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Occlusion Dynamics and Temporomandibular Joint Disorders – A Narrative Review

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Abstract

Temporomandibular disorder is a common condition affecting the temporomandibular joint that causes pain and discomfort. There are multiple factors leading to its aetiology. A relationship between malocclusion and temporomandibular disorders has been upheld in the past but has never been convincingly established. Various other environmental, social, and psychological factors, stress, trauma and parafunctional habits are also causative factors in temporomandibular disorder with bruxism being the most common. This narrative review aims to understand if dental occlusion is an etiological factor in temporomandibular disorder. However, various temporomandibular disorders can lead to secondary changes in dental occlusion. This can exhibit as occlusal discrepancies like posterior open bite, anterior open bite, midline deviation and facial asymmetry. These differences must be clearly distinguished. There is a necessity for advanced and extensive research involving various aspects of dental occlusion and its significant relation to being a causative factor in the onset of temporomandibular dysfunction to reach a definitive conclusion.

Keywords:TemporomandibularJoint,TemporomandibularDisorder, Occlusion, Malocclusion,Bruxism, OcclusalSplint

Introduction

The masticatory system is defined as a functional complex characterized by components including bones, teeth, soft tissues, muscles, tendons, ligaments, and discs.¹ The temporomandibular joints on both sides enable translational and rotational movement of the mandible. The movement of the mandible activates the

jaw muscles which provide jaw movement and imparts force on the teeth.¹

The temporomandibular joint is made of hard and soft tissues and is one of the most complex joints in the human body. It connects the mandible with the temporal bone with articular surfaces between which the articular disc is located.² It consists of two joints connecting the jaw bone to the skull. The main components include the articular disc, joint capsule, mandibular condyles, articular surface of the temporal bone and the temporomandibular ligament, stylomandibular ligament, sphenomandibular ligament, and lateral pterygoid muscle.³ The articular disc comprises dense fibrocartilagenous joints and has an upper and lower compartment.³ The compartments are synovial cavities and lined by synovial membranes which produce fills cavities.³ synovial fluid that the Each temporomandibular joint is classed as а "ginglymoarthrodial" joint since it is both a hinging joint and a sliding joint.³ The condyle of the mandible articulates with the temporal bone in the mandibular fossa.³

According to the glossary of prosthodontic terms, temporomandibular joint disorder (TMD) is defined as a condition producing abnormal, incomplete or impaired function of the temporomandibular joint.⁴ These are a heterogeneous group of conditions affecting the temporomandibular joints (TMJ), the jaw muscles and the related structures.⁵ Temporomandibular disorders are a major cause of non-dental pain in the orofacial region. Population-based studies show that Temporomandibular disorders affect 10% to 15% of adults.⁶ It is the third most common oral illness in society⁷

The aetiology of temporomandibular disorder is multifactorial, including biological, environmental, social, emotional, and cognitive stimulations.⁶ Factors

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mostly associated with this are psychological factors, malocclusion, oral parafunction, oral habits, trauma,⁴ autoimmune disorders, sleep apnoea, and psychiatric illness.⁶ Proper functioning of the temporomandibular joint is responsible for basic physiological activities such as speaking, swallowing, and eating. Dysfunctions within the joint are reflected as pain, chronic headache, crackling or clicking sounds and difficulty with joint mobility.²

Dental occlusion is believed to be the core of dentistry⁵. The term occlusion is used to define different entities: The Angle's classification, the anatomic or orthodontic jaw relation, the static contact between the teeth of the upper and lower jaws, the dynamic contact between the teeth of the upper and lower jaws and the prosthetic classifications, specifically in cases of complete or partial edentulous arches⁸

The relationship between dental occlusion and temporomandibular disorders is still a topic of speculation in dentistry. Experts in the field of orofacial pain seem to have adopted a biopsychosocial model of temporomandibular disorder including it within the broader aspects of orofacial pain, while professionals such orthodontists, as restorative dentists. prosthodontists focusing on the study of dental occlusion are inclined to not accept concepts that diminish the importance of occlusion.5 The action of the adjacent masticatory muscles and tongue plays an important role in the maintenance of proper occlusion. Most of the research conducted involves centric relation, maximum intercuspation and mediotrusive interferences of occlusion on temporomandibular disorders, but much association has not been established,⁵ however certain dental anomalies such as anterior open bite, class II malocclusion and unilateral posterior cross bite have been associated with greater risk а of

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temporomandibular disorder onset, but sufficient evidence is not available to confirm it.⁹ Therefore, it is not believed that temporomandibular disorder results from any particular type of malocclusion. It is extremely important to identify the true etiology and early intervention is required to prevent extensive damage to the joint and surrounding tissues. This study aims to understand the relationship between occlusion and temporomandibular disorders. The study objectives are to study the effect of occlusion in causing temporomandibular disorder. Study the secondary changes in occlusion as a result of temporomandibular disorder and understand appropriate diagnosis and management of temporomandibular disorders.

Methodology

To review the literature, studies were selected from PubMed, Scopus, Web of Science and Google Scholar from 2014 to the latest publishes, to provide a comprehensive overview of current knowledge on the relationship of occlusion to temporomandibular disorders. The review focused on evaluating the correlation of occlusal disharmony as a causative factor for temporomandibular disorder and secondary changes in occlusion as a consequence of temporomandibular disorder. The search terms included: "Occlusion", "Malocclusion", "Temporomandibular Disorder", "Temporomandibular Joint", "Bruxism", "Posterior Open Bite", "Anterior Open Bite" and "Occlusal Splint". The research encompassed, case reports, laboratory studies, clinical studies and systematic reviews.

Definition of Temporomandibular Disorders

According to the American Dental Association, 1983, temporomandibular disorders are defined as a set of diseases and disorders that are related to alterations in the structure, function, or physiology of the masticatory system that may be associated with other systemic and

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comorbid medical conditions.¹⁰ The musculoskeletal structures of the masticatory system, neurological structures and cervical structures¹⁰ have a paramount role in the normal and abnormal functioning of the temporomandibular joint. Therefore, it is a blanket term used in defining one of the most prevalent orofacial pain disorders, which may be arthogenous and/ or myogenic in origin.

Prevalence of Temporomandibular Disorders

Various cross-sectional and retrospective studies conducted in this field reveal the prevalence of temporomandibular disorders to be between 5% and 12%.11 Unlike other unusual chronic pain, the prevalence rate of temporomandibular disorders is higher among younger people and it is twice as prevalent in women as compared to men.¹¹ In 2013, the TMJ Association of USA concluded that 35 million people in the US are affected with disorders associated with temporomandibular joint and masticatory muscle. An epidemiological study has shown that at least 75% of the population presented with one symptom and 30% with two or more symptoms.¹² Meta- Analytical studies conducted on subjects with temporomandibular disorders based on geographic region and patient age concluded that geographical location plays a significant role in the epidemiology of temporomandibular disorder with it being higher in South America (47%) compared to Asia (33%) and Europe (29%). It also suggested that temporomandibular disorders were highest in the age group of 18-60 years followed by 60+ age group and least in the age group less than 18 years.¹³ However, a significant difference was not observed when comparing the different age groups. A Brazilian study on prepreparatory school students showed a very high prevalence of 89.9%. Another study in India assessed temporomandibular disorder prevalence to be 97% in

health and science students which could be due to stresses from college.¹⁴ The widespread rate of temporomandibular disorder is an issue that must be considered and dealt with.

Signs and Symptoms of Temporomandibular Disorders

Temporomandibular disorders can exhibit a combination of one or more of these symptoms including severe pain in the temporomandibular joint, joint sounds or clicking sounds, difficulty in mouth opening, chewing difficulty, limited mobility, bruxism, sensitive teeth and burning mouth.¹⁵ The nature of the symptoms, the extent of pain, the duration of the disorder and the severity of the disorder may vary for each individual.

Research has been concentrated in four areas which include acute (develops suddenly) versus chronic (develops over a while), high-impact chronic pain, as a multi-system disorder, and pain as a disease.^{16,17} Since 2014. the DC-TMD (Diagnostic Criteria for Temporomandibular Disorders) is the most accepted classification for temporomandibular disorders.^{16,17} It consists of two axes: Axis 1 for physical diagnosis and Axis 2 assessment for psychosocial status and painrelated disability.¹⁸ It further subclassifies temporomandibular disorders into joint pain, joint disorders, joint diseases, fractures, and congenital or developmental disorders.¹⁹

Impact of Occlusal Changes on Temporomandibular Disorder

Functional disturbances in the masticatory system develop after an event which may be local such as occlusal trauma, placement of crowns, prosthetic appliances, orthodontic corrections, etc, or systemic factors like emotional stress. Scientific studies from the 1950's suggested occlusal conditions can affect masticatory muscle function and electromyographic studies were used to prove a correlation.²⁰ However, it was not until the late 1980s that professionals began to recognise the complexity of the temporomandibular joint disorder and since then there has been extensive research to find an effective way in the management of the disorder.²¹ But there would be no single etiology that would account for all the signs and symptoms and occlusion changes in can be secondary to temporomandibular disorder. This draws emphasis on the fact that there are two explanations for these findings and that no single treatment can have an effect on all the aetiologies.

Etiological Factors Leading To Temporomandibular Disorder

Five major factors have an association with temporomandibular disorders and that include occlusal condition, trauma, emotional stress, deep pain input and parafunctional habits. The occlusal relation of the teeth with the other facial structures is in a vertical direction but during parafunctional habits such as bruxism heavy forces are applied which causes the mandible to shift from side to side. This imparts a horizontal force which can be damaging to the surrounding structures.²¹

Dental occlusion reflects unique information contained in the centre of the brain producing neurological signals originating from periodontal, dental and soft tissue receptors. This complex is controlled by the central nervous system to adjust the position of the mandible and movement according to the peripheral inputs.¹ The mandibular position is an important factor in maintaining inter-arch and musculoskeletal relations because most functions occur near the intercuspal position. The instability of the mandibular condyles influences temporomandibular disorders. Most stable centric occlusion occurs when mandibular condyle is located in the mandibular fossa, at the base of the articular tubercle of the temporal bone.¹² During chewing or other functional activity, the occlusal forces are unevenly distributed on both sides which can create an imbalance. Studies from 2014 prove that there is a significant relationship between distance of the centre of occlusal forces, asymmetry of occlusal forces and pain in the temporomandibular region. ¹²

Functional muscle activity consists of a harmonious well-controlled contraction and relaxation of muscles involved in jaw function. However, parafunctional habits result in strained muscle contraction over a long period. Parafunctional habits are mostly subconscious in the form of bruxism or clenching. It mainly occurs during sleep. Instrument-based studies on symptomatic and non-symptomatic subjects show that myofascial pain was only detected among subjects with sleep bruxism.²² Various factors influence the bruxing activity with emotional stress being an important factor. Other etiological factors include genetic predisposition, disturbances in the central nervous system and use of certain medications like antidepressants.²¹ Parafunctional habits inhibit normal blood flow within the muscles resulting in symptoms of fatigue, spasm and pain.²³ Except for bruxism other parafunctional habits like nail biting and gum chewing do not correlate with temporomandibular disorder.

Secondary Occlusal Changes from Temporomandibular Disorder

Changes in occlusion can occur as an outcome of temporomandibular joint pathology or muscle-related condition. The changes include posterior open bite, anterior open bite, crossbite, midline deviation and facial asymmetry.

The posterior open bite may be seen in joint pain, joint disorders, joint diseases and fractures.¹⁹ This occur as a displacement of the mandibular condyles. Posterior disc

displacement, posterior displacement of the posterior fragment after a TMJ disc fracture and increased posterior thickness of the retrodiscal tissue can all cause a disturbance in mandibular closure hence causing a posterior open bite.²⁴ Masticatory muscle disorder such as myalgia is considered by trigger points in the inferior lateral pterygoid and may cause mild occlusal changes which can be presented as ipsilateral posterior teeth and premature contact of contralateral anterior teeth.¹⁹ Immediate postoperative surgeries to the temporomandibular joint can also exhibit posterior open bite.²⁴ An anterior open bite from temporomandibular disorder should be distinguished from nontemporomandibular disorder causes such as tongue thrusting habit. This may occur secondary to degenerative joint disorders, resorption of condylar structures, systemic arthritis and fractures.¹⁹ Other occlusal changes such as facial asymmetry and shift in midline can occur from various benign and malignant neoplasms affecting the temporomandibular joint hard and soft tissues. It can also be exhibited as an aftermath of trauma or fracture or even congenital or developmental disorders like aplasia, hyperplasia and hypoplasia of the condyles.¹⁹

Management of Temporomandibular Disorders

Appropriate diagnosis is mandatory for the identification of the symptoms and optimal treatment results. Physical examination of the muscle structures and temporomandibular joint with assessment along imaging in with radiologic severe patients temporomandibular disorder should be used to reach a diagnosis. Physical examination includes measuring the mandibular opening range of motion, and palpating the anterior temporalis muscle and the temporomandibular joint.

There are invasive and non-invasive treatment approaches in the management of the disorder. Noninvasive approaches include patient education, pharmacological intervention, occlusal splints, topical ointment, physical therapy, cognitive behavioural therapy and bio behavioural approach.²⁵ Invasive treatment approaches include intra-articular injection, orthodontic intervention, dry needling, acupuncture therapy and surgical interventions.²⁵

Occlusal splints are also known as night guards and oral appliances. These are beneficial for preventing harmful effects from bruxism, decreasing muscle activity and reduces tension. Occlusal splints prevent the patient from achieving maximum intercuspation which in turn positions the jaw properly facilitating seating of condyle in centric relation.²⁶ Therefore, the patient's habit will be disrupted and they will not clench their teeth protecting the temporomandibular joint, teeth and associated musculature.²⁶ Occlusal orthotics with and appliance that can be used at night is beneficial in the treatment of masticatory muscle pain, temporomandibular joint pain, restricted mobility and temporomandibular dislocation. This along with improved sleeping position can have a beneficial impact on people who wake up with temporomandibular disorder pain.²⁷ Different therapies can be followed in the management. Medicative therapy includes the administration of non-steroidal antiinflammatory drugs and steroids.^{27,28} Passive approach includes jaw muscle stretching exercises and physiotherapy modalities including heat. cold. ultrasound, etc.^{27,28} The Active approach includes head and neck posture improvement exercises and indirect approach includes performing cervical therapies like manual therapies and neuromuscular re-education.^{27,28} Patient compliance is essential in symptom management.

Most patients opt for conservative therapies like self-

care, occlusal splints, and physical therapy instead of orthodontic and surgical approach because it permanently alters the joint anatomy.

Conclusion

Occlusal harmony is a vital part of the masticatory system. There is insufficient information proving occlusion to be an absolute etiological factor in causing temporomandibular disorder. It also cannot be considered irrelevant to the adequate functioning of the temporomandibular joint and surrounding masticatory musculature. Parafunctional habits such as sleep bruxism exhibit a negative impact on the occlusion of teeth, joints and muscles. It is most likely that the patients with temporomandibular disorder will present with one or more of the etiological factors. Secondary changes as a result of temporomandibular disorders also have to be carefully looked upon. Precise diagnosis is mandatory in attaining a suitable management of the disorder. Management of the disorders also has multiple aspects based on the extend and severity of the disorder and patient compliance. It is equally important to identify disorders that mimic a temporomandibular disorder that can harm the patient's symptoms including the general health and provide patients with therapies that offer a long-term symptom relief.

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