

Mandibular Tori and Sleep Bruxism: Is There a Relationship? A Systematic Review

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Abstract

Aim of Investigation: To investigate the hypothesis that patients that have Mandibular Tori are more prone to have an associated bruxism habit. Additionally this review also investigated a possible link between Mandibular torus size and the strength of par functional oral activities.

Methods: Studies were considered for inclusion if they report on the presence of Mandibular Tori in patients with Bruxism, with a minimum of 20 teeth in the mouth with at least 10 on each arch. No restrictions will be applied regarding age or gender.

Both prospective and retrospective observational/clinical studies were included: clinical trials, cohort studies, case control studies and case series studies with 10 or more patients. However, we excluded studies, where removable artifacts or fixed orthodontic appliances were used.

Results: Searches of electronic databases, Google Scholar and partial grey literature yielded 435 original articles (1355 before removal of duplicates). After review of the titles and available abstracts, 45 satisfied the phase 1 inclusion criteria and were retrieved in full for further article review. Hand searching of their bibliographies was performed. The application of the aforementioned inclusion/exclusion criteria as a phase 2 review process resulted in the rejection of 37 articles. Therefore after the phase 2 review process, only 12 articles fully satisfied the selection criteria.

Conclusions: There is a strong association between Mandibular torus and presence of Bruxism and wear facets. Some patients with Bruxism have no Mandibular torus at all.

Keywords: *Sleep Bruxism; Mandibular Tori; Maxillary torus; Mylohyoid muscle*

Introduction

Bruxism is an oral parafunctional activity that involves the medial pterygoid muscles, which move the opposing dental arches one against another in a side to side motion. This is associated intraorally with grinding of teeth and clenching of the jaw. It is one of the most common sleep disorders and it can result in occlusal trauma, abnormal wear patterns, abfractions, tooth fractures, tooth loss and/or gum recession [1,2].

An oral torus is a slowly growing bony exostosis composed of dense cortical bone, internal spongy bone and a mucosal cover. It is considered congenital and benign with no clinical significance unless it interferes with a prosthetic appliance, or with tongue or speech functions. In such cases it needs to be partially or totally surgically removed. It can be located in the maxillary midline (maxillary torus) or along any part of the lingual surface of the mandible usually near the premolars (torus mandibularis). In the mandible it is usually found bilaterally above the mylohyoid muscle attachment [2,3]. The size of a torus may change during life and it is related to many factors including local stresses, genetic factors, environmental factors and continuing surrounding bone growth [4].

Mandibular Tori are more common than maxillary Tori and are also more common in Asian and Inuit populations. Tori are found mostly in children less than 10 years old [5] but are also often seen in young adults and middle-aged individuals [6]. Mandibular torus oc-

curs in various ethnic groups with prevalences ranging from 0.5 % among Brazilian Indians [5], 3.2 % among Nigerians [7], 20 % among Brazilians [8] and 31.9 % among Thais and up to 74 % in the Japanese population [9]. Some authors [10] consider that palatine torus is more frequently seen in women whereas Mandibular torus is more common in men. An epidemiological study on lesions diagnosed during a period of 29 years involving patients with a mean age of 34.17 years found that the mean age of patients with torus was 43.55 years with women representing 60 % of the cases and Mandibular torus being predominantly seen [11].

As mentioned before the Mandibular torus, or Mandibular Tori in plural form, is a thickening or growth that occurs in the inner part of the mandible. It is classified as an abnormality of the oral cavity. On most occasions, the condition actually occurs as multiple instead of just one bony elevation, appearing at both the left and right sides of the mandible. Mandibular torus is a slow-growing condition, and it also has the tendency to fluctuate in size. In some cases, where there is more than one protrusion, the tori can grow to the point of touching each other [12-16].

Recently, some studies [16-19] identified an association between Mandibular Tori sleep Bruxism and temporomandibular joint dysfunction, but no comprehensive collective review has been made. Thus this systematic review will investigate the hypothesis that patients that have Mandibular Tori are more prone to have an associated bruxism habit. Additionally this review will also investigate a possible link between Mandibular torus size and the strength of parafunctional oral activities e.g. anxiety, wear facets, headaches and muscle fatigue.

Materials and Methods

The reporting of this systematic review will use the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement for reporting systematic reviews of health sciences [20]. Neither a review protocol nor systematic review registration was completed.

Data Sources and Searches

Electronic searches up to March 30, 2013 were conducted using the following electronic bibliographic databases: PubMed, MEDLINE; EMBASE; Web of Science, PASCAL, EBM (Evidence-Based Medicine) Reviews-Cochrane Central Register of Controlled Trials; EBM Reviews - Cochrane Database of Systematic Reviews (CDSR), EBM Reviews - Database of Abstracts of Reviews of Effects (DARE); and Health STAR. The search strategy was developed with the help of a specialized health sciences librarian. The used key words involved: "torus", "bruxism", "anxiety", "masticators stress", "parafunctional habits", and "Tori", "wear facts"; "mandibular torus"; "mandibular tori"; "mandibular exostosis", "clenching", "grinding" and "parafunctional activity". In addition, the reference lists of the finally selected articles were screened for any articles that may have been omitted. No restrictions were applied regarding publication year or language. If any important information from the selected articles was deemed to be unclear the authors were contacted for clarification.

Study Selection

Studies will be considered for inclusion if they report on the presence of Mandibular Tori with a minimum of 20 teeth in the mouth with at least 10 on each arch. No restrictions will be applied regarding age or gender. Both prospective and retrospective observational/clinical studies will be included: clinical trials, cohort studies, case control studies and case series studies. However, we excluded studies, where removable artifacts (e.g. partial or total prosthesis or orthodontic appliances) or fixed orthodontic appliances were used.

Two reviewers independently will review the list of titles and abstracts for inclusion. Once potentially adequate abstracts are selected, full articles will be retrieved in a second final selection process. If the abstract is judged to contain insufficient information for a decision of inclusion or exclusion, the full article will be obtained and reviewed before a final decision is made. Any discrepancies in inclusion of articles between reviewers will be addressed, at both selection stages, through discussion until consensus is reached.

Risk of Bias Assessment

The Case control, case series and cohort studies (association values) will be used to appraise the methodological quality of the relevant studies. The methodological quality will be assessed by two reviewers and discrepancies will be resolved by discussion until consensus is reached.

Data Extraction and Data Synthesis

The same two reviewers will extract data independently, in duplicate. The extracted data will be combined and compared for accuracy with discrepancies resolved by reexamination of the literature as a team to achieve consensus. If the available collected information is found to be adequate, we plan to consider conducting a meta-analysis.

Results

Study Selection

Searches of electronic databases, Google Scholar and partial grey literature yielded 435 original articles (1355 before removal of duplicates). After review of the titles and available abstracts, 45 satisfied the phase 1 inclusion criteria and were retrieved in full for further article review. Hand searching of their bibliographies was performed; however no additional articles were identified.

The application of the aforementioned inclusion/exclusion criteria as a phase 2 review process resulted in the rejection of 37 articles. Therefore after the phase 2 review process, only 12 articles fully satisfied the selection criteria.

Study Characteristics

A summary of key methodological data and results of the studies can be found in Table 2. All the twelve included articles were in English language and published between 1965 and 2012. Seven of the studies had a case control study design, and the other five had a cohort study design. Sample sizes ranged from 45 to 300 patients. The age of the participants ranged from 13 to 80 years. With regard to the strong association found between Mandibular torus and presence of wear facets, Igarashi *et al.* [21] concluded that a high degree of dental attrition is one of the indicators showing that teeth and mandible suffer occlusal stress. Their results suggest that masticatory stress is responsible for the development of torus. Johnson *et al.* [22] found a strong relationship between the wear on molars and formation of Mandibular torus. Following the same rationale, Bukhari *et al.* believed that the cause of torus can be a functional response in those individuals having well-developed masticatory muscles or worn teeth due to occlusion. They also stated that the age period between 20 and 30 years is the period of greater tooth wear [23]. Also, in a study conducted by Locker *et al.* [25] it was found that the growth of Tori is gradual being greater in the second and third decades of life. Also the same study showed that the average age when experiencing the onset of torus is 34 years.

Risk of Bias

Methodological appraisal of selected studies according to the Cochrane Risk of Bias criteria for assessing individual studies found the quality of reported methodology to range from mild to moderate bias. Common weaknesses identified were: failure to justify or calculate sample sizes, failure to report reliability, failure to identify limitations in study design, failure to implement allocation concealment and blinding of both the assessors and the particular outcome assessment. The selected studies were the best level of evidence available to answer the clinic question posed in the systematic review.

Discussion

Summary of Evidence

The results found in this systematic review demonstrate a strong association between Mandibular torus and presence of both bruxism and wear facets thus corroborating hypotheses raised by several authors. The study by Natvig [26] involving 2,010 individuals has already shown that functional forces and number of functional teeth are related to the frequency of Mandibular torus.

Furtado *et al.* [27] also believed that the predominance of Mandibular torus is directly associated with the presence of teeth. According to the authors Mandibular torus can be formed by the forces being exerted on cusps and by the force from the palatine facet of upper tooth being transmitted to the lingual facet of the alveolar process. This is also corroborated by other authors [28,29, 30] who suggested that masticatory stress may be the major cause of torus development, thus possibly being an indicator of parafunctional activity [31], a finding supporting the results of the present study.

Clifford *et al.* [32] found a higher prevalence of Mandibular torus in patients with TMD, which is similar to the findings of Pechenkina *et al.* [33], who reported that there is a significant correlation between Mandibular torus, exostosis and TMD pathologies. The authors [34] found no relationship between Mandibular torus and palatine torus suggesting that both conditions are genetically independent despite being influenced by the same environmental factor. Adopting an inverse relationship but agreeing with the positive association found between Mandibular torus and bruxism.

Serra *et al.* [35] found that individuals with Mandibular torus are 9.5 times more likely to have bruxism compared to individuals without torus. Similar to the findings of the present study Nakamura *et al.* [36] found a statistically significant relationship between the presence of Mandibular torus and parafunction (clenching). Nevertheless, the same authors found no relationship between Mandibular torus and tooth grinding, a finding reported by the present study. With regard to the strong association found between Mandibular torus and presence of wear facets, Igarashi *et al.* [37] concluded that a high degree of dental attrition is one of the indicators showing that teeth and mandible suffer occlusal stress, which is also corroborated by this study. Their results suggest that masticatory stress is responsible for the development of torus. Shiho *et al.* [38] found a strong relationship between the wear on molars and formation of Mandibular torus.

Following the same rationale, Garcia-Garcia *et al.* [39] believed that the cause of torus can be a functional response in those individual shaving well-developed masticatory muscles or worn teeth due to occlusion. Hugoson *et al.* [30] stated that the age period between 20 and 30 years is the period of greater tooth wear. Also, in a study conducted by Bruce *et al.* [40] it was found that the growth of Tori is gradual being greater in the second and third decades of life. Also the same study showed that the average age when experiencing the onset of torus is 34 years. Nevertheless it is not easy to compare the range of ages provided in the studies that were analyzed. In the present study the correlation between the severity of bruxism with torus size was positive but only suggests a trend because the study was not designed with the goal of finding this association.

Considering the association between the duration of bruxism and torus size, as this was a cross-sectional study the exposure and outcome were measured at the same time. Thus, for this study it was not possible to determine the duration of bruxism. This would only happen if it was a longitudinal study and the patients with bruxism had been followed over a long period. The amount of wear of teeth decreases gradually over time due to the increase in occlusal contacts, which reduces the force per unit area. Perhaps such a concept justifies the affirmation that torus is a dynamic phenomenon and its prevalence is higher by the third decade of life [41] and decreases after 50 years of age probably due to a decrease in the number of functional teeth [42].

Similarly, Pechenkina *et al.* [33] also believed that exostosis reduces both frequency and degree of expression in populations whose masticatory function decreases after 30 or 40 years of age. The reduction of muscle force or the high frequency of edentulous individuals at older ages seems to be a remodeling response to exostosis [43]. The authors [44] believed that torus frequency in dentulous patients is higher than in edentulous ones, which is in accordance with Apinhasmit *et al.* [45], who stated that there is a decrease in the frequency of Mandibular torus between 50 and 59 years of age resulting from absence of teeth, reduced masticatory function and less occlusal stress.

Clifford *et al.* [46] believe that the exact cause of torus development has not yet been clarified but the most accepted theory involves genetic factors which is supported by the findings of Johnson *et al.* [24] who showed that pedigrees strongly indicate an autosomal dominant mode of inheritance. Other authors [38] state that the etiology of exostosis is multi factorial, including genetic and functional factors. This finding is also in accordance with Eggen [40] who reported that the development of torus is 30 % genetic and 70 % environmental. On the other hand the results reported by Uysal *et al.* [7] suggest that the same mechanism is involved in the rise of mineral bone density and presence of exostosis, thus indicating that the presence of Mandibular torus may be a marker of high mineral bone density and less risk of osteoporosis in the future.

Finally, there is no relevant evidence showing that the other variables studied (i.e. anxiety, headache and/ or muscle fatigue, self-perception and family members' perception of bruxism) have an association with the presence of Mandibular torus and/or torus size. Corroborating these results Garcia-Garcia *et al.* [39] found no relationship between Mandibular torus and muscle pain or stress; however, Clifford *et al.* [46] reported a higher prevalence of Mandibular torus in patients with headache.

Database	Keywords	Results
PubMed 1971 to March 30 2013	Torus or Bruxism or Anxiety or Masticatory stress, or parafunctional habits or tori Case control or mandibular torus or mandibular tori or clenching or grinding	220
Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R) 1952 to March 29 2013	Torus or Bruxism or Anxiety or Masticatory stress, or parafunctional habits or tori Case control or mandibular torus or mandibular tori or clenching or grinding	130
Embase 1981 to 2013 Week 12	Torus or Bruxism or Anxiety or Masticatory stress, or parafunctional habits or tori Case control or mandibular torus or mandibular tori or clenching or grinding	178
EBM Reviews - Cochrane Database of Systematic Reviews 2006 to February 2012	Torus or Bruxism or Anxiety or Masticatory stress, or parafunctional habits or tori Case control or mandibular torus or mandibular tori or clenching or grinding	5
EBM Reviews - Database of Ab- stracts of Reviews of Effects 1st Quarter 2013	Torus or Bruxism or Anxiety or Masticatory stress, or parafunctional habits or tori Case control or mandibular torus or mandibular tori or clenching or grinding	3
EBM Reviews - Cochrane Central Register of Controlled Trials March 2013	Torus or Bruxism or Anxiety or Masticatory stress, or parafunctional habits or tori Case control or mandibular torus or mandibular tori or clenching or grinding	38
Ovid Health star 1975 to March 2013	Torus or Bruxism or Anxiety or Masticatory stress, or parafunctional habits or tori Case control or mandibular torus or mandibular tori or clenching or grinding	129
PASCAL 1991 to 2013 Week 13	Torus or Bruxism or Anxiety or Masticatory stress, or parafunctional habits or tori Case control or mandibular torus or mandibular tori or clenching or grinding	78
Web of Knowledge 1985 to March 2013	Torus or Bruxism or Anxiety or Masticatory stress, or parafunctional habits or tori Case control or mandibular torus or mandibular tori or clenching or grinding	298
Scopus 1984 to March 2013	Torus or Bruxism or Anxiety or Masticatory stress, or parafunctional habits or tori Case control or mandibular torus or mandibular tori or clenching or grinding	276
Total Databases Searches		1355
# of Duplicates		920
Final		435

Table 1: Search Strategy, Keywords and Results from Individual Databases.

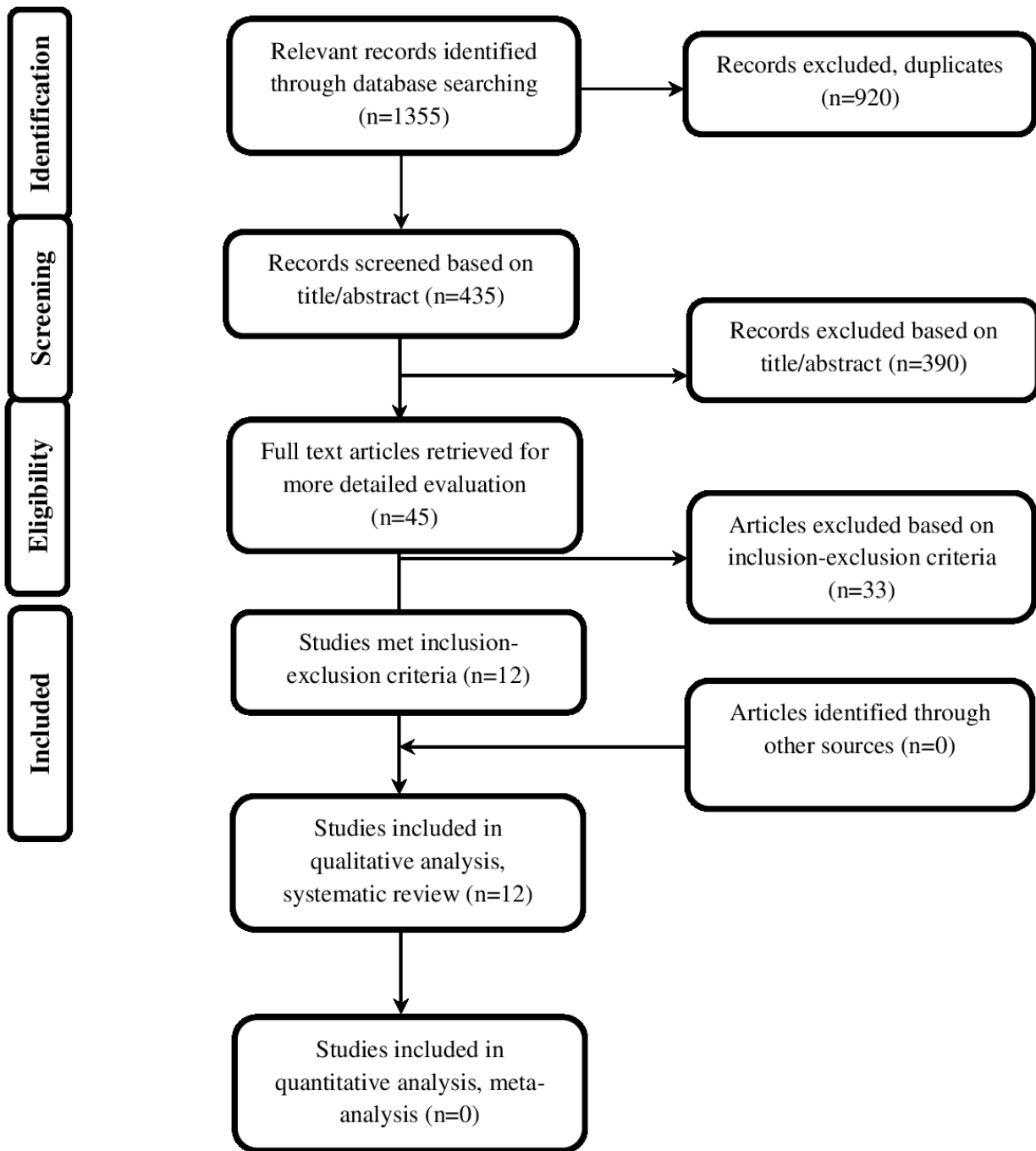


Figure 1: Flow diagram of the literature search according to the PRISMA.

Article	Study Design	Country	Sample Size	Patient Age	Criteria evaluated	Follow-up
Pechenkina et al, 2002	CT, R	USA	45 (21 M, 24 F)	25-70	Reliability and validity	5 yrs
Kerdpon et al, 2003	CS, R	USA	25(11 M, 14 F)	15-60	Reliability	4 yrs
Breslin et al, 2003	CS, R	USA	50 (21 M, 29 F)	20-75	Validity	3 yr
De Luca Canto et al, 2012	CT, R	Brazil	100 (33 M, 67 F)	20-62	Reliability and validity	2 yrs
Locker et al, 2006	CS, R	Canada	90(40 M, 60 F)	20-70	Reliability and validity	4 yrs
Johnson et al, 1965	CS, R	USA	80(25 M, 55 F)	15-57	Reliability	5 yrs
Sirirungrojying et al, 1999	CS, R	Thailand	59(20 M, 39 F)	20-70	Reliability and validity	2 yrs
Apinhasmit et al, 2001	CT, R	Thailand	60(25 M, 35 F)	18- 68	Reliability and validity	3 yrs
Bukhari et al, 2003	CT, R	Indonesia	300(100 M, 200 F)	13- 80	Reliability and validity	5 yrs
Igarashi et al, 2008	CT, R	Japan	170(70 M, 100 M0)	20-70	Reliability and validity	3 yrs
Bernaba. 1976	CT, R	Brazil	200(50 M, 150 F)	19 -68	Reliability and validity	2 yrs
Cagirankaya, 2005	CT, R	Turkey	230(80 M. 150 F)	20 -70	Reliability and validity	3 yrs

Table 2: Summary of finally selected studies reporting on mandibular tori and sleep bruxism.

Abbreviations: R: retrospective study; CS: case series; CT: clinical trial; yr: year; F: female; M: male

Conclusion

1. There is a strong association between Mandibular torus and presence of bruxism and wear facets.
2. Some patients with bruxism have no Mandibular torus at all.

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