Torus mandibularis in the childhood and in the initial stages of adolescence

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The aim of this study was to determine, in the childhood and the first stage of the adolescence, the prevalence and the changes in morphology of the torus mandibularis and to establish criteria which can help us in the understanding of this structure. The comprehension of the variations at these age ranges could be related to the appearance of this formation. We analyzed 295 subjects between 8 and 15 years that were divided into 4 age groups (8-9, 10-11, 12-13 and 14-15 years). Seventy-three cases presented torus mandibularis (25.4%) and a significant increase in number during the studied period (P=0.044) was observed. There were no significant differences in gender (P=0.31). The location and size changed with age and presented an elongated bar-shaped uniodular morphology. We consider that torus mandibularis is not just a formation present in adults, but appears in childhood and develops at a young age, probably suffering the same changes that happened during the growth of the body of the mandible.

Keywords: lingual mandibular protuberance; mandibular exostosis; mandibular growth

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Introduction

Torus mandibularis classically has been defined as a benign hyperostosis localized in the lingual aspect of the mandible [1, 2]. This bony formation is studied both in the living subjects [3, 4] and in skeletons [1, 5, 6]. Authors conclude that appears more frequently in males and in the third decade of life [1-4, 6] and its prevalence varies enormously: from 7.9% of Kolas et al. [8], up to 64% of Mayhall and Mayhall [7]. Basically, two morphological types have been described: uniodular or single and multidiodular or multiple [3-5, 8].

The origin of torus mandibularis has aroused controversy: it may have a purely genetic basis determined by inheritance [9-12] or may be caused by masticatory stress [1, 2, 13-15], or even genetic and environmental factors could be involved both in its origin and development [3, 5, 6, 16-18].

Torus mandibularis is a variable formation that undergoes changes during a person’s life [2-4, 16, 18]. It could be stabilized in adulthood [1, 8] and have no signs of resorption during senility [1], may increase in size [16, 19], or even in the edentulous resorbed by the loss of masticatory function [2] or extractions undertaken [13, 17].

Increased muscle strength, combined with increased masticatory stress in young people [2], the number of present teeth [20], good features of facial development and developed mandibles [13, 17], and a strong association with clenched grinding [21] appear to be related to the presence of mandibular tori. Eggen [18] found that the genetic determination of mandibular tori was 30% and environmental influence in terms of occlusal stress was 70%.

The aim of this study was to determine, in the childhood and the first stage of the adolescence, the prevalence and change in morphology of the torus mandibularis and to establish criteria that can help us in the understanding...
Every single torus were photographed by a camera Nikon F70 with a Sigma 105 mm macro lens. To identify any statistical differences between different groups, Chi-square test ($\chi^2$) was employed. A two-sided $P$-value less than 0.05 was considered significant. All tests were carried out using the Statistical Package for the Social Sciences 15.0.1 (SPSS Inc, USA).

Results

The obtained prevalence was 25.4% (Table 1) with unilateral torus mandibularis in 13 subjects and bilateral in 62. We found a significant increase in the prevalence of this formation with age (Table 1). There was no statistical significance based on gender (Table 2). All the exostoses were delimited and circumscribed differing from the lingual aspect of the mandible and on palpation presented a similar hardness. The mucous membrane, surrounding the torus mandibularis, had the same color and appearance as the adjacent tissue.

<table>
<thead>
<tr>
<th>Table 1 Prevalence of torus mandibularis</th>
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<td>No torus</td>
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</tr>
<tr>
<td>8-9 years</td>
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<td>10-11 years</td>
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Number of subjects for group and the corresponding percentages in brackets ($P$<0.05 were considered significant). A significant increase in the prevalence of the torus mandibularis with age were found ($P$=0.044).

<table>
<thead>
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<th>Table 2 Torus distribution depending on gender</th>
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<td>Groups</td>
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<tr>
<td>8-9 years</td>
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In the first group, we observed five formations: a unilateral torus in a eight year-old girl (Figure 1A) and two children (female and male) of nine years of age with bilateral torus mandibularis (Figure 1B and 1C). All these formations presented elongated bar-shaped unimodular morphologies and the tori were located at the lower permanent incisors (mesial end) and the area of the lower deciduous second molar (distal end), with the greatest thickness at the lower canine (Figure 1A, 1B and 1C). Torus mandibularis was located in the curved area which formed the body of the mandible to continue with the symphysis, rising from the lingual aspect of the mandible. The prevalence of this group was 11.5% (Table 1), and was most prevalent in females.
We observed differences between the children of 10 and 11 year-old on the inspection of the torus mandibularis. At 10 years of age, these formations were similar to those described at nine years, though the distal end of this exostosis was located more accurately at the mesial area of the lower deciduous second molar. Also we found dehiscence at the level of the reference zone because of tooth replacement (Figure 2A and 2B). On the contrary, at 11 years-old, torus mandibularis appeared as bone relief with the greater thickness located between the permanent lower canines and the first permanent lower molars (Figure 2C and 2D). These exostoses were decreasing in thickness until their distal ends at the lower permanent second premolar or the lower deciduous second molar (Figure 2C and 2D). Mesially, these formations finished at the area of the lateral perman-

**Figure 1** A: Eight-year-old female with unilateral torus mandibularis. B: Nine-year-old female with bilateral torus mandibularis. C: Nine-year-old male with bilateral torus mandibularis. Mesial limits (head of arrow) were located at the level of the lower incisors between the central and the lateral (A) or the central (B and C). The distal limits (arrow) were located at the area of the lower 2\textsuperscript{nd} deciduous molar. Greater thickness (asterisk) was seen in the lower deciduous canine.

**Figure 2** A: Ten-year-old female with bilateral torus mandibularis. B: Ten-year-old male with unilateral torus mandibularis. Mesial limits (head of arrow) were located at the level of the lower incisors; the distal limits (arrow) were at the mesial area of the lower 2\textsuperscript{nd} deciduous molar. Greater thickness (asterisk) was in the lower deciduous canine. C: Eleven-year-old male with bilateral torus mandibularis. D: Eleven-year-old male with bilateral torus mandibularis. Mesial limits (head of arrow) were located at the lower permanent lateral incisors, and distal limits (arrow) were at the lower permanent second premolar or the lower deciduous second molar. Greater thickness (asterisk) was located between the permanent lower canines and the first permanent lower molars.
lower incisors. The torus presented an elongated bar-shaped uniodular morphology. In this group the prevalence was 15.4% (Table 1). Four children had unilateral torus mandibularis.

At 12 year-old, torus mandibularis presented the same morphological characteristics that we already had observed at 11 years (Figure 3A and 3B). However, we noted that in certain cases the limits of this exostosis changed, so that the mesial end was located now between the lower permanent lateral incisors and the canines (Figure 3C and 3D), the maximum thickness was at the level of the lower first premolar (Figure 3C and 3D) and the distal end at the lower permanent first molar (Figure 3D). This formation appeared in the 26.2% of the subjects (Table 1) with six cases with unilateral torus mandibularis.

**Figure 3 A:** Twelve-year-old male with bilateral torus mandibularis. B: Thirteen-year-old female with bilateral torus mandibularis. Mesial limits (head of arrow) were located at the lower permanent lateral incisors, and distal limits (arrow) were at the lower permanent second premolar. Greater thickness (asterisk) was between the permanent lower canines and the first permanent lower molars. C: Twelve-year-old female with bilateral torus mandibularis. D: Thirteen-year-old male with bilateral torus mandibularis. Mesial limits (head of arrow) were located between the lower permanent lateral incisors and the canine. The greater thickness (asterisk) was at the level of the lower first premolar. Distal limit (arrow) was located at the lower second premolar (C) or at the lower permanent first molar (D).

In the oldest group, Torus mandibularis still presented a bar-shaped uniodular morphology localized in the curved area which formed the body of the mandible to continue with the symphysis. The thicker of these formations was at the area of the lower first premolars, becoming less and less bulky to disappear in the lower permanent first molars. The mesial limit was between the lower permanent lateral incisors and the lower canines (Figure 4A, 4B, 4C and 4D). The prevalence was 31.6% (Table 3), the greatest of all. Unilateral torus mandibularis was only observed in two cases.

**Discussion**

Though there is not a standard model for the study of torus mandibularis [3, 5, 16], it is very important to establish some basic criteria that allow us to detect the presence of this exostosis in young people. At the studied ages, we constantly observed that this formation corresponded to any bulky bony structure located in the lingual aspect of the body of the mandible, cranially to the mylohyoid ridge, between the permanent lower incisors and the permanent lower first molar.
There are few studies made on the appearance of the torus mandibularis in juveniles. Moorrees et al. [9] observed that the frequency of this formation was 30% in children under 10 and Axelsson and Hedegard [16] find highly significant positive association between age and frequency of occurrence and size in schoolchildren. Our total prevalence was the highest compared with other studies where several age groups are involved [8, 17, 20, 22]. But comparisons with researches specifically on adults [4, 5, 21], our results were similar. Therefore, we cannot agree with those authors [1, 2] who considered torus mandibularis a rare formation in children, one that instead appeared during childhood. These authors justify the low presence of this exostosis because they considered masticatory stress as the main cause for the appearance. However, the high frequency found in schoolchildren by Axelsson and Hedegard [16] was justified by the strong influence of environmental factors. Nevertheless, Moorrees et al. [9] argued that their highest prevalence obtained in children under 10 was due to the influence of genetic factors.

Different authors [1, 2, 16] have found a relationship between the age of the subject and the appearance of the torus mandibularis. For us, age was an important factor in the development of this formation because we observed a significant increase in its prevalence with age: the greater the age, the greater the presence of tori. We also agree with all the authors who have pointed out that it is a formation in which we can observe changes with age [2-4, 19]. We consider that there could be a relationship between the growth of the body of mandible and the development of mandibular torus, because we have found that both the area where its greatest thickness was located and the mesial and distal ends changed in location at different ages. So, at 8 years of age the greatest volume was located at the level of the lower deciduous canines and at 15 years was in the permanent lower first premolar. Regarding its length, at 8 years it was circumscribed between the permanent lower central incisor and the second deciduous lower molar and at 15 years the mesial limit was between the lower permanent lateral incisors and the lower canines and the distal limit in the lower permanent first molars. Ellerston [19] observed the development and change in morphology of two torus mandibularis in a person during more than 30 years (from adult to senility), noting the fact of the grow-
that this exostosis.

We detected a greater number of juveniles with bilateral torus mandibularis rather than unilateral. We agree with all authors [2, 6, 16, 23, 24] who noted that torus mandibularis usually occurs bilaterally. Pynn et al. [24] remarked that 20% of the torus mandibularis population may present unilateral tori.

Wright studies [1-3, 6] have found this formation more frequent in males. For Ossenberg [2], this was due to increased masticatory muscle strength, however Sperber [17] considered the torus mandibularis as a genetic exostosis, unrelated to any muscular attachments or known functional matrices. Therefore, we agree with Kolas et al. [8]. Axelsson and Hegedard [16] and Al Qurani and Ali-Dawari [25] because they did not find statistically significant differences between genders.

Based on the morphological classification established by researchers [3-5, 8], we must take into account the number of nodules or elevations that presented these formations: single or uninodular (one nodule); or multinodular multimodular (more than one). At the studied ages, we have observed an uninodular morphology. This coincided in part with the observations made by Axelsson and Hegedard [16], noting that the single torus was the most frequent between 6 and 12 years of age, but we did not agree when they stated that after 12 years, multinodular was the most common. More accurately, we would consider at the studied ages a single elevation in a thino-shape, because it has a straight surface, smooth and rounded, with two ends: the mesial one, at the lower incisors and the distal end at the lower premolars/molars region.

It is difficult to mould in children the mechanism of appearance of the torus proposed by Ossenberg [2]. According to this author, the horizontal component of the force tips the lower canine, premolars and first molar so that their root splices exert pressure on the premaxillary membrane causing formation of new bone on the lingual cortical plate of the alveolar process. She proposes that primary factor is masticatory stress. For us, at the studied ages, it would be necessary continuous greater forces during a long period of time to cause it. Moreover, these phenomena do not explain either the protrusions at the level of the vestibular cortical plate of maxillars and premolars that Ellerston [19] found when he studied during more than 30 years the development of alveolar processes in a subject. According to the author, even at such a young age, we consider that there is no sufficient appearance of this bony formation due to an unknown genetics factors, suffering changes in the growth of the body of the mandible.

The changes in morphology could be due to the mandibular location of the tori because is an area of subperiosteal bone apposition [26].

Conclusion

This is one of the few studies to analyze torus mandibularis exclusively in juveniles. We consider that torus mandibularis is not just a formation present in adults, but appears in childhood (in a bar-shape or uninodular morphology) and develops with age, probably suffering the same changes that happen during the growth of the body of mandible. It is questioned if primary cause of appearance is masticatory stress.

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Torus Mandibularis in Juveniles


