ISSN: 0976-3031

Available Online at http://www.recentscientific.com

CODEN: IJRSFP (USA)

International Journal of Recent Scientific Research
Vol. 9, Issue, 12(E), pp. 30127-30131, December, 2018

International Journal of Recent Scientific Research

DOI: 10.24327/IJRSR

Research Article

SYSTEMATIC REVIEW OF ETIOLOGIC FACTORS CAUSING TEMPOROMANDIBULAR DISORDERS

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DOI: http://dx.doi.org/10.24327/ijrsr.2018.0912.2993

ARTICLE INFO

Article History:

Received 10th September, 2018
Received in revised form 2nd October, 2018
Accepted 26th November, 2018
Published online 28th December, 2018

Key Words:

Prosthodontics, Systematic Review, Temporomandibular Disorders, Etiology, Occlusal Interferences, Parafunctional Habits

ABSTRACT

The aim of this review article is to assess the various etiologic factors causing Temporomandibular disorders. The term Temporomandibular disorders (TMD) include all functional disturbances of the masticatory system. It is multifactorial and the active search to find the possible etiological factors for TMD started in the 1950s and continues till date. The articles considered for review included The MEDLINE- Pubmed from September 2017 to five years previously and from other sources. The data was extracted from the studies included for review, publication, study design, number of patients, etiologic factor and Temporomandibular disorders as per PRISMA guidelines. A total of 28 articles were reviewed after applying the necessary filters. It was found that occlusal interferences caused TMD in more than 72% of the population and parafunctional habits in 42% of the population and various other causes such as orthognathic surgery, trauma, systemic conditions such as scleroderma and juvenile arthritis, facial asymmetry, genetics and posture contributed to TMDs. These results help the prosthodontist to understand the complex and multifactorial etiology of TMD and hence aid in its efficient management.

INTRODUCTION

The term Temporomandibular disorders (TMD) include all functional disturbances of the masticatory system. The term was adopted by the American Dental Association to avoid discrepancies in terminology and to coordinate efforts for research. The active search to find the cause of TMDs started in 1950s. The studies conducted during this period suggested that the condition of occlusion could affect the function of mastication and electromyographic studies were employed to establish the same.

The late 1950s paved the way for publication of first textbooks that discussed the TMDs. These books attributed the main cause for masticatory muscle pain disorders as occlusaldisharmony. The 1960s and 1970s witnessed the evolution of occlusion and emotional stress as the major cause of functional disorder of the masticatory apparatus. Budding interest in the aetiology of TMDs in the late 1970s led to the conclusion that the pain disorders arose from intracapsular sources (Jeffrey P. Okeson (2013).This information reoriented the profession's thinking and direction in the area of TMDs.

The complexity around the etiologic factors causing TMDs has driven the prosthodontist to ascertain their role in the efficient management of TMDs. Hence a systematic analysis was performed to check the possible etiological factors for Temporomandibular disorders.

MATERIALS AND METHODS

The following analysis was performed according to the guidelines and principles of the PRISMA statement for a systematic review.

Focussed question (PICO)

The review is focussed on various etiologic factors causing Temporomandibular disorders

Search Strategy

The MEDLINE- Pubmed was searched from September 2017 to five years previously. The following search terms were used as shown in the (Figure 1)

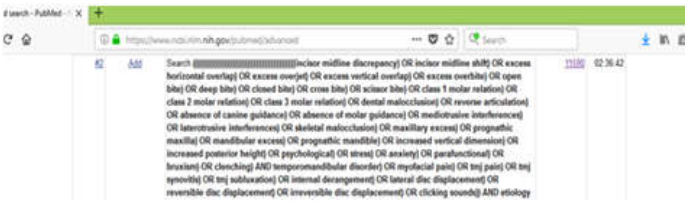

Figure 1 Search terms used for MEDLINE-PubMed search

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Study inclusion criteria

Studies were analysed according to the following inclusion criteria

- Studies that dealt with Temporomandibular disorders
- Studies that dealt with muscle pain
- Studies that dealt with TMJ pain and clicking sound

Study exclusion criteria

- Patient samples with neuromuscular disorders
- Medically compromised patients
- Patients with bone pathologies

Data extraction

All studies which met the inclusion and exclusion criteria for review were obtained and screened independently. Relevant studies without abstract were included for full text screening. The data were extracted from the following studies according to the search strategy (Figure 2) included for review, Publication, study design, number of patients, etiologic factor and Temporomandibular disorders as per PRISMA guidelines.

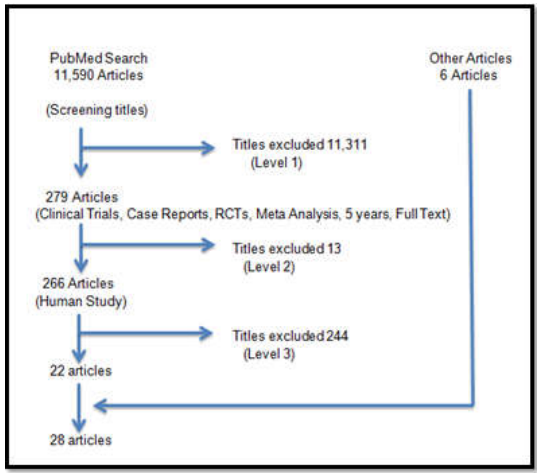

Figure 2 Search Strategy

RESULTS

DISCUSSION

Occlusal Interfernces

Glossary of Prosthodontic Terms-9(GPT 9) defines occlusal interferences as any tooth contact that inhibits the remaining occluding surfaces from achieving stable and harmonious contacts or any undesirable occlusal contact. These interferences can be caused by uneven tooth wear, disharmonic occlusion, restorative procedures performed incorrectly, that lead to a disharmonic relation between the arches. These interferences can cause alteration of muscular tone that lead to pain in the stomatognathic system (Lima AF *et al* 2010).

In the review by Iodice *et al* 2013, posterior cross bite was considered as an important factor causing TMD, however a definitve conclusion could not be drawn from the study. Reissman *et al* 2014 studied the effect of tooth replacement in bilateral molar loss and compared them with non-replacement of molars on TMD symptoms and concluded that tooth replacement had no effect on reducing TMD pain. Egermark-Eriksson *et al* 1983studied the effect of dental status, occlusal interferences, occlusal anomalies, general background on symptoms of TMD in children of various ages. They found a positive correlation between dental wear and age to TMD and found TMJ clicking to positively increase with age and female gender. They also concluded that functional malocclusion had a greater impact on TMD than morphological malocclusion such as class II, Class III, anterior open bite.

Kampe T and Hannerz H1987compared 96 individuals ranging between 13 to 15 years of age with intact teeth to a control group of 129 individuals with dental restorations and found adoloscents with dental restorations had higher incidence of occlusal interferences causing TMD with no specific relation to age and gender unlike the previous study by Egermark-Eriksson I. In an epidemiological study on students in Taiwan university by Shiau YY and Chang C 1992 found 42.9% students with a majority of female gender had one or more signs of TMD with occlusal factors such as balancing contact, dental restoration, molar guidance in eccentric movement more

Table 1 Results of the literature reviewed

S.no	Reference	Study design	Sample size	Age group	Etiology	Relationship to tmd
1	Z. Catherine	Systematic review Cross sectional study	14 studies (2994 patients)	14-50 years	Orthognathic surgery	7.5% affected
2	B.Haggman-Henrikson	Systematic review	6 articles	>18 years	Whiplash trauma	Significant correlation
3	Vito Crincoli	Systematic review Observational study	80 patients	>18 yrs	Scleroderma	>73.8% affected
4	Antonio Jiminez- Silva	Systematic review	39 studies	> 19 yrs	Bruxism	Low to moderate correlation
5	Kasper Dahl Kristensen	Systematic review	21 articles	>20 yrs	Idiopathic juvenile arthritis	Moderate correlation
6	Daniele Manfredini	Systematic review	34 articles	Adoloscents, adults	Facial asymmetry	Moderate correlation
7	Ana M Moreno- Fernandez	Review article	-	Adults	Fibromyalgia	Positive correlation
8	M. Naeije	Review article	167 articles	All age groups	Anatomical, Biomechanical, hypermobility	18-35% affected
9	L.J.Robinson	Systematic Review	6 articles	Adults	Chronic fatigue syndrome	32% affected
10	C.P.Rocha	Systematic review	17 articles	All age groups(adult)	Head and cervical posture	Low significance
11	L. Stepan	Systematic review	12 articles	All age groups	Otolaryngeal disorders	Significantcorrelation
12	C.M.Visscher	Systematic review	215 studies	All age groups	Genetic	Significantcorrelation
13	O.C.Almassan	Case report	61 patients	16-36 yrs	Cephalometric changes	Significant correlation
14	Giorgio Iodice	Systematic review	43 articles	All age groups	Posterior cross bite	55% affected
15	Barbara Cristina Zanandréa Machado	Case report	102 patients	Middle age group	Clenching	60% affected
16	H. Morales	Review article	-	-	Multifactorial	Significant correlation
17	K. I. Reid	Review article	-	-	Multifactorial	Significant correlation
18	Daniel R. Reissmann	Randomized controlled trial	215 patients	All age groups	Missing posterior teeth	90% affected
19	ChristhianiGiane da Silva	Systematic review	11 studies (17,051 patients)	Children ,adolescent	Parafunctional	1 in 6 affected
20	Letícia Miranda Resende da Costa	Randomized controlled trial	40 patients	18-35 yrs	Postural changes	17 to 25% affected
21	R. F. C. P. De freitas	Systematic review	7 articles	All age groups	Psychological	Significant correlation
22	A.Silveira	Case report	40 patients	19-49 yrs	Neck pain	Significant correlation
23	Egermark-Erikson *et al*	Randomised sampling	402 patients	7-15 yrs	Occlusal interferences	Significant correlation
24	Kampe and Hannerz	-	225 patients	Adolescents	Occlusal interferences	Significant correlation
25	Shiau and Chang	-	2033 patients	17-32 years	Balancing interference group function	Significant correlation
26	Kirveskari *et al*	-	237 patients	5-10 years	Occlusal interferences	Significant correlation
27	Al Hadi	-	600 patients		Group function occlusal interferences	Significant correlation
28	Lobezzoo-Scholte *et al*	-	522 patients	Mean 34 years	Balancing side interferences	Significant correlation

prevalent in patients affected with TMD. A prospective study conducted by Kirveskari P, Alanen P and JaT 1992 prospectively studied the effect of developing occlusal disturbances in children from age 5 who were annually followed up and reported an increase in TMD symptoms with progressing age and occlusal disturbances.

A clinical survey on 600 patients of both genders by Al-Hadi LA in 1993 studied the effect of occlusal interferences on TMD and found high dependence between the frequency of TMDs and patients with class II division 1, class III patients, group function occlusion, and a high horizontal overlap. A study by Lobbezoo-Scholte AM *et al* in 1995 divided patients into groups that differed considerably with respect to general characteristics, pain variables, signs of craniomandibular disorders, self-reported para-functional habits, psychosocial factors, and general health factors, but found no significant relationship between various factors and TMD symptoms. From the above references, which includes systematic reviews and RCTs consisting of 4234 patients as samples it was concluded that occlusal interferences causes TMJ pain in more than 72% the population.

Parafunctional Habits

Parafunction is defined as disordered or perverted habit (GPT-9). The main parafunctional habits are bruxism, non nutritive sucking and nail biting of which bruxism plays a vital role in the development of TMDs. Bruxism is a group of oral parafunctional habits, which contains all kinds of clenching and grinding activities, due to some disorders in masticatory system (Seraj *et al* 2009)

Jiménez-Silva *et al* 2014reviewed articles for positive correlation between occurrence of bruxism in adults and the presence of TMD symptoms in them. Though they achieved a mild to moderate correlation between the two conditions, they couldn't completely rule out the possible etiological role of bruxism in TMD. Machado BC *et al* 2016 reviewed the effect of oral mouth exercises and low lever laser therapy on TMDs caused due to bruxism and found improvement in symptoms in TMD in patients caused by bruxism. A review by da Silva CG *et al*2016 studied about TMD in children and adolescents and found an incidence of one in every six children being affected by TMD, the major etiology being parafunctional behaviour.

From the above references, which includes systematic review and case reports consisting of 17,153 patients, parafunctional habits causes TMJ pain in 42% of the population

Other Causes

In a review by Catherine Z*et al*2016, orthognathic surgery with counter clockwise rotation and posterior placement of condyle with advancement more than 10mm caused condylar resorption leading to TMD. This was found with an increased frequency in female patients with estrogen deficiency, class II malocclusion with a high mandibular plane angle, diminished posterior facial height and a posteriorly inclined condylar neck. *Whiplash* is an acceleration-deceleration mechanism of energy transfer to the neck that results from rear-end or side-impact motor vehicle collisions and causes bony or soft-tissue injuries leading to a variety of clinical manifestations (Spitzer *et al* 1995).TMDs due to whiplash trauma was reviewed by Häggman-Henrikson *et al* 2015 and reported the prevalence of whiplash trauma ranged from 8·4% to 70% in patients with TMD, compared with 1·7-13% in the control group and reported more TMD symptoms, such as limited jaw opening and pain, more headaches and stress symptoms and concluded that the prevalence of whiplash trauma was significantly higher in patients with TMD.

Systemic sclerosis is a chronic, multisystem connective tissue disease characterized by microangiopathy leading to inflammation and fibrosis involving skin and internal organs. Systemic sclerosis is divided into diffuse cutaneous and limited cutaneous forms based on the extent of skin involvement (Vishwanath *et al* 2013). A study by Crincoli V *et al* 2015studied eighty patients with sclereoderma and compared them with 80 healthy control patients and found that TMD symptoms were reported by 92.5% of scleroderma patients compared to only 76.2% of controls. A study by Kristensen*et al* 2016 to find an association between TMD and idiopathic juvenile arthritis showed moderate correlation between the two conditions.

Manfredini *et al* 2016attempted to review prevalence of TMD in patients with different facial morphology and found no significant association between various facial forms. However class II profiles with hyperdivergent facial patterns could have more impact on the presence of TMD symptoms. Moreno-Fernández *et al* 2017 reviewed the association between fibromyalgia and TMD. Fibromyalgia is chronic syndrome with core symptoms of widespread pain, fatigue, and sleep disturbance. Other symptoms include cognitive difficulty, headache, paresthesia, and morning stiffness (Mease 2005). The authors from their review found a possible association between the pathogenesis of the two conditions. Naeije *et al* 2013 reviewed the association between internal derangement of the disc with reduction and found correlation between this condition and the presence of TMD.

Robinson *et al* 2016 tried to find an association between TMD and chronic fatigue syndrome. Prolonged fatigue is defined as self-reported, persistent fatigue of 1 month or longer and Chronic fatigue syndrome is characterized by profound, debilitating fatigue with a combination of symptoms resulting in substantial reduction in occupational, personal, social, and educational status.[34] Authors have proposed thatchronic painful TMD is a central sensitivity syndrome related to hypersensitivity of the central nervous system but a definitive pathogenesis mechanism has not been established and TMD is considered to have a possible overlap with chronic fatigue syndrome.

The cervical spine and stomatognathic system are considered to be interrelated because of common muscular and ligamentous attachments. In a systematic review conducted by Rocha *et al*2013 found an association between cervical posture and TMDs was sought. Results showed that the relationship between TMDs and the head and neck posture was controversial because of insufficient number of articles. Stepan*et al*2017 reviewed possible correlation between TMD and otolaryngeal symptoms and found that both conditions were significantly different. Visscher CM and Lobbezoo F2015reviewed articles for possible genetic association for TMDs and found a moderate association. This association was

due to inheritance of genes that code for proteins regulating pain mechanism.

Almăşanet al2013 studied the posteroanteriorcephalometric changes in patients with unilateral and bilateral TMD. The authors found that unilateral TMDs had posteroanteriorcephalometric changes with respect to distance of horizontal plane to antegonion and vertical plane to gonion, antegonion, condyle and chin and concluded that skeletal mandibular asymmetry contributed significantly to development of unilateral TMDs. Morales H, Cornelius Rin 2016and Reid, Greene CSin 2013 concluded TMD to be multifactorial disease requiring multidisciplinary intervention.

da Costa *et al*2016 studied the effect of pilate training in female patients with TMDs because of the possible effects of posture on TMD symptoms. Initial results have shown improvement in symptoms in the group with combined pilate and occlusal splint therapy. Freitaset al2013 reviewed articles relating to psychological counselling in the improvement of symptoms related to TMD and found significant improvement in tenderness reduction following counselling of patients affected with TMD. This study strongly established the fact that psychological and psycho-social factors significantly contribute to development of TMD in addition to biomedical factors. Silveira *et al* 2015 reviewed articles for possible correlation between neck disability, jaw dysfunction, and muscle tenderness in subjects with TMD and compared them with patients with no TMD. The rationale behind the study was that tender points in the neck are common in patients with TMD. The study found a strong correlation between TMD and the associated neck factors and non TMD patients.

From the above references, which includes systematic review and RCTs other causes such as orthognathic surgery, trauma, systemic conditions such as scleroderma and juvenile arthritis, facial asymmetry, genetics, psychological conditions and posture can cause TMDs in significant amount of the population.

Summary

Based on the available data from the existing studies with a follow up period of 5 years, it can be summarised that Temporomandibular disorders are mainly caused by occlusal interferences followed by parafunctional and then by other causes.

Though these results are based on studies which followed proper clinical and diagnostic protocol, these values still cannot be considered to be conclusive of the possible etiologic factors causing Temporomandibular disorders. Hence long term follow up with a larger sample size is needed to extrapolate the results to confirm the etiologic background of the above said factors.

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How to cite this article:

Ganagamani A.T. *et al*., 2018 Systematic Review of Etiologic Factors Causing Temporomandibular Disorders. *Int J Recent Sci Res*. 9(12), pp. 30127-30131. DOI: http://dx.doi.org/10.24327/ijrsr.2018.0912.2993

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