Original Article

Effect of Centric, Assisted Non-Working, and Unassisted Non-Working Interferences on Temporomandibular Disorders

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ABSTRACT

Background and Aim: Temporomandibular disorder (TMD) is a multifactorial problem caused by many reasons. There is still controversy about the effect of different types of occlusal disorder on TMD. This study was designed to determine the effects of centric and assisted and unassisted non-working interferences on TMD.

Materials and Methods: In this cross-sectional study, 100 dental students, including 64 males and 36 females with the age range of 18 to 24 years old, were examined. Subjects with a history of systemic or muscular diseases and orthodontic treatment were excluded. TMD signs and symptoms including maximum mandibular opening limitation, maximum lateral movement limitation, maximum protrusion limitation, deviation and deflection, joint pain and tenderness, joint sounds, and masticatory muscle tenderness were examined. Subjects were also examined for having centric interferences and eccentric interferences including assisted and unassisted non-working interferences. Data were analyzed using the chi-square test and independent-sample T-test.

Result: Subjects with centric interference had a significantly higher number of clicks (P=0.02), medial pterygoid tenderness (P=0.009), and right medial pterygoid tenderness (P=0.007). We could also find a significantly higher number of clicking in subjects with assisted non-working interference (P=0.002).

Conclusion: The findings of the present study suggest that different types of occlusal interference, specially centric and assisted non-working interferences, can lead to TMD signs and symptoms.

Keywords: Temporomandibular Joint Disorders, Traumatic Dental Occlusions, Chi-Square Distribution

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Introduction:

Temporomandibular disorders (TMDs) include all problems and symptoms presented in the temporomandibular region because of disorders of this area. TMDs include joint, muscle, teeth, and bone problems.[(1)] Joint problems include changes in the normal range of joint movement, displacement and malformation in joint disc and surfaces, pain, and joint sounds.

Muscle problems include pain, sensitivity to palpation, hypertrophy, muscle shortening, and changes in the normal range of muscle movement or headache. Dental problems include mobility, tooth migration, tooth fracture, and tooth pain or sensitivity and bone manifestations in the form of bone resorption in the area of teeth under inappropriate occlusal pressures. TMD might be caused by trauma in two general forms of micro and macro. Macrotrauma includes sudden forces exerted on the mandible or articular fossae while microtrauma is considered as small forces with a high frequency imposed on joint components because of occlusal interferences.[2] Although previous studies claim that there is controversy on the effect of malocclusion on TMD, the relationship between malocclusion and TMD cannot be ignored, and it is believed that the elimination of occlusal interferences is an important part of TMD treatment. [3-6] Cao et al mentioned a direct relationship between occlusal interferences and masticatory muscle tenderness. [7] Okeson states that orthopedic instability leads to disharmony between the stable intercuspal position (ICP) and the musculoskeletal stable (MS) position of the joint, leading to the overload of muscles and teeth, which will have the role of microtrauma. [8] Some researchers have not mentioned occlusal interferences as the main factor causing TMD but they believe that malocclusion has a predisposing role.[9,10] Some researchers describe non-working contacts as destructive because of changes in the mandibular leverage, forces non-parallel to the long axis of the teeth, and interferences with the normal function of the muscles.[11]

Non-working interferences are divided into two subgroups of assisted and unassisted. When a patient does the lateral movement himself, if there is a contact on the non-working side, it is called unassisted non-working interference, and if during the lateral movement of the mandible, a force is applied superiorly and medially to the mandible's non-working side angle, it is called unassisted non-working interference.[8] Okeson believes that unassisted contacts can have undesirable effects on the function of the muscles while assisted ones can have protective effects on the joint, especially during heavy movements like bruxism. Dawson believes that because of the mandible's flexibility, it is not possible to harmonize occlusion with different degrees of muscle contraction, and as non-working contacts are destructive, there should be no non-working contacts.[12]

Considering different ideas about the effects of non-working interferences on TMD and the controversy about the effects of assisted and unassisted non-working interferences, in this study, we tried to specifically investigate the effects of centric, assisted non-working, and unassisted non-working interferences on the presence and prevalence of TMD symptoms.

Materials and Methods

In this cross-sectional study, 100 participants (64 males and 36 females) with the mean age of 21.1±2.15 years, ranging from 18 to 24 years old, were selected randomly from among Shiraz Dentistry College students affiliated to Shiraz University of Medical Sciences. The inclusion criteria comprised Class I occlusion and full dentition (absence of wisdom teeth was also known as full dentition). Subjects with a history of systemic or muscular diseases, orthodontic treatment or maxillofacial surgery were excluded.

TMD signs and symptoms and centric and non-working interferences were examined.[13] All the findings from the examination were recorded in datasheets.

Mandibular mobility evaluation included:

a) Maximum opening: a centimeter ruler was used to measure the maximum opening. In the maximum intercuspal position, the place of the incisal edge of the maxillary central incisors was marked on the labial surface of the lower teeth, then the participant was asked to do the maximum opening, and the distance between the maxillary incisal edge and the marked line on the lower teeth' surface was measured. The normal range of mouth maximum opening is 53-58 mm, and less than 40 mm is known as a limitation in mouth opening.

b) Maximum lateral movement: to measure the mandible's maximum lateral movement, the maxillary midline was marked on the mandibular teeth' labial surface, and then, the participants were asked to move the mandible to the left and right. The distance between the maxillary midline and the mark on the lower teeth was measured and recorded as maximum lateral movement. Lateral movements less than 7 mm are known as a limitation.

c) Maximum protrusion: to measure the mandible's maximum protrusion, the maxillary canine's cusp tip was marked on the lower teeth' labial surface when the teeth were in the ICP. Then, the participants were asked to protrude the mandible maximally, and the distance between the maxillary canine's cusp tip and the mark was measured; if it was less than 7 mm, it was recorded as a limitation.

d) Path of opening: during the mouth's maximum opening, the mandible may move in a straight path or it may deviate. A ruler was used to assess the mandible's path of opening; it was placed in front of the participants' midline, and then, he/she was asked to open the mouth maximally. The way that the mandible moved was compared with the ruler's axis. If the mandible was opened straight to the ruler's axis, it was recorded as straight. If it deviated during the movement but when the opening was finished, the midline axis was the same as where it was in the maximum intercuspation, it was recorded as a deviation; if there was a difference, it was recorded as deflection.

2) Joint pain or tenderness: pain in the joint was recorded by taking history in yes/no dimension, and tenderness was recorded by examination. To diagnose tenderness, palpation of the joint's lateral surface and intra-auricular examination were done. Both intra- and extra-auricular examinations were performed when the mouth was closed and while opening and clenching; if any pain or tenderness was present, it was recorded.

3) Joint sounds including a) click, which is a short sound during opening the mouth, b) reciprocal click, a short sound heard while opening and closing the mouth, and c) crepitus, which is a grating sound during mandibular movements.

4) Muscle tenderness: the medial pterygoid, lateral pterygoid, temporalis, and masseter muscles were examined on both sides. First, the temporalis muscle was examined. Its anterior part was palpated above the zygomatic arch and anterior to the temporomandibular joint (TMJ). The middle part was palpated right above the TMJ, and the posterior part was palpated superior and posterior to the ear. The masseter muscle was studied in two parts of superior and inferior. First, the superior part was palpated above the zygomatic arch and in front of the joint, and then, the fingers were moved inferiorly to palpate the inferior part on the interior border of the ramus. The lateral pterygoid examination was done by placing the forefinger over the buccal area of the maxillary third molar region and exerting pressure in a posterior, superior, and medial direction behind the maxillary tuberosity. To palpate the medial pterygoid muscle, the index finger was slid a little posterior to the traditional insertion site for an inferior alveolar nerve block to where the muscle is felt, and then, it was pressed laterally. In the present study, the combination of right medial pterygoid, right lateral pterygoid, right temporalis, and right masseter tenderness (right masticatory muscles) was known as right muscle tenderness. The combination of left masticatory muscle tenderness was known as left muscle tenderness. The combination of right and left medial pterygoid muscles was known as medial pterygoid tenderness, and the combination of right and left lateral pterygoid muscles was known as lateral pterygoid tenderness.

5) Centric relation (CR) interferences: to guide the mandible to the CR, we used bilateral manipulation according to the Dawson's method. [1] First, we put cotton roles between upper and lower teeth for 5 minutes to avoid any contacts, so masticatory muscles were deprogrammed, and they could not avoid guidance of the mandible to the CR. The patient was in a semi-sitting position and was asked to take their chin up, so their face was parallel to the ground. When the head was in an appropriate position, the patient's chin was lifted, and the neck was slightly stretched. Then, four fingers of both hands were placed on the lower border of the mandible, and the thumbs were placed on the mandibular symphysis. Finally, a very gentle force without any additional pressure guided the mandible. When we moved the mandible, it was hinging freely and the condyles seemed to be fully seated up in their fossae; this position is called the CR. If in this situation, any premature contact occurs between the teeth, it is called CR interference.

6) Eccentric interferences: the participants were asked to do lateral movements to the left and right, and the presence of non-working interferences was examined and noted.

The presence of contacts during the lateral movement of the mandible on the non-working side was diagnosed as non-working interference, which was divided into two subgroups of assisted and unassisted. If during normal lateral movement of the mandible, a contact was seen on the non-working side, it was called unassisted but if a high degree of force was applied to the mandible's non-working side angle in a superomedial direction by the researcher, the contact was noted as assisted non-working interference.

The chi-square test and independent-sample T-test via SPSS 17.0 software (SPSS Inc., Chicago, IL, USA) were used to analyze the data. A P-value of less than 0.05 was considered statistically significant.

Results

The prevalence of centric, assisted non-working, and unassisted non-working interferences among the participants was about 75%, 80%, and 50%, respectively. These distributions according to gender were not significant in the centric (P=0.33), assisted non-working, (P=0.91) and unassisted non-working interferences (P=0.07). TMD-related problems included clicks (56%), deviation (45%), lateral pterygoid tenderness (14%), medial pterygoid tenderness (23%), and left muscle tenderness (16%). The prevalence of TMD-related problems was not significantly different between males and females (P>0.05). Notably, the data regarding deflection, crepitus, mandibular movement limitation, and some muscle tenderness were not seen or they were not enough to be considered for analyzing; therefore, they were omitted.

The results indicate that the relationship between the distribution of interferences and TMD symptoms was significant in centric interference and clicking (P=0.02), medial pterygoid tenderness (P=0.009), and right medial pterygoid tenderness (P=0.007). Also, clicking showed a significant relationship with assisted non-working interference (P=0.02). Table 1 shows the distribution of interferences among TMD patients. After analyzing the data related to assisted and unassisted non-working interferences, we found a relationship between clicking and assisted non-working interference. There was also a relationship between assisted non-working interference and clicking on the side of interference.

Table 1: Distribution of interferences (%) among patients with temporomandibular disorders (TMD)

Interference \ TMD		Click		R. Click		L. Click		Med. Ptr		R. Med. Ptr	
		No	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**
Centric	No	16	36	80	20	76	24	96	4	100	0
	Yes	37.3	62.7	58.7	41.3	64	36	70.7	29.3	76	24
Ass NW	No	75	25	85	15	90	10	85	15	85	15
	Yes	36.3	63.7	58.8	41.3	61.3	38.7	75	25	81.3	18.7
R Ass NW	No	57.6	42.4	77.8	22.2	72.7	27.8	84.8	15.2	88	12
	Yes	37.3	62.7	56.3	43.7	64	36	73	27	79	21
L Ass NW	No	55.6	44.4	75.8	24.2	81.8	18.2	77.8	22.2	80.6	19.4
	Yes	37.5	62.5	58.2	41.8	59.7	40.3	76.6	23.4	82.8	17.2

,L=Left, R=Right
,Ass=Assisted
,NW=Non-working
Ptr=Pterygoid, Med=Medial

Discussion:

The present study, which was performed on 100 subjects between 18 and 24 years old, showed that centric interference could relate with some symptoms of TMD, such as click and tenderness of the masticatory muscles, especially the medial pterygoid muscle. Also, this study showed that assisted non-working interference can lead to clicking; this correlartion was statistically significant. There are several explanations for these results; first, the non-working side interference has a negative effect on the stability of the TMJs and their loading. In the presence of such interference, the lever system of the mandible changes and the non-working interference becomes the fulcrum for the mandible under the effect of the masticatory muscles. The TMJ may distract and lose its stability as the mandible pivots around the non-working interference. Also, the relevant teeth are overloaded as occlusal forces are imposed on these teeth and outside their long axes.

Some studies have shown no significant relationship between TMD and occlusal interferences, (7,14-16) while several studies acknowledge occlusal interferences as a predisposing factor for TMD. (7,9,17,18) Some studies have shown a significant correlation between occlusal interference and TMD. (17,19-21). The present study accredits this relationship.

In this study, subjects with centric interferences showed significantly more tenderness in the medial pterygoid muscle. However, some studies have found no correlation between occlusion and masticatory muscle tenderness. (10,18,22) Cao et al detected a direct relationship between occlusal interferences and masticatory muscle tenderness.(7) A study by Badel et al showed similar results. (21).

If more cases or parameters, such as chewing habits, were examined, we could have explained some sort of relationship between the function and centric interference and right medial pterygoid muscle tenderness.

Manfredini et al showed that only non-working side interferences and retruded contact position to maximum intercuspation (RCP-MI) slide more than 2 mm are correlated with a click.(14) Okeson divided non-working interferences into two groups of assisted and unassisted. He believed that unassisted interference is destructive but assisted interference has a protective effect. (23) Fujii found that occlusal interferences have no correlation with TMJ pain and click on the same side.(16) However, the present study showed that subjects with assisted non-working interference experience more clicking on the side of interference.

Minagi et al showed that the incidence of joint sounds is higher in people without non-working interferences; therefore, they concluded that non-working contacts have a protective effect on the TMJ.(24) Baba et al showed that non-working interferences lead to a higher anterior temporalis muscle activity on the same side, and this could increase the amount of load on the non-working side.(25) No correlation was seen between non-working interference and muscle pain in our study.

Karlsson et al introduced non-working interferences and showed that clinical manifestations of non-working interference can be different in individuals, but some symptoms such as the increase in masticatory muscle tenderness were observed in most of the subjects.(26) After one week, all the subjects were adapted to these changes, and clinical symptoms were refined.(26) Ćelić et al concluded that people with working and non-working side interferences do not have any significant difference in having TMD.(15) However, our study showed that there is a significant relationship between assisted non-working interference and clicking. We did not find any correlation between unassisted non-working interference and TMD. However, assisted interferences showed a significant statistical relationship with clicking.

Conclusion

The results of the present study suggest that the presence of different types of occlusal interference, especially centric and assisted non-working interferences, can lead to some TMD signs and symptoms.

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