

## **Idiopathic Osteosclerosis: A rare CBCT incidental finding in the mandibular condyle**

**Osteoesclerose Idiopática: Um achado incidental de TCFC no côndilo mandibular**

**Osteoesclerosis Idiopática: Un hallazgo accidental en el cóndilo mandibular a través de Tomografía Computarizada**

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### **Abstract**

Intrabony radiopaque lesions are common manifestations of neoplasia, sequel of carious lesions, traumatic event, malignant tumors, metastasis, neoplastic and non-neoplastic entities or developmental alterations. Idiopathic Osteosclerosis (IO) is a rare bone lesion, normally asymptomatic and not associated with inflammatory, traumatic or infectious stimulus which is usually found in the molar mandibular area. Although IO is a well-recognized radiological entity that is generally symptom-free, it is important to distinguish it from other radiopacities. Finding this type of lesion in the mandibular condyle is odd and it could be easily misdiagnosed and confused with other imaging findings. The present case report aims to describe a rare imaging finding of idiopathic osteosclerosis in temporomandibular condyle which was accidentally found in the CBCT of a patient with painful TMD symptoms by emphasizing the importance of multidisciplinary involvement between the general practitioner, the radiologist and the pain specialist to diagnose and provide an indicated treatment, whenever necessary.

**Keywords:** Osteosclerosis; Temporomandibular Joint Dysfunction Syndrome; Temporomandibular Joint; Cone-beam Computerized Tomography.

### **Resumo**

Lesões radiopacas intraósseas são manifestações comuns de neoplasia, sequela de lesões cariosas, eventos traumáticos, tumores malignos, metástases, entidades neoplásicas e não-neoplásicas ou alterações do desenvolvimento. A Osteoesclerose idiopática (OI) é uma lesão óssea rara, normalmente assintomática e não associada a estímulos inflamatórios, traumáticos ou infecciosos, que geralmente é encontrada na área molar mandibular. Embora a OI seja uma entidade radiológica bem reconhecida e geralmente livre de sintomas, é importante distingui-la de outras condições. Encontrar este tipo de lesão no côndilo mandibular é estranho e pode ser facilmente mal diagnosticado e confundido com outros achados de imagem. O presente relato de caso visa descrever um raro achado de imagem de osteoesclerose idiopática no côndilo temporomandibular que foi acidentalmente encontrado na Tomografia Computadorizada de Feixe Cônico (TCFC) de um paciente com sintomas de DTM dolorosa, enfatizando a importância do envolvimento multidisciplinar entre o clínico geral, o radiologista e o especialista em dor para diagnosticar e fornecer um tratamento indicado, sempre que necessário.

**Palavras-chave:** Osteoesclerose; Síndrome da Disfunção da Articulação Temporomandibular; Articulação Temporomandibular; Tomografia Computadorizada de Feixe Cônico.

## Resumen

Las lesiones radiopacas intraóseas son manifestaciones comunes de neoplasia, secuela de lesiones cariosas, eventos traumáticos, tumores malignos, metástasis, entidades neoplásicas y no neoplásicas o alteraciones del desarrollo. La osteosclerosis idiopática (OI) es una lesión ósea poco frecuente, normalmente asintomática y no asociada a estímulos inflamatorios, traumáticos o infecciosos, que suele encontrarse en la zona molar mandibular. Aunque la OI es una entidad radiológica bien reconocida y generalmente asintomática, es importante distinguirla de otras radiopacidades. El hallazgo de este tipo de lesión en el cóndilo mandibular es inusual y podría ser fácilmente mal diagnosticado y confundido con otros hallazgos de imagen. El presente caso clínico pretende describir un hallazgo de imagen poco frecuente de osteosclerosis idiopática en el cóndilo temporomandibular que se encontró accidentalmente en el examen de Tomografía Computarizada (TC) de un paciente con síntomas de TTM doloroso, enfatizando la importancia de la participación multidisciplinaria entre el médico general, el radiólogo y el especialista en dolor orofacial para diagnosticar y proporcionar un tratamiento indicado, siempre que sea necesario.

**Palabras clave:** Osteosclerosis; Síndrome de la Disfunción de Articulación Temporomandibular; Articulación Temporomandibular; Tomografía Computarizada de Haz Cónico.

## 1. Introduction

Intraosseous radiopaque lesions are common manifestations of neoplasia, sequelae of carious lesions, traumatic event, malignant tumors, metastases, neoplastic and non-neoplastic or developmental changes (Ledema-Montes et al., 2019). Many different names have been proposed for them: osteosclerosis, condensing osteitis, bone eburnation, bone scar, osteopetrotic scar, osteopetrosis, enostosis, sclerotic bone, socket sclerosis, bone whorl and dense bone island (Austin & Moule, 1984; Chen et al., 2014; Marami et al., 2011; McDonnell, 1993; Misirlioglu et al., 2014; Sisman et al., 2011a, 2011b; Wang et al., 2013). In recent years, several studies on radiopaque lesions of the maxillofacial regions separated two distinct entities of different origins: the first ones are a consequence of an inflammatory process such as caries or dental necrosis. The second one consists of painless, radiopaque or mixed (radiolucent–radiopaque) lesions associated with non-carious teeth (Austin & Moule, 1984; Eversole et al., 1984; Farman et al., 1978; McDonnell, 1993; Miloglu et al., 2009; Wang et al., 2013). Idiopathic Osteosclerosis (IO) can be defined as a dense bone lesion, non-expansible, asymptomatic, and in different shapes and sizes (varying from 1 to 7mm), usually found in the maxilla and mandible. The prevalence of IO among Brazilians is 5,6% and its etiology is still unknown, but some hypotheses arise in the literature. Some authors propose that it can be formed by overloading or by retained deciduous molar roots that have been absorbed, but the main hypothesis is that IO can be a developmental bone variation of normal trabecular bone (de Souza Tolentino et al., 2014; Geist & Katz, 1990)

Clinically, to conclude the diagnosis of IO the lesion cannot be related to caries, deep restorations, reabsorptions, thickening of lamina dura, or related to remnants of deciduous or permanent teeth (Macdonald-Jankowski, [s.d.]). Also, no communication to the sinus or mandibular canal can be present, otherwise, it could demonstrate signs of expansion, which is not a characteristic of IO lesions. On the radiographic exams, the lesion cannot be rounded by a radiolucent halo, and it is purely radiopaque, with no mix of radiolucent areas that can induce a different diagnosis, such as odontomas (de Souza Tolentino et al., 2014). According to the study of Wang et al. (2021), IO is a lesion that may develop in early stages of life, with little change occurring once the individual is mature and being relatively stable in the middle stage of life. Also, no obvious association between IO and orthodontic treatment was found in patients, which may be due to the limitations of two-dimensional shooting of panoramic radiography and the sample size (S. Wang et al., 2022). OI also shows itself as a low prevalence lesion although it appears to be more frequent among females in their third decade and primarily found in the mandibular molar region (Al-Habib, 2022).

The differential diagnosis of IO is a hard task since, on imaging, it can be similar to many other conditions. There is a common misdiagnosis of IO because of its similarity to other lesions such as condensing osteitis, odontomas, osteomas, residual roots, hypercementosis, and cementoblastoma, but, excluding residual roots, all these other lesions can be

symptomatic (Williams & Brooks, 1998). There is no requirement for treatment since its growth is limited, contraindicating any surgical intervention, but imaging monitoring is suggested (Ledesma-Montes et al., 2019).

Most of the incidental findings in the maxillofacial region, including the TMJ region, appear in panoramic radiography due to the necessity of a general investigation at the beginning of treatments. However, recently the use of Cone-beam computerized tomography (CBCT), has been promoting a better analysis of these incidental findings because of the excellent detailed images of high contrast (Price et al., 2012). Moreover, because of the better quality of CBCT exams, detection of such findings increased. Idiopathic osteosclerosis lesion is normally seen as an incidental finding due to its absence of symptomatology (Geist & Katz, 1990). The present study aims to report a rare case of IO present in the condylar region found incidentally on a routine diagnosis of persistent TMJ arthralgia and to show the importance of correct referral to a specialist by the radiologists.

## 2. Methodology

The present study is a clinical case report, which was conducted in a private practice of an Orofacial Pain specialist, following the Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) (Ohrbach R et al., 2013). The methodology used was based on a case report, which is a descriptive-analytical study (Pereira et al., 2018) characterized as qualitative research, in which the considerations of theorists will be presented, contemplating the positive and negative points in their respective analyses (Ludke & Andre, 2013).

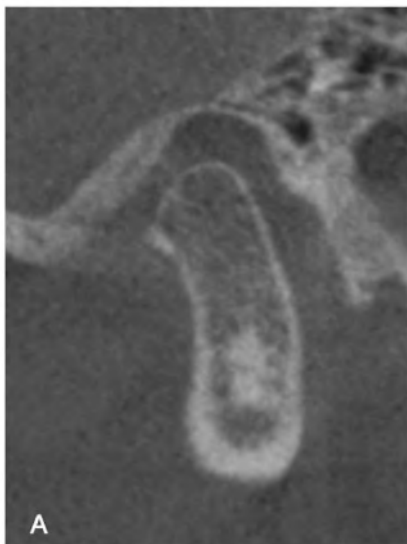
The ethical principles of the Declaration of Helsinki were respected. The patient agreed and signed the Term of Free and Informed Consent (TCLE), and the study was approved by the Research Ethics Committee of the UNISAGRADO - Centro Universitário Sagrado Coração.

## 3. Case Report

A 67-year-old man presented to the dental office with a chief complaint of severe bilateral orofacial pain for the last 5 years. Due to patient complaints, he was referred to an orofacial pain specialist who performed a complete history and clinical examination of the case. During history taking, the patient reported a history of lumbar decompression surgery and knee joint degeneration disease. According to the Pittsburgh Sleep Quality questionnaire, he presented poor sleep quality and self-reported awake and sleep bruxism. Throughout the clinical evaluation, familiar pain was reproduced during palpation exam of masseters and temporalis muscles bilaterally, referring to the cervical region. Also, severe pain in the left TMJ along with limited jaw opening (35mm with no pain and 43mm with pain).

Because of the history of knee joint degeneration disease and severe pain during palpation in the left TMJ, a CBCT was requested to investigate TMJ bone changes (Figures 1, 2 and 3). The CBCT confirmed the presence of mild flattening in both condylar articular surfaces. Moreover, a localized high-density area in the cortical bone extending into the bone marrow was detected also in the left TMJ neck. In the CBCT image, it appeared as a well-defined lesion, with non-expansile characteristics, a homogeneous high-density area, isodense to cortical bone, and blending to the cortical surface of the condylar neck and not to the articular surface of the condyle. Such findings could be easily confused with subcortical sclerosis or perhaps with central osteomas, the last one being a more serious bone lesion. Nevertheless, the fact that it is not attached to the articular surface, led us to exclude the subcortical sclerosis diagnosis and, moreover, because signs of expansion and displacement are absent, we could also discard the option of central osteoma. Owing to all that was mentioned previously, the diagnosis of IO seemed to be the most appropriate, although this type of lesion is more normally found in the mandibular molar area with or without root involvement.

**Figure 1** - Sagittal CBCT showing a homogeneous high-density area in the medullary bone of the left condyle. It appears to be isodense to cortical bone and blends into the posterior cortex of the condyle. No expansion of the bone was noted.



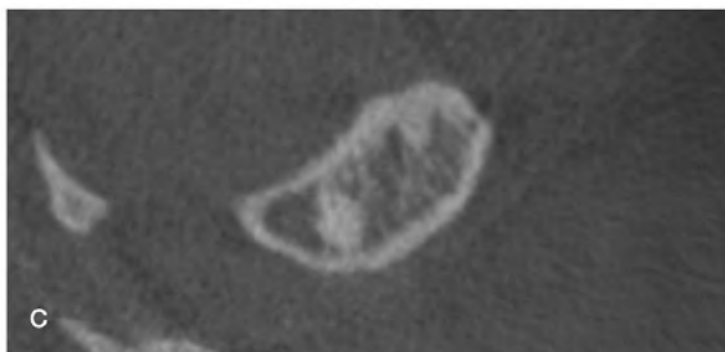
Source: Authors (2023). Software: Horos v3.3.1

**Figure 2** - Coronal CBCT of the same TMJ showing a high-density area. This should not be confused with subchondral sclerosis, as this is not blending into the articular surface of the condyle.



Source: Authors (2023). Program: Horos v3.3.1

**Figure 3** - Axial CBCT images also showing the same high-density area blending into the cortex.



Source: Authors (2023). Software: Horos v3.3.1

The CBCT confirmed the presence of mild flattening in both condylar articular surfaces. Moreover, a localized high-density area in the cortical bone extending into the bone marrow was detected also in the left TMJ neck. In the CBCT image, it appeared as a well-defined lesion, with non-expansile characteristics, a homogeneous high-density area, isodense to cortical bone, and blending to the cortical surface of the condylar neck and not to the articular surface of the condyle. Such findings could be easily confused with subcortical sclerosis or perhaps with central osteomas, the last one being a more serious bone lesion. Nevertheless, the fact that it is not attached to the articular surface, led us to exclude the subcortical sclerosis diagnosis and, moreover, because signs of expansion and displacement are absent, we could also discard the option of central osteoma. Owing to all that was mentioned previously, the diagnosis of IO seemed to be the most appropriate, although this type of lesion is more normally found in the mandibular molar area with or without root involvement.

According to the CBCT images evaluation, the patient was diagnosed with no degenerative joint disease but flattening of the condylar articular surface in both TMJs (more severe in the right condyle) with the presence of idiopathic osteosclerosis in the left joint. In addition to that, the patient was diagnosed with arthralgia in the left TMJ together with bilateral myofascial pain with referral in the masseter and temporalis muscles, according to the DC/TMD.

In line with all that was mentioned previously, treatment was based on reducing pain-related symptoms and TMJ overload, to avoid a degenerative joint disease. It was proposed a self-management program, including pain education, thermal therapy, a pain-free diet; monitoring and avoidance of parafunctional behavior; the use of an occlusal appliance during sleep; pharmacotherapy (nonsteroidal anti-inflammatory drug and muscle relaxant as initial treatment), and, if necessary, lidocaine injection of the trigger points. In addition, the idiopathic osteosclerosis lesion will be monitored periodically to assess whether there will be changes in their imaging aspects.

### 3. Discussion

As imaging techniques and image quality develop, the ability to determine incidental findings increases and a higher frequency of detecting such findings. Incidental findings are commonly observed by radiologists in all imaging modalities. Cone beam computerized tomography (CBCT) is an important diagnostic imaging modality that is commonly used in the maxillofacial region, providing excellent images of high-contrast structures. It can provide detailed information about anatomical structures, such as the temporomandibular joint (TMJ) (Price et al., 2012).

As CBCT examinations provide more information than the two-dimensional methods, radiologists are expected to detect a higher rate of incidental findings using this method (Dief et al., 2019; Kurtuldu et al., 2020; Price et al., 2012), depending on some factors such as studies sample sizes, age group, the categorization of incidental findings, and the size of the

FOV field. While analyzing a CBCT image, despite the structure of interest, peripheral structures appearing in the imaging field should be taken note of, specially by the radiologist but by the clinician also, to avoid any missing findings. A better understanding of incidental findings and the head–neck anatomy will enable clinicians to avoid misinterpretations (Horner et al., 2009). Like any other imaging modalities, incidental findings can be detected during imaging of the TMJ (Makdissi et al., 2013).

Most Common TMJ radiopacities are subchondral sclerosis along with degenerative joint disease. According to Shetty et al., areas of increased density of the cortical bone extending to bone marrow are called sclerosis. Even though it is the most common type of sclerosis, it still represents a small percentage of TMJ tomographic findings, as it can be observed in Price et al. (in 3.3% of the condyles) and Kurtuldu et al. (in 7.5% of the TMJ) studies (Kurtuldu et al., 2020; Price et al., 2012). Less common TMJ radiopacities are osteochondroma, osteoma, idiopathic osteosclerosis, bony ankylosis and rare but important radiopacities are chondrosarcoma, osteosarcoma and metastatic disease (Curé et al., 2012). The present case reports a rare incidental finding of an IO in the left condyle, with no relation to the chief complaint of TMJ pain. Although there are many papers in the literature discussing incidental findings on other parts of the body, no case report, to our knowledge, has ever been published reporting IO as an incidental finding in TMJ CBCT.

Idiopathic osteosclerosis should be distinguished from osteomas. Idiopathic osteosclerosis (IO) is a located growth of compact bone within the cancellous bone. Already, osteomas are benign tumors composed of mature compact or cancellous bone and they most commonly arise in the craniofacial bones, in the posterior mandibular body or condyle. At imaging, osteomas appear as a non–tooth-related circumscribed sclerotic mass. Since imaging of these two conditions is very similar, some features should be analyzed, and the most important one is the presence of bone expansion. It may not be possible to differentiate osteomas from IO if no bone expansion is present (Curé et al., 2012). Therefore, the presence of obvious expansion or displacement is enough to rule out IO. In the absence of expansion, evidence of continuous growth could support the diagnosis of IO, and not osteoma (Kaplan et al., 2008). Idiopathic osteosclerosis can appear at any age, with no gender predilection, and patient has no symptoms, irrespective of the place of appearance, tooth, condyle or other maxillofacial area (Kaplan et al., 2008).

It is important to note that, in the present case report, despite image findings of flattening, and a rare IO lesion in the left TMJ, it did not correspond to the clinical symptomatology reported by the patient. History taking and clinical examination are still the first and most important steps that will provide the dentist with a proper diagnosis, and imaging exams should be requested only for complementary evaluation when the clinical examination did not show a clear diagnosis. They should be seen as a powerful ally that could help to reach a final diagnosis when in doubt of clinical examination and they should only be requested if this could change our treatment plan.

#### **4. Final Considerations**

Oral radiologists should be aware of incidental findings and must evaluate the possibilities of underlying diseases in a comprehensive way, and if there is a concern about the finding, they should refer the patient to the relevant specialist. Knowledge of imaging characteristics of IO is fundamental for a precise diagnosis when this incidental radiopacities appears, especially when it comes to rare cases such as this one in particular. The CBCT imaging can facilitate the interpretation of the IO features, especially to observe if the lesion is a homogeneous high-density area, isodense to cortical bone, and blending to the cortical surface of the condylar neck and not to the articular surface of the condyle.

The knowledge of both the pathophysiology TMDs, as well as the ability to interpret the different types of imaging findings, becomes essential for the treatment of these patients. It is important to emphasize that not every imaging finding will



be the answer to the patient's complaint. Many times, as in this case, it is more an uncommon finding than a cause-effect correlation. This is why the role of the TMD and orofacial pain specialist is crucial. Due to the localization of this lesion, which is not common in itself, we suggest that further studies are needed.

## References

- Al-Habib, M. A. (2022). Prevalence and Pattern of Idiopathic Osteosclerosis and Condensing Osteitis in a Saudi Subpopulation. *Cureus*. <https://doi.org/10.7759/cureus.22234>
- Austin, B. W., & Moule, A. J. (1984). A comparative study of the prevalence of mandibular osteosclerosis in patients of Asiatic and Caucasian origin. *Australian Dental Journal*, 29(1), 36–43. <https://doi.org/10.1111/j.1834-7819.1984.tb04541.x>
- Chen, C.-H., Wang, C.-K., Lin, L.-M., Huang, Y.-D., Geist, J. R., & Chen, Y.-K. (2014). Retrospective comparison of the frequency, distribution, and radiographic features of osteosclerosis of the jaws between Taiwanese and American cohorts using cone-beam computed tomography. *Oral Radiology*, 30(1), 53–63. <https://doi.org/10.1007/s11282-013-0139-z>
- Curé, J. K., Vattoth, S., & Shah, R. (2012). Radiopaque Jaw Lesions: An Approach to the Differential Diagnosis. *RadioGraphics*, 32(7), 1909–1925. <https://doi.org/10.1148/rg.327125003>
- de Souza Tolentino, E., Henrique Capel Gusmão, P., Saintive Cardia, G., de Souza Tolentino, L., Vessoni Iwaki, L. C., & Amoroso-Silva, P. A. (2014). Idiopathic Osteosclerosis of the Jaw in a Brazilian Population: a Retrospective Study. *Acta Stomatologica Croatica*, 48(3), 183–192. <https://doi.org/10.15644/asc48/3/2>
- Dief, S., Veitz-Keenan, A., Amintavakoli, N., & McGowan, R. (2019). A systematic review on incidental findings in cone beam computed tomography (CBCT) scans. *Dentomaxillofacial Radiology*, 48(7), 20180396. <https://doi.org/10.1259/dmfr.20180396>
- Eversole, L. R., Stone, C. E., & Strub, D. (1984). Focal sclerosing osteomyelitis/focal periapical osteopetrosis: radiographic patterns. *Oral Surgery, Oral Medicine, and Oral Pathology*, 58(4), 456–460. [https://doi.org/10.1016/0030-4220\(84\)90344-x](https://doi.org/10.1016/0030-4220(84)90344-x)
- Farman, A. G., de V. Joubert, J. J., & Nortjé, C. J. (1978). Focal osteosclerosis and apical periodontal pathoses in “European” and Cape Coloured dental outpatients. *International Journal of Oral Surgery*, 7(6), 549–557. [https://doi.org/10.1016/S0300-9785\(78\)80072-6](https://doi.org/10.1016/S0300-9785(78)80072-6)
- Geist, J. R., & Katz, J. O. (1990). The frequency and distribution of idiopathic osteosclerosis. *Oral Surgery, Oral Medicine, Oral Pathology*, 69(3), 388–393. [https://doi.org/10.1016/0030-4220\(90\)90307-E](https://doi.org/10.1016/0030-4220(90)90307-E)
- Horner, K., Islam, M., Flygare, L., Tsiklakis, K., & Whaites, E. (2009). Basic principles for use of dental cone beam computed tomography: consensus guidelines of the European Academy of Dental and Maxillofacial Radiology. *Dentomaxillofacial Radiology*, 38(4), 187–195. <https://doi.org/10.1259/dmfr/74941012>
- Kaplan, I., Nicolaou, Z., Hatuel, D., & Calderon, S. (2008). Solitary central osteoma of the jaws: a diagnostic dilemma. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*, 106(3), e22–e29. <https://doi.org/10.1016/j.tripleo.2008.04.013>
- Kurtuldu, E., Alkis, H. T., Yesiltepe, S., & Sumbullu, M. A. (2020). Incidental findings in patients who underwent cone beam computed tomography for implant treatment planning. *Nigerian Journal of Clinical Practice*, 23(3), 329–336. [https://doi.org/10.4103/njcp.njcp\\_309\\_19](https://doi.org/10.4103/njcp.njcp_309_19)
- Ledesma-Montes, C., Jiménez-Farfán, M. D., & Hernández-Guerrero, J. C. (2019). Idiopathic osteosclerosis in the maxillomandibular area. *Radiologia Medica*, 124(1), 27–33. <https://doi.org/10.1007/s11547-018-0944-x>
- Ludke, M. & Andre, M. E. D. A. (2013). Pesquisas em educação: uma abordagem qualitativa. São Paulo: E.P.U.
- Macdonald-Jankowski, D. S. ([s.d.]). *Idiopathic osteosclerosis in the jaws of Britons and of the Hong Kong Chinese: radiology and systematic review*. <http://www.stockton-press.co.uk/dmfr>
- Makdissi, J., Pawar, R. R., Radon, M., & Holmes, S. B. (2013). Incidental findings on MRI of the temporomandibular joint. *Dento Maxillo Facial Radiology*, 42(10), 20130175. <https://doi.org/10.1259/dmfr.20130175>
- Marami, A., Tofangchiha, M., Kabudvand, AH., & Moradi, M. . (2011). Radiological frequency of idiopathic osteosclerosis in patients referred to Qazvin Dental School (2009). *Journal of Inflammatory Diseases*, 15(3), 81–86. <https://journal.qums.ac.ir/article-1-1156-en.html>
- McDonnell, D. (1993). Dense bone island. *Oral Surgery, Oral Medicine, Oral Pathology*, 76(1), 124–128. [https://doi.org/10.1016/0030-4220\(93\)90307-P](https://doi.org/10.1016/0030-4220(93)90307-P)
- Miloglu, O., Yalcin, E., Buyukkurt, M.-C., & Acemoglu, H. (2009). The frequency and characteristics of idiopathic osteosclerosis and condensing osteitis lesions in a Turkish patient population. *Medicina Oral, Patologia Oral y Cirugia Bucal*, 14(12), e640-5. <https://doi.org/10.4317/medoral.14.e640>
- Misirlioglu, M., Nalcaci, R., Baran, I., Adisen, M. Z., & Yilmaz, S. (2014). A possible association of idiopathic osteosclerosis with excessive occlusal forces. *Quintessence International (Berlin, Germany : 1985)*, 45(3), 251–258. <https://doi.org/10.3290/j.qi.a31210>
- Pereira A. S. et al. (2018). Metodologia da pesquisa científica. [free e-book]. Santa Maria/RS. Ed. UAB/NTE/UFSM.
- Price, J. B., Thaw, K. L., Tyndall, D. A., Ludlow, J. B., & Padilla, R. J. (2012). Incidental findings from cone beam computed tomography of the maxillofacial region: a descriptive retrospective study. *Clinical Oral Implants Research*, 23(11), 1261–1268. <https://doi.org/10.1111/j.1600-0501.2011.02299.x>

Sisman, Y., Ertas, E. T., Ertas, H., & Sekerci, A. E. (2011b). The frequency and distribution of idiopathic osteosclerosis of the jaw. *European Journal of Dentistry*, 5(4), 409–414.

Wang, H., Xu, L., You, M., Zhao, S., Jiang, M., Li, N., Liu, Y., & Ren, J. (2013). Bone islands of the craniomaxillofacial region. *Journal of Cranio-Maxillary Diseases*, 2(1), 5. <https://doi.org/10.4103/2278-9588.113565>

Wang, S., Xu, L., Cai, C., Liu, Z., Zhang, L., Wang, C., & Xu, J. (2022). Longitudinal investigation of idiopathic osteosclerosis lesions of the jaws in a group of Chinese orthodontically-treated patients using digital panoramic radiography. *Journal of Dental Sciences*, 17(1), 113–121. <https://doi.org/10.1016/j.jds.2021.05.002>

Williams, T. P., & Brooks, S. L. (1998). A longitudinal study of idiopathic osteosclerosis and condensing osteitis. *Dento Maxillo Facial Radiology*, 27(5), 275–278. <https://doi.org/10.1038/sj/dmfr/4600362>