primary School 3=Secondary school 4= Collage----------☐

4. Address ----------

Chief complaint (If any of these) 1=YES, 2= NO

5. Clicking sound in joint area----------☐

6. Unable to open the mouth----------☐

7. Unable to close the mouth----------☐

8. Pain in the facial region----------☐

Side affected

9. Right----------☐

10. Left----------☐

11. Both----------☐

12. Does the patient has signs of myofascial pain 1 =YES, 2= NO----------☐

If no 7 above is Yes categorize the cause below by indicating 1= YES, 2= NO

13. Bruxism----------☐

14. Infections----------☐

15. Wearing artificial teeth----------☐

16. Poor restorations---------- ☐

17. Others ---------- ☐

18. Does the patient has dislocation 1= YES, 2= NO---------- ☐

If no 9 above is Yes what was the cause (Choose 1= YES, 2= NO

19. Spontaneous---------- ☐

20. Yawning---------- ☐

22. Others---------- ☐

23. Is the patient unable to open the mouth 1= YES, 2= NO---------- ☐

If no 11 above is Yes what was the cause (Choose 1= YES, 2= NO

24. Trauma to the face---------- ☐

25. Infections---------- ☐

26. Previous surgery---------- ☐

27. Others---------- ☐

28. What is the duration of the condition---------in days? / years?

What are the reason(s) for consultation? (choose 1= YES, 2= NO

29. Pains---------- ☐

30. Unable to eat---------- ☐

31. Disfigurement---------- ☐

32. Disturbing sounds---------- ☐

33. Others---------- ☐

34. Have you ever had such problem before 1=YES, 2= NO---------- ☐

35. How often-1=once 2=twice 3=thrice 4=more than three times---------- ☐

36. Have you ever attended for treatment anywhere 1=YES, 2= NO---------- ☐

If no17 above is Yes, where (Choose 1= YES, 2= NO

37. Hospital---------- ☐

38. Health centre---------- ☐

39. Dispensary---------- ☐

40. Not attempted---------- ☐

41. Others---------- ☐

42. Width of mouth opening before treatment----------in mm

43. Width of mouth opening after treatment----------in mm

44. Abnormal joint findings on radiograph 1=YES, 2= NO---------- ☐

If no 21 above is Yes indicate among the choices below (Choose 1= YES, 2= NO

45. Anterior disc/ condyle displacement---------- ☐

46. Fractured condyle---------- ☐

47. Fibrous tissue formation in the joint space---------- ☐

48. Bone formation in the joint space---------- ☐

49. Osteolytic changes of the articular surfaces---------- ☐

Types of treatment offered 1= YES, 2= NO

50. Surgery---------- ☐

51. Medications---------- ☐

52. Manual reduction---------- ☐

53. Others ---------- ☐