Abstract

OBJECTIVE: To assess radiographically the prevalence of morphological alterations of the styloid process in patients with temporomandibular joint disorders. MATERIALS AND METHODS: We have analyzed 1,500 panoramic x-ray films of temporomandibular joint from both male and female patients with no age limit, who were attended in the Service of Temporomandibular Joint Disorder of Faculty of Odontology at Universidade Federal de Juiz de Fora, MG, Brazil, in the period between 1997 and 2003. RESULTS: Eighty-three (5.53%) of the analyzed patients (74 female and 9 male), predominantly in the age range between 41 and 50 years (32.5%), presented with, at least, one of the joint sides with morphological alteration of the styloid process. As far as the type of styloid process in concerned, 113 elongated, 21 pseudoarticulated and 19 segmented were observed. Also, it was noticed that the morphological alterations of the styloid process develop in a symmetrical fashion. CONCLUSION: In individuals with temporomandibular joint disorder, styloid process alterations occur symmetrically and in a different way for each patient, independently from sex and age. Keywords: Styloid process; Temporomandibular joint disorder; Radiography.

Resumo

Prevalência de alteração morfológica do processo estilóide em pacientes com desordem temporomandibular. OBJETIVO: Avaliar, radiograficamente, a prevalência de alterações morfológicas do processo estilóide em pacientes com desordens temporomandibulares. MATERIAIS E MÉTODOS: Foram analisadas 1.500 radiografias panorâmicas da articulação temporomandibular de pacientes de ambos os sexos e sem limitação de idade, que foram atendidos pelo Serviço de Desordem Temporomandibular da Faculdade de Odontologia da Universidade Federal de Juiz de Fora, MG, no período de 1997 a 2003. RESULTADOS: Oitenta e três (5,53%) dos pacientes da amostra apresentaram pelo menos um dos lados da articulação com alteração morfológica do processo estilóide, sendo 74 do sexo feminino e 9 do sexo masculino, concentrados na faixa dos 41 a 50 anos de idade (32,5%). Com relação ao tipo morfológico do processo estilóide, verificaram-se 113 alongados, 21 pseudo-articulados e 19 segmentados. Constatou-se, também, que as alterações morfológicas do processo estilóide desenvolvem-se de forma simétrica. CONCLUSÃO: Em pacientes com desordem temporomandibular as alterações do processo estilóide ocorrem de forma diferenciada e de maneira simétrica em cada paciente, independentemente do sexo e da idade. Unitermos: Processo estilóide; Desordem temporomandibular; Radiografia.
above the common carotid artery, between the external and internal branches, immediately proximal to the internal jugular vein and the facial nerve\(^{(1)}\). The styloid process length may vary, but the mean length is 25 mm; also, it may be absent\(^{(6)}\), as well as present elongated.

Langlais et al.\(^{(7)}\) have classified the styloid process elongation and/or stylohyoid ligament calcification into three types, according to their radiographic appearance: elongated — the styloid process and the stylohyoid ligament appear like a continuous, 2.5–3.2 cm-length structure; pseudoarticulated — the process seems to be joined to the stylomandibular or stylohyoid ligament by means of a single pseudo-joint, typically situated above the mandible angle; segmented — the styloid process and ligaments consist of several mineralized segments.

The differential diagnosis between Eagle syndrome and temporomandibular joint dysfunction may be performed on the basis of clinical history, digital styloid process palpation in the area of the tonsillar fossa, local anesthesia infiltration\(^{(5,8)}\), as well as visualization of the styloid process on x-ray or computed tomography\(^{(9)}\). Besides palpation, mouth opening test, intra- and extra-oral inspections, and algesic area observation\(^{(1)}\), in 1937, Eagle\(^{(10)}\) suggested the diagnostic confirmation through the classical triad of foreign body sensation in the throat, palpable stiffness in the tonsillar region, and radiographic image with styloid process elongation.

Imaging studies like panoramic, modified panoramic, transfacial, transcranial, transorbital x-rays, and tomography are the basis for the temporomandibular disorders diagnosis\(^{(3)}\). However, several authors\(^{(3,5,11,12)}\) recommend the panoramic x-ray for visualization and analysis of the styloid process as well as its variations in size and shape. Arellano\(^{(13)}\) has asserted that the panoramic x-ray presents limitations like images amplification, overlapping and unclearness.

Therefore, by associating temporomandibular disorders with Eagle syndrome, this study is intended to radiographically evaluate patients with temporomandibular joint disorders for the presence of morphological alterations of the styloid process and/or stylohyoid ligament likely to influence the diagnosis of this joint disorder.

**MATERIALS AND METHODS**

This study has encompassed the analysis of 1,500 temporomandibular joint x-rays of both male and female patients with no age range limit, attended at Faculdade de Odontologia da Universidade Federal de Juiz de Fora – Service of Diagnosis and Guidance for Patients with Temporomandibular Disorders (Juiz de Fora, MG, Brazil) between August/1977 and March/2003. All the studies were performed in a Rotograph Plus with fixed 10 mA and (Dabi Atlante) model appliance, according to the patient’s physical complexion (varying between 60 kVp and 85 kVp). A Kodak film with a curved 12.7 x 30.5 cm. intensifying screen was employed. The film processing was manually made employing the time-temperature method.

The x-ray images have been analyzed and those presenting at least an one-sided morphological alteration of the styloid process were selected. The morphological types (variations) have been evaluated and classified according Langlais et al. criteria\(^{(7)}\) as follows: normal, elongated, segmented and pseudoarticulated (Figure 1).

The Cramer’s V correlation coefficient was utilized for evaluating the association between nominal, qualitative variables (categorical).

**RESULTS**

From the group of 1,500 x-rays, 83 patients (5.53%) presented with at least an

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**Figure 1.** Scheme for classification of morphological alterations of the styloid process\(^{(7)}\) (modified by the author).
one-sided morphological alteration of the styloid process, with a female prevalence (74 patients), i.e. 89.2% of the sample, and in only 9 male patients. In spite of this distribution by sex, there was not a predominance (in %) of a sex in relation to the other, although the sample had a higher number of women. The distribution by age range can be seen on Table 1, where a higher number of patients (32.5%) in the age range between 41 and 50 years is shown. There was no patient with less than 10 years of age presenting morphological alteration of the styloid process.

Table 1  Study sample distribution by age range (n = 83).

<table>
<thead>
<tr>
<th>Age range</th>
<th>Frequency (n)</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (up to 10 anos)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2 (11 to 20 anos)</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>3 (21 to 30 anos)</td>
<td>12</td>
<td>14.5</td>
</tr>
<tr>
<td>4 (31 to 40 anos)</td>
<td>14</td>
<td>16.9</td>
</tr>
<tr>
<td>5 (41 to 50 anos)</td>
<td>27</td>
<td>32.5</td>
</tr>
<tr>
<td>6 (51 to 60 anos)</td>
<td>13</td>
<td>15.7</td>
</tr>
<tr>
<td>7 (61 to 82 anos)</td>
<td>12</td>
<td>14.5</td>
</tr>
<tr>
<td>n</td>
<td>83</td>
<td>100</td>
</tr>
</tbody>
</table>

The general classification of the styloid process morphological pattern can be seen on Table 2, the elongated type being the most frequent (n = 113), with 59 right-sided, and 54 left-sided.

As regards the symmetry (Table 3), it was found that 56% (n = 47) of morphological alterations of the styloid process are elongated, bilateral (2/2). The second more incident were the right-sided elongated and left-sided normal types (2/1), with 12% (n = 10) of the sample. The third more incident type was the pseudoarticulated bilateral one (3/3), in nine patients (10.8%).

**DISCUSSION**

Many studies\(^1\,^2\,^4\,^14\) have been developed for a better understanding of the disorders associated with temporomandibular joints, whose morphological alterations may result in an array of signs and symptoms which complicate the diagnosis, and, consequently, the therapeutic conduct\(^2\).

In spite of the fact of several studies performing the measurement of the styloid process, this has not been the aim of the present study, since the analyzed x-ray images (modified, panoramic for temporomandibular joint) presented distortions and amplification in their processing\(^13\). However, in several published studies\(^3\,^5\,^11\,^12\) the panoramic radiography has been utilized for observation and process analysis, because it is an easy-to-perform examination, besides being widely available for patients. For Arellano\(^13\), Basekim \(et\,al\)\(^6\) and Heitz \(et\,al\)\(^15\), computed tomography is the most effective method for evaluating the styloid process length and morphological alterations, since this examination provides 2D and 3D reconstructions of the whole temporomandibular joint\(^16\). However, based on the results of the present study, one may consider that the modified radiography for the temporomandibular joint and the panoramic x-ray are good imaging methods for visualizing morphological alterations of the temporomandibular joint, including the styloid process. The great limitation of this examination is the impossibility of measuring the process extent, however this has not been a determining factor in the diagnosis of the syndrome\(^17\) (Figure 2).

In the whole sample of the present study, it was found that 15.7% of the patients were male, and 84.3%, female, with the majority of them (65.2%) in the age range between 21 and 50 years. Both results confirm the reports from \(Okeson\)\(^14\) and \(Saad & Barros\)\(^15\) about temporomandibular disorders.

Among the patients with temporomandibular disorder, 5.53% presented at least one side of the temporomandibular joint with morphological alteration of the styloid process\(^18\). However, \(Zaki\) \(et\,al\)\(^19\) have found, also in patients with temporomandibular disorder, an even more significant incidence (27%). For \(Eagle\)\(^17\), in 4% of the patients with morphological alteration of the styloid process, only 4% presented symptoms compatible with the Eagle syndrome.

In absolute numbers, the incidence of morphological alterations of the styloid process was higher in women (74) when
Figure 2. Left temporomandibular joint x-ray image, demonstrating morphological alteration of the styloid process.

compared with men (9). However, once the V Cramer test was applied, it was found that the prevalence is similar for both female and male patients. This result is different from the findings of Gozil et al. (20), Eagle (10) and Aral et al. (21), who have reported a higher male incidence, and also differ from those of Hernandez et al. (22), who have found a higher female incidence.

In the present study, 32.5% of the patients presented with morphological alterations of the styloid process, and the majority of patients were in the age range between 41 and 50 years for both sexes. In the other age ranges (21–30 years, 31–40 years, 51–60 years and 61–82 years) the mean incidence was 15%. This result is in disagreement with the studies of Zaki et al. (6), Basekim et al. (7) (31–40 years), Basekim et al. (6,18,21,23) and Aral et al. (21) (31–40 years), Basekim et al. (34 years) and Gozil et al. (30) (31–50 years). In the present study, only five patients (6% of the sample) in the age range between 11 and 20 years were included with such alteration. Also in this study, in a total of 1,500 patients, there was no patient less than 10 years old with morphological alteration of the styloid process. However, in the referred scientific literature (8) there is a case report on a ten-year old patient.

With this great variation in the presence of morphological alterations of the styloid process in several age ranges, and based on several studies results (6,18,21,23), including the present ones, it should be considered that the styloid process elongation or stylohyoid complex mineralization develops in a particular fashion for each individual, independently from sex and age (23).

Most of the studies found in the literature about morphological alterations of the styloid process are clinical case reports (8,10–12,15,21,22,24) and rather than evaluating the styloid process morphology, they analyze the symptomatology and the presence of the process elongation.

Based on the studies of Langlais et al. (5), the 83-patient sample was studied for the morphological type of each styloid process. The elongated pattern was the most frequent one (113), and the other morphological type (normal, pseudoarticulated and segmented) have not demonstrated significant differences, confirming the findings of several authors (6,20,21). Similarly to the study of Aral et al. (21), in the present study there was no predominance of one of the sides in the morphological alteration of the styloid process.

It is important to highlight the relevance of the diagnosis in the craniomandibular dysfunctions by means of clinical and imaging studies (6,9,13,14,16), aiming at establishing the final diagnosis, since the treatment for temporomandibular disorders is primarily symptomatic, with conservative and reversible therapies (19), and the treatment for Eagle syndrome involves surgical excision (5,20,22,24,25), with intra- or extra-oral approach (24) for the elongated styloid process or the calcified stylohyoid ligament removal. However, Camarda et al. (22) have asserted that many patients may tolerate the symptoms of the elongated styloid process, without being submitted to surgery.

In agreement with several authors (1,5,24), it is believed that, in cases of orofacial pains, there is a necessity of interdisciplinarity intervention and cooperation of radiologists, otorhinolaryngologists, surgeons, dentists, neurologists, orthopedists, ophthalmologists, phoniatricians, physiotherapists and psychologists (16), each professional acting in his/her specialty for definition of the diagnosis and appropriate therapeutical conduct.

CONCLUSIONS

Radiographically seen, the prevalence of morphological alteration of the styloid process in patients with temporomandibular disorder was of 5.53% (in 9 (10.8%) male and 74 (89.2%) female patients). A higher frequency was found in the age range between 41 and 50 years (32.5%).

The morphological types of the temporal bone styloid process radiographically seen were: 113 elongated, 21 pseudoarticulated and 19 segmented, totaling 153 styloid processes of 83 patients, 13 being considered as normal. Also, it was found that there is a correlation between the right and the left patterns, i.e., the morphological alteration is symmetrical.

REFERENCES

Morphologic alterations of the styloid process in patients with temporomandibular joint disorder


