Risk factors of temporomandibular disorders: literature review

Faktor-faktor risiko gangguan temporomandibular: tinjauan literatur

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ABSTRACT

Over recent years temporomandibular disorders (TMD) have been reported to increase in numbers. The TMD is a condition that causes the temporomandibular joint and or chewing muscles not to function normally and is often observed in combinations; covers a large area and has major symptoms like pain, followed by limitations in the mandibular movement, and other clinical problems. If the disorder is not treated immediately, it will cause pathological changes and create more complex conditions. Although the risk factors of the TMD are still debated, they nonetheless have been found to be in the development of the disorders. In short, identifying, understanding, and controlling the risk factors may help to prevent the TMD, and more benefits lead to a successful treatment.

Keywords: temporomandibular joint, temporomandibular disorders, risk factors

ABSTRAK

Selama beberapa tahun terakhir gangguan temporomandibular (GTM) telah dilaporkan meningkat jumlahnya. Gangguan ini adalah suatu kondisi yang menyebabkan sendi temporomandibula dan atau otot pengunyah tidak berfungsi secara normal dan sering diamati dalam kombinasi; cakupan areanya luas dan memiliki gejala utama seperti nyeri, diikuti oleh keterbatasan gerakan mandibula, dan masalah klinis lainnya. Jika gangguan tersebut tidak segera diobati, maka akan menyebabkan perubahan patologis dan menciptakan kondisi yang lebih kompleks. Meskipun faktor risiko GTM masih diperdebatkan, namun faktor tersebut ditemukan dalam perkembangan gangguan tersebut. Singkatnya, mengidentifikasi, memahami, dan mengendalikan faktor risiko dapat membantu mencegah GTM, dan lebih banyak manfaat mengarah pada pengobatan yang berhasil.

Kata kunci: sendi temporomandibular, gangguan temporomandibular, faktor risiko
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INTRODUCTION

Temporomandibular disorders (TMD) are the conditions producing abnormal, incomplete, or impaired function of the temporomandibular joint (TMJ) and or the muscles of mastication.[1] These conditions depict a group of symptoms observed in various combinations, to not only involve the temporomandibular joints and the masticatory muscles, but also the associated structures like head and neck muscles.[2]

The TMDs have been reported to increase in numbers for these recent few years and have been a significant public health problem. In 2021, a systematic review and meta-analysis, conducted by Valesan et al, presented a higher prevalence of TMD at 31% for adults and elderly, while approximately 11% for children and adolescents.[2] In Indonesia, according to a study published in 2018 by Marpaung et al, found the prevalence of TMD in adolescences and children at 23.4% and 36.9%, respectively.[3]

Individuals who suffered from TMD rarely realize the conditions they experience.[4,5] Only one out of four individuals was aware of the symptoms and reported them to a specialist.[4] Aside from that, the knowledge level of dental practitioners and clinicians about TMD also influences the role in diagnosing and treating patients.[5] According to a study by Marpaung in 2018, the knowledge level of general dental practitioners about TMD in Jakarta was only at 25%.[5]

The TMDs scope a wide range of symptoms, with pain as the main complaint, and followed by limitation in jaw movement leads to difficulties in speaking and eating, these conditions could be accompanied by the TMJ sound heard while performing the jaw movements.[2-5] Lack of knowledge in terms of etiology and pathogenesis paths of TMD could lead to unnecessary complicated treatments.[4,5]

Hence, this review aims to build more understanding of TMD especially the risk factors which are essential for preventing the conditions that may cause the pathological changes to develop and lead to a more complex condition.

LITERATURE STUDIES

The TMJs are parts of the mastication system, coming together with the masticatory muscles, teeth, and other supporting structures.[1-5] The mastication system is very complex which, most of the time, can function without any significant complications in the entire life of an individual.[6] Unfortunately, when the problems arise, the situation can be complicated just like the mastication system itself.[6]

Interestingly, Okeson said most of the symptoms

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of TMD are experienced by individuals in the range of age 20 to 40 years old.[6] As the age gets older, the symptoms also increase in number, but for a population of age 60 and above, they seldom report any complaints related to their TMD condition.[6] Meanwhile, approximately only 26% of individuals reported the symptoms they experienced, and only 10% visited specialists for the need of treating the severe symptoms.[6]

Within the limitation of current studies, understanding the risk factors becomes crucial in preventing and bringing awareness about TMD before they get more complicated.

Risk factors classifications

The etiology of TMD is complex and multifactorial. A successful treatment for this condition depends on how to identify the contributing factors and control them. These factors are divided into three categories, namely 1) predisposing factors. These factors related to pathophysiological, psychological, structural changes cause the changes in the mastication system and increase the risk for developing TMD. Some of the conditions considered and classified as predisposing factors are anomalies of occlusal functions, psychological factors, hormonal factors, etc.; 2) initiating factors. The factors which trigger TMD to occur, related to the causes such as trauma or the impact of mastication load above the normal range, lead to a disturbance of equilibrium and result in structural or functional changes, represented as clinical signs or symptoms; and 3) perpetual factors. The factors disrupt the healing process and or worsen the conditions of TMD, by examples a) parafunctional factors (grinding, clenching, abnormal head posture, b) social factors (influence how someone learns to respond and interpret the pain perception), c) emotional factors (depression and anxiety), and d) cognitive factors.[4,7]

RISK FACTORS

The risk factors of TMD are still debatable until now, whether they indeed have a significant relationship to develop the disorders. Several risk factors will be discussed based on the publications and research reports conducted in these recent years.

Occlusal factors

Occlusion is one of the risk factors of TMD which remains controversial.[4,8] Several occlusal conditions predicted to have correlations in developing TMD are 1) posterior cross-bite. A systematic review by Thilander et al grouped the conditions of posterior cross-bite into three main types, skeletal, dentoalveolar, and functional. They reported there was no correlation between bilateral posterior cross-bite and TMD. Meanwhile, the functional type of unilateral posterior cross-bite showed a significant correlation.[9] A retrospective study by Khayat et al of 345 patients with TMD according to the diagnostic criteria for TMD and 149 without TMD, they concluded there was no relationship between any conditions of the posterior cross-bite and the TMD.[10] 2) midline shifting, overjet/overbite more than 5mm. Study by Almăşan et al of 24 patients with TMD showed individuals with the TMD had bigger overjet than normal, but not significantly related to the disorders.[11] A critical review by Caldas et al about occlusal changes secondary to TMJ conditions stated midline shifting correlated to TMD;[12] 3) centric relation (CR) to intercuspal position (ICP) more than 2 mm. Systematic review conducted by Jiménez-Silva et al found 20 articles describing a correlation between 2-4 mm CR-ICP discrepancy and TMD. Seven articles showed no correlation at all, but the authors said CR-ICP discrepancy still could not be concluded strongly as the risk factor of TMD;[8] 4) edge-to-edge bite. Although only a few studies observed the correlation of edge-to-edge bite and TMD, Costa et al did a research to 50 patients with TMD and 50 without TMD, they found approximately 38% of individuals with TMD, had an edge-to-edge bite, and this finding was taken into account of having the relationship between both;[13] 5) class III jaw relationship. A study by Almăşan et al also showed that individuals with TMD and class III jaw relationship had SNB value and horizontal relationships much different to those with class III jaw relationship but not having TMD;[11] 6) anterior open-bite. Caldas et al carried out a critical review in terms of anterior open-bite which was often found in individuals with TMD. Even though it was rarely complained about, but it should be considered as a sign of degeneration process was happening in the TMJ;[12] 7) losing five or more teeth. Costa et al also observed around 62% of individuals who suffered TMD, had lost five or more teeth in the posterior region.[13]

Another occlusal factor was observed by Ugolini et al for 224 patients who received orthodontic treatments and analyzed for their TMJ condition after the treatments were accomplished and one year after. The findings were listed as 1) female patients had a 90% odds ratio higher than males to develop TMD after orthodontic treatments; 2) patients with depression or anxiety disorder had a 2.2 times higher risk to develop TMD after orthodontic treatments; 3) patients with somatic disturbance symptoms (phobia, tinnitus, back pain, headache, oral parafunctional, difficulties in chewing and swallowing, etc) had a 3.6 times higher risk to develop TMD after orthodontic treatments; 4) there were not enough evidence for malocclusion types and the length of orthodontics treatments to have a signifi-

nificant correlation in developing TMD after the treatments.[14]

Tecco et al did an observation regarding occlusal factors and TMD to 37 patients who had malocclusion and myofascial pain syndrome, they showed the trigger points on masseter and temporal muscles, clicking sound, muscle and joint pain significantly decreased after the orthodontic treatments.[15]

Psychological factors

Stress condition and personality are also accounted as the risk factors of TMD and have undergone extensive scrutiny. Impellizzeri et al in their study involving 51 child patients, reported among 29 patients with TMD, 41.4% were in moderate distress and 27.6% were in low distress. Meanwhile, among 22 patients with no TMD, only 9.1% were in moderate distress and 18.2% were in low distress. Although it showed a strong correlation, the authors realized the physical and psychological conditions of patients could be strongly different because of the growing process.[16] Another study by Ugolini et al showed the patients with depression or anxiety disorder had a 2.2 times higher risk to develop TMD after orthodontic treatments.[14]

Hormonal factors

The signs and symptoms of TMD were found four times more often to be experienced by a female. The female was also three times more often to seek medical help for the conditions compared to males.[17] The recent studies showcased estrogen and relaxin contributing to the degeneration of cartilage in TMJs. But still, there were no adequate studies to prove a direct correlation between TMD and hormonal role.[18]

Macrotrauma factors

Macrotrauma is categorized as initiating and predisposing factor. An injury like whiplash type on the head or neck is considered a significant risk factor causing TMD. In a study by Fischer et al involving 400 individuals with TMD, 24.5% reported having experience(s) of trauma.[19]

Moreover, a systematic review by Häggmann-Henrikson et al suggested the prevalence of whiplash trauma is higher in patients with TMD compared to the control groups. Howbeit, the authors also commented the studies had different methods and some even without control groups, made it difficult to draw firm conclusions for the correlation of trauma and TMD.[20]

Parafunctional

Parafunctional is a functional disturbance in the TMJs. Related to this, excessive gum chewing, teeth clenching, and bruxism are considered risk factors of TMD.[4] A study by Costa et al for 50 patients with TMD showed that 68% of individuals, also had habits of grinding or clenching. In the clinical assessment, there were facets on five or more teeth as the result of parafunctional habit.[13]

In a randomized controlled trial done by Correia et al, 63% of individuals reported TMD symptoms of arthralgia and myofascial pain after chewing gum more than 3 hours at a time. Of the individuals who chewed gum less than an hour a day once a week, 83% experienced myofascial pain. While the individuals chewed gum three hours a day for once a week, 33% of them showed symptoms of arthralgia.[21]

A retrospective study by Khayat et al divided bruxism into sleep and awake categories. The condition of sleep bruxism (during asleep) was said to be significant to TMD, but not to the condition of disc displacement. While awake bruxism (during awake) also showed a similar result, but in addition the pain intensity drastically spiked when it came together with disc displacement.[10]

A clinical study by Ohlmann et al in 2020 found none of the non-bruxer group had any symptoms of TMD, while 17.2% of the bruxers had myofascial pain with or without limited mouth opening. The result showed significant differences between the bruxers and the non-bruxers groups.[22]

Hyperlaxity and hypermobility of the joint(s)

A clinical and experimental study conducted by Pasinato et al enrolled 34 women with TMD, 22 of them were assessed for having generalized joint hypermobility and the rest without. The authors found the individuals in the hypermobility group to have a greater mandibular range of motion and the painful mouth opening was statistically higher.[23]

A publication by Mitakides et al reported hypermobility in TMD related to other joints systematically. The patients who experienced hypermobility in TMJ, often observed to have an increase in mandibular opening more than normal (40-45 mm), which was not rarely, could lead to dislocation or limited opening of the jaw.[24]

Hereditary factors

Visscher et al in their systematic review collected 21 studies about hereditary factors and TMD. The suspected gene to be the carrier of pain in TMD, often associated with other genes which responsible in systematic scope. The author concluded there was still a lack of evidence to confidently claim TMD could be genetically inherited.[25] On the other side, Melis and Giosia in their literature review suspected there was a correlation between genetic factors and TMD, but not by a

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specific single gene which often resulted in false-negative findings.[26]

Head and neck posture

Rocha et al in their systematic review among 17 studies evaluated seven studies with high-quality methodology, but only five studies showed a relationship between head and neck posture and TMD, meanwhile, the other two studies showed no correlation at all. Although in total more than 70% of studies showed the correlation of head and neck posture to TMD, not all of them had an excellent methodology in their researches. Therefore, the authors encouraged more studies to focus on the methodology in assessing the relationship between head and neck posture and TMD.[27] A study by Pattnaik et al published in 2020 showed a significant correlation between neck inclination angle and temporomandibular dysfunction. [28]

DISCUSSION

Occlusal factors are considered to have a big role in TMD, but recent studies showed some of them were not that significant. Thilander et al believed there was no correlation between bilateral posterior cross-bite and TMD, but the functional type of unilateral posterior cross-bite showed a significant correlation. They predicted it could be because of the differences of masticatory muscle thickness on the cross-bite and the other side, which were responsible for the changes of condyle position and resulted in pain and joint sound.[9] Khayat et al found the otherwise, they concluded there was no relationship between any conditions of posterior cross-bite and TMD.[10]

Regarding overjet/overbite of more than 5 mm, Almăşan et al found individuals with the TMD had bigger overjet than normal, but not significantly related to the disorders. They also reported a significant influence of overbite on signs of TMD. They believed an examination of the TMJ in subjects with a large overjet should be considered.[11] Caldas et al stated midline shifting correlated to the TMD and these conditions occurred as the result of condyle resorption, and leading to improper sitting into the fossa, then caused unilateral posterior open-bite on the ipsilateral side and burdened the canine on the contralateral side, hence the shifted midline.[12]

About centric relation (CR) to intercuspal position (ICP) more than 2mm, Jiménez-Silva et al stated CR-ICP discrepancy still could not be concluded strongly as the risk factor of TMD because most of the articles had a weak methodology and only put one variable (CR-ICP discrepancy) into their observations.[8] More studies with strong methodology are needed for this issue in the future.

Costa et al did research on 50 patients with TMD and 50 without TMD, they found approximately 38% of individuals with TMD, had an edge-to-edge bite. This high prevalence of problems in the upper and lower incisors relationship is reflected directly on the anterior guide of patients, which is considered essential for the health of the stomatognathic system. This finding was taken into account of having the relationship between both.[13]

A study by Almăşan et al showed that individuals with TMD and class III jaw relationship had SNB value and horizontal relationships much different to those with class III jaw relationship but did not have TMD. Yet, the authors still wondered whether such measures would also prevent the development of TMD or decrease the TMD signs in such patients since the cause of mandible dysfunction is obviously multifactorial.[11]

Caldas et al claimed anterior open-bite which was often found in individuals with TMD happened in osteoarthritis and was responsible for the collapsing of TMJs, consequently the decrease of ramus height, retrusion of the mandible, and open-bite in the anterior. Even though it was rarely complained about, but it should be considered as a sign of degeneration process was happening in the TMJ.[12]

Costa et al observed individuals who had lost five or more teeth in the posterior region tended to suffer TMD. This reckoned due to the functional changes after losing teeth, which could develop further into disc displacement.[13]

Ugolini et al said there was a possibility, during the orthodontic treatment, the abnormal occlusion that developed before the bite was settled could bring on forward movement of the articular disc. The authors observed it appeared to be temporary, and the clicking resolved on its own. However, in some cases, it could persist.[14] Tecco et al showed the trigger points on masseter and temporal muscles, clicking sound, muscle, and joint pain significantly decreased after the orthodontic treatments. These findings fathomed the result of the maxillary expansion to align the teeth which allowed the mandible to move forward and settled in the natural decompressive position of the TMJs. Thus, the mastication muscles improved significantly, although the disorders themselves were not dissipated.[15]

The manifestation of depression and stress into physical symptoms is undoubtedly for the case of the TMD.[4] For example, the pain caused by the TMD is considered as the factor to increase the incidence of depression and mental disorders.[4] Vice versa, stress and anxiety can induce muscle hyperactivity and fatigue expressed as spasms and lead to contracture, occlusal disharmony, internal disturbance, and degenerative joint inflammation resulted in occlusal scheme changing.[13]

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Impellizzeri et al showed a strong correlation between the psychological factor and TMD, but the authors realized the physical and psychological conditions of patients could be strongly different because of the growing process.[16] While Ugolini et al assumed the role of catecholamine O-methyl transferase (COMT) implied the sensitivity of pain sensation, it was why depression and anxiety disorder patients with TMD depicted pain as their manifestation. The authors suggested further studies were still needed to conclude the direct correlation between both.[14]

Not much different for the hormonal factors, some studies that put gender variable into their work, concluded it did not significantly relate to TMD.[10,11] Meanwhile some other studies found females experienced TMD four times more often than males, so far they only suspected testosterone hormone played the role.[17] Or a hypothesis about estrogen hormone receptors in TMJs on females, gave rise to metabolic changes and induced ligament laxity. Estrogen also increased susceptibility towards pain stimulus.[18] These leave us in gray areas where it is still not clear enough to decide before taking hormonal factors as one of the risk factors of TMD.

Whiplash trauma is believed to play a role in TMD. Fischer et al said the association between head and neck injuries and TMD increased, albeit non-significantly, with the number of head and/or neck injuries, as well as with the severity of the injury.[19]
Häggmann-Henrikson et al suggested that the disorders might develop over time after whiplash trauma, rather than being part of an acute syndrome.[20]

Many authors consider parafunctional habits to have a strong correlation to the TMD. Some of the most suspected habits are bruxism, gum chewing, teeth clenching, and grinding. Costa et al characterized bruxism or clenching as the result of emotional stress inducing muscles hyperactivity, so when an emotional component is associated with physical factors, such as occlusal changes, stress relief by the stomatognathic system produces symptoms of pain and dysfunction.[13] Ohlmann et al also believed sleep bruxism did not simply show a cause-and-effect relationship to TMD, but nonspecific physical symptoms to be a stronger predictor for the diagnosis, such as emotional personality or depression.[22]

Joint range of motion is influenced by numerous factors, including biochemical changes to the structure of collagen and elastin, causing a loss of resistance to traction, laxity, and an increase in joint mobility. Pasinato et al claimed individuals with TMD associated or not with generalized joint hypermobility did not differ as to clinical and psychosocial aspects assessed, except concerning the mandibular opening range of motion.[23] In agreement with the statement above, Mitakides et al also concerned more with the mandibular opening in the hypermobility joint which could cause relocation of the joint resulting in pain, bony destruction, and limited mobility.[24]

Hereditary factor as one of the etiology factors of TMD is relative recently. Melis and Giosia concluded the study of genetic factors was frequently hampered by false negative associations when single nucleotide polymorphism was evaluated independently. A complex disease with multiple factors such as TMD resulted from contributions of various polymorphisms. To get a significant result, the trials should involve large populations. Additionally, the authors suspected the widespread pain and localized pain in TMD was affected by different genes in different neurological mechanisms.[26]

Pattnaik et al explained the relationship of head and neck posture and TMD, by the measurement of the inclination angle of the neck, on the seventh cervical vertebra. The movement of the craniocervical unit caused adaptive movements in the jaw and related structure, retrusion of the mandible. This abnormal position might lead to an excessive amount of tension on the masticatory muscles, teeth, and supporting structures. They would lead to increased muscle activity during postural changes, mostly on masseter muscle, resulted in tenderness in palpation.[28]

Understanding the risk factor is crucial to prevention and alert to TMD interference before it gets more complicated. Although the risk factors of the TMD are still debated, they nonetheless have been found to be in the development of the disorders. Among the risk factors mentioned above, parafunctional habit is considered to have the most agreement of strong correlation to TMD. In short, identifying, understanding, and controlling the risk factors may help to prevent the TMD, and more benefits lead to a successful treatment.

As TMD is a complex condition, more studies such as systematic reviews, randomized controlled trials, and observational studies are needed to form a firm ground in determining the risk factors significantly related to TMD.

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