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## RESEARCH ARTICLE

### ASSOCIATION OF DEEP BITE WITH TEMPOROMANDIBULAR DISORDER: A SYSTEMATIC REVIEW

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#### ABSTRACT

**Introduction:** The aim of this study was to critically review the available data about the association between the deep bite and temporomandibular disorder and to discuss, evaluate based on the scientific evidence. **Material and methods:** Electronic databases were searched. Articles on temporomandibular disorder, any association between deep bite and TMD, data only from human subjects, language in English, randomized controlled studies (RCTs) and case-control studies, prospective clinical studies, and retrospective clinical studies and sample size not less than 30 subjects, overbite more than 4mm or moderate deep bite mentioned in the articles were included. **Results:** Total 162 articles were retrieved. 13 articles full text was thoroughly evaluated and only 7 articles were included for final evaluation. Out of 7 articles included in 2 studies significant association between deep bite and TMD, in 5 studies no significant association was observed. Except for 1 study, none of the studies considered gender influence for their study. 3 studies were of moderate quality and 4 studies were of low quality and none of the studies had high quality. **Conclusion:** Scientific evidence is lacking to confirm the association between deep bite and temporomandibular disorder. To set the exact scientific evidence further properly design randomized control trials only between the moderate or severe deep bite and temporomandibular disorder is required.

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## INTRODUCTION

The term temporomandibular disorder (TMD) is used to elaborate the collaboration of different clinical problems which include the masticator musculature, structures associated with temporomandibular joint (TMJ), or both" (American Academy of Temporomandibular Disorders, 1993). The aetiology behind the TMJ disorders is thought to be multifactorial and among them occlusion is one of the important factor (Mohlin, 1980). The most common symptoms of temporomandibular disorders are pain in the temple and face area, joint noises and some studies have reported that this symptoms are influencing their oral health-related quality of life (John et al., 2003; LeResche, 1997; Tenenbaum, 1999). If the knowledge can be gained about this potential risk factors for temporomandibular disorders than it will be great benefit for the public health.

Till now there has been various studies conducted to determine the relationship between the overjet, overbite and TMD, however the results varied in different studies. Some studies reported no association between overjet, overbite and TMD (John, 2002). Some studies reported weak correlation between the self-reported and clinically assessed temporomandibular disorders signs and symptoms (De Kanter, 1993). Some other studies reported association between deep bite and temporomandibular disorders, due to the over closure and their effects on the masticatory muscles (Thompson, 1986; Graber, 1969; Berry, 1978). Since till now no evidence based studies have been conducted on the relationship between the influence of deep bite on temporomandibular disorder, so the aim of this study was to critically review the available data about the association between the deep bite and temporomandibular disorder and to discuss, evaluate based on the scientific evidence.

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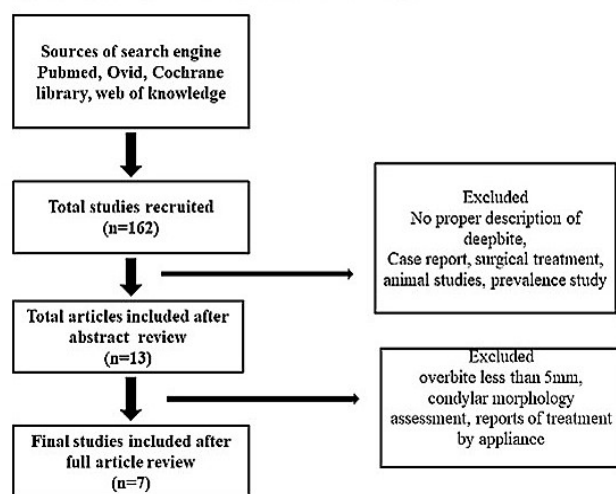
## MATERIALS AND METHODS

**Search strategy:** For this study review articles, national and internationally published articles, relevant cited articles were included. The data were searched from the MEDLINE database, Cochrane Library, Scopus journal search, knowledge of science by using the term temporomandibular disorder and deep bite, temporomandibular dysfunction and overbite, TMD symptoms and overbite. All the articles published till 2017 were included for this study.

**Inclusion criteria:** Articles on temporomandibular disorder, any association between deep bite and TMD, data only from human subjects, language in English, randomized controlled studies (RCTs) and case control studies, prospective clinical studies, and retrospective clinical studies and sample size not less than 30 subjects, overbite more than 4mm or moderate deep bite mentioned in the article.

**Exclusion criteria:** Animal studies, case reports, articles that did not follow the objective of this review, articles in a language other than English, deep bite correction by surgery, temporomandibular disorder in a syndromes or any muscular dystrophy subjects. After retrieving of articles from all searched engines, critically all the studies were read by two examiners. If any confusion was present regarding any study then the third and fourth examiner was approached and after discussion among all examiners only final conclusion was drawn.

Figure 1 showing the flowchart of search strategy



**Data extraction:** Each study was evaluated independently by four examiners (S.J, S.D, D.J & P.P) and if there was any conflict regarding the study then all the examiners re-evaluate the study again and final conclusion was drawn. In each study following criteria were thoroughly evaluated: sample size not less than 30, sample selection described in the study, adequate statistics were applied, if control groups were present in the study then any comparison between the groups by applying appropriate statistics. After the match of all the above mention criteria final articles were included. The quality of the study was scored using the modified quality evaluation methods given by Feldmann I, Bondemark L which was a modification of quality evaluation method described by Antczak *et al.* (1986) and Jadad *et al.* (1996) In this ten variables were evaluated and they are: Randomized control trial, 3 points; prospective study, 1 point; retrospective study, 0 point;

adequate sample size, 1 point; previous sample size estimation, 1 point; adequate selection description, 1 point; method-error analysis, 1 point; blinding in measurement, 1 point; adequate statistics provided, 1 point; and confounders included in analysis, 1 point. The quality of each study was categorized as low (0-4 points), medium (5-8 points), or high (9-11 points).

## RESULTS

Total 162 articles were retrieved and the entire articles abstract was studied by two examiners. After applying the inclusion and exclusion criteria, only 13 articles abstract was relevant to this study, hence only those articles full text was retrieved for thorough evaluation and studied by all the examiners. In 5 studies there was confusion regarding the results of the study, to come to conclusion regarding whether this articles should be included in the final study or not, all the examiners thoroughly again investigated the full articles text and only after agreement among all the examiners, the final conclusion was drawn. After reading full text only 7 articles met the inclusion criteria and for final study only those articles were considered. The flowchart of the search strategy was shown in Figure 1. Table 1 showing the quality assessment in all included studies. In 3 studies moderate quality grade was found and in 4 studies low quality grade. None of the studies considered blinding and method error analysis in their study. Confounding factors was considered only in 2 studies out of 7 included studies. Few studies explained the sample selection for their study. Except one study none of the other studies considered previous sample size estimation. The symptoms included in all the studies to evaluate the temporomandibular disorders were myofascial pain, jaw ache or stiffness, feeling of an uncomfortable bite, ringing in the ears, bruxism, pain in lateral pterygoid and medial pterygoid, disc displacement, arthralgia, osteoarthritis, osteoarthritis with disc displacement, Disc displacement without reduction, Disc displacement with reduction. Table 2 showing the results of the included studies. Out of 7 studies included for the final analysis only in 2 studies (Sonnesen, 2008; Tinastepe, 2015) significant association between temporomandibular disorder and deepbite was found. In one study (Tinastepe, 2015) pain in the lateral pterygoid muscles upon palpation, joint sounds and deviation more in the deepbite group compared to the control group was observed in the age group from 20-45 years. More nocturnal and diurnal grinding, jaw ache or stiffness in the morning, feeling of uncomfortable bite, ringing in the ears, tension type headache and disc displacement with arthralgia were found more in the deepbite groups compared to the control groups. But no significant differences between the genders in relation to temporomandibular disorder were found (Sonnesen, 2008). In three studies no statistical difference was observed between the deepbite and temporomandibular disorder (Pullinger, 1988; Sonnesen, 1998; Matsumoto, 2002). In other two studies also direct association between the deepbite and temporomandibular disorder was not found but instead in female subjects statistical significant difference was found in those subjects who were having Osteoarthritis with no history of derangement (Pullinger, 1991; Pullinger, 1993).

## DISCUSSION

In this systematic review various studies were thoroughly evaluated to determine the association between deepbite and temporomandibular disorders.

Table 1. Quality assessment of included studies

| Author                                      | Sample size | Previous estimate size | Study design | Selection description | Valid measurement methods | Method error analysis | Blinding in measurements | Adequate statistics | Confounding factors | Quality  |
|---|-------------|------------------------|--------------|-----------------------|---------------------------|-----------------------|--------------------------|---------------------|---------------------|----------|
| Pullinger A.G., 1988 <sup>4</sup>           | Adequate    | No                     | Prospective  | No                    | Yes                       | No                    | No                       | No                  | No                  | Low      |
| Pullinger A.G., 1991 <sup>15</sup>          | Adequate    | No                     | Prospective  | No                    | Yes                       | No                    | No                       | Yes                 | No                  | Low      |
| Pullinger A.G., 1993 <sup>16</sup>          | Adequate    | No                     | Prospective  | No                    | Yes                       | No                    | No                       | Yes                 | No                  | Low      |
| Liselotte Sonnesen, 1998 <sup>17</sup>      | Adequate    | No                     | Prospective  | Yes                   | No                        | No                    | No                       | No                  | No                  | Low      |
| Matsumoto, 2002 <sup>18</sup>               | Adequate    | No                     | Prospective  | Yes                   | Yes                       | No                    | No                       | Yes                 | No                  | Moderate |
| Sonnesen L & Svensson P, 2008 <sup>19</sup> | Adequate    | No                     | Prospective  | Yes                   | Yes                       | No                    | No                       | Yes                 | Yes                 | Moderate |
| Tinastepe, 2015 <sup>20</sup>               | Adequate    | Yes                    | Prospective  | Yes                   | Yes                       | No                    | No                       | Yes                 | Yes                 | Moderate |

Table 2 summary of included 5 articles

| Article                                | Sample size   | Age   | Result  |
|--|---|---|---|
| Pullinger A.G., 1988 <sup>4</sup>      | Study group=222<br>Control group=none   | Mean age=23.9 years   | No significant difference between TMJ clicking, crepitus, tenderness and deepbite   |
| Pullinger A.G 1991 <sup>15</sup>       | Control group =107,<br>TMJ patients (213 subjects) Group 1: DDR=41, Group 2: DDWR=20,<br>Group 3: OA with Disc Displacement History = 42,<br>Group 4: OA=34,<br>Group 5: Myalgia only=76  | Age group not mentioned   | No association between deepbite and TMJ symptoms  |
| Pullinger A.G 1993 <sup>16</sup>       | Control group =147,<br>Experimental group (413),<br>Group 1: DDR (n = 81),<br>Group 2: DDWR (n=48),<br>Group 3: OA with Disc Displacement History (n = 75),<br>Group 4: Primary OA (n = 85),<br>Group 5: Myalgia Only (n = 124) | Age group not mentioned   | No association between deepbite and TMJ symptoms  |
| Liselotte Sonnesen, 1998 <sup>17</sup> | Study group= 104<br>Control group= none   | 7-13 years  | No significant association between deepbite and TMD   |
| Matsumoto, 2002 <sup>18</sup>          | 60 patients of male and female  | 20 to 27 years  | No significant difference between malocclusion and control group  |
| Sonnesen L, 2008 <sup>19</sup>         | 60 subjects,<br>30 study group (F=20, M=10), 30 control group (F=20, M=10)  | Deepbite group (F=22-42, M=23-43 years)<br>Control group (F=23-40, M=25-44 years) | Significant difference between deepbite and control group. In TMD group more tension headache (p<0.000), Nocturnal clenching (p<0.003), diurnal clenching (p < 0.010), uncomfortable bite (p< 0.000), jaw ache/stiffness (p<0.050), ringing in ears (p<0.000) were found. |
| Tinastepe, 2015 <sup>20</sup>          | 60 patients 20=M,<br>40 = F,<br>30 study group, 30 control group  | 20 to 45 years  | In deepbite group pain in lateral pterygoid muscle on palpation (p<0.037), Joint sounds (p < 0.05), Deviation (p < 0.05)  |

OA: osteoarthritis, DDR: disc displacement with reduction, DDWR: disc displacement without reduction

Table 3. Showing the excluded studies

| Studies                              | Reasons for exclusion   |
|--------------------------------------|---|
| Runge ME <i>et al.</i> , 1989        | Eventhough the relation between overbite and TMD was evaluated but the overbite included was in normal range  |
| Tanne K <i>et al.</i> , 1993         | Syndromic subjects were included  |
| John MT <i>et al.</i> , 2002         | Prevalence study among all ranges of overbite subjects  |
| Ari-Demirkaya A <i>et al.</i> , 2004 | Condylar path was assessed in deepbite subjects, not TMD  |
| Castroflorio T <i>et al.</i> , 2004  | Treatment reports of occlusal splint appliance  |
| Cooper BC <i>et al.</i> , 2006       | Prevalence study and deepbite was considered where overlap is >2mm  |
| Uhaç I <i>et al.</i> , 2006          | Prevalence study, Normal overbite were observed   |
| Selaimen CM <i>et al.</i> , 2007     | Normal overbite subjects were taken in study group  |
| Almāsan OC <i>et al.</i> , 2011      | All overbite range was included in different malocclusion groups, no specific observation of deepbite and TMD |
| Wohlberg V <i>et al.</i> , 2012      | Joint morphology was evaluated in deepbite  |
| Mladenovic I <i>et al.</i> , 2014    | No deepbite groups were included  |
| Chiodelli L <i>et al.</i> , 2016     | Sample size very less (n=5)   |
| Lin SL <i>et al.</i> , 2017          | No specific observation of deepbite and TMD   |

After thorough evaluation and reading of all studies only 7 studies met the inclusion criteria. The excluded studies are given in table 3. All the 7 studies quality was assessed by using the quality assessment criteria given by Feldmann I, Bondemark L. On quality assessment 3 studies were found to have moderate quality grade and 4 studies were under low quality grade. Out of 7 studies included for the final analysis only in 2 studies significant association between temporomandibular disorder and deepbite was found. Various limitations were observed in the included studies. Except one study by Sonnesen L and Svensson, the other studies did not investigate the influence of the gender in occurrence of the temporomandibular disorder. Hence, dilemma still exists on regarding the influence of this parameter on temporomandibular disorder in deepbite subjects. In two studies by Pullinger *et al.* (1991 and 1993); direct observation was not carried out between the deepbite and Temporomandibular disorder, instead the study observed the relationship between the overbite and temporomandibular disorder in all five TMD groups who were divided according to various characteristics of TMD symptoms. Hence the result of the study might have been altered. Matsumoto MA *et al.* (2002) in their study did not described the association between temporomandibular disorder and deepbite.

The overall association between malocclusion (class II malocclusion, deepbite, overjet 3mm) and normal group was reported as no statistical significant difference when the tenderness in the lateral and medial pterygoid muscles was compared. They also reported pain while palpation through the meatus in normal occlusion group in 43.3% and only 30% in those with malocclusion group; however, this difference was not statistically significant. In the previous study by Mohlin B *et al.*<sup>21</sup> reported that the deepbite is not a common factor in a temporomandibular patients, this similar finding also reported by pullinger *et al.* (1991 and 1993) Mohlin *et al.* (2007) also quoted in their study that the muscular resistance offered may be the most significant factor than any existence of a certain malocclusion. Out of seven studies included, two studies showed significant association, other five studies did not find any association between deepbite and temporomandibular disorder. Since only two studies found significant association and those studies are of moderate quality, hence to come to conclusion regarding any association between deepbite and TMD is still lacking evidence.

## Conclusion

Scientific evidence is lacking to confirm the association between deepbite and temporomandibular disorder.

To set the exact scientific evidence further properly design randomised control trials only between the moderate or severe deepbite and temporomandibular disorder is required. This study concludes that there is lack of scientific evidence to confirm the association between deepbite and temporomandibular disorder. This has opened the potential for far more efficient and further properly design randomised control trials only between the moderate or severe deepbite and temporomandibular disorder is required to set the exact scientific evidence.

**Conflict of Interest statement:** Nil

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