

ORIGINAL RESEARCH

Prevalence and characteristics of stylohyoid ligament calcification in panoramic radiographs

Prevalencia y características de la calcificación del ligamento estilohioideo en radiografías panorámicas

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ABSTRACT

Stylohyoid ligament calcification is a metaplastic process in which the fibrous tissue mineralizes. This condition can range from partial to complete calcification of the ligament. Objective: To determine the prevalence and morphological characteristics of stylohyoid ligament calcification by analyzing imaging studies. Materials and methods: An observational, descriptive, retrospective, cross-sectional study with a quantitative approach was conducted. Digital panoramic radiographs of patients treated at a specialized center were analyzed; these were selected using non-probability convenience sampling based on inclusion and exclusion criteria. The presence of stylohyoid ligament calcification was evaluated, along with its laterality (unilateral or bilateral), degree of calcification (partial or total), and distribution by sex. Statistical analysis employed descriptive statistics, including absolute frequencies, percentages, and measures of central tendency where appropriate. Results: A predominance of bilateral (81%) and partial (81%) calcification was observed, with no cases of total calcification recorded. Among unilateral cases, a slightly higher frequency was noted on the right side. Additionally, calcification was more frequent in females. These findings may relate to genetic, endocrine, or metabolic factors, although further research is needed to confirm this association. Conclusion: Calcification of the stylohyoid ligament showed a high frequency of bilateral involvement and a predominance of partial calcification in the studied population. Detecting this abnormality via panoramic radiography contributes to the differential diagnosis of patients with orofacial pain and to the prevention of complications.

Keywords: Stylohyoid ligament. Heterotopic calcification. Eagle syndrome. Panoramic radiography. Orofacial pain.

RESUMEN

La calcificación del ligamento estilohioideo es un proceso de metaplasia donde el tejido fibroso se mineraliza. Este cuadro puede variar desde una calcificación parcial hasta la calcificación completa del ligamento. Objetivo: determinar la prevalencia y las características morfológicas de la calcificación del ligamento estilohioideo mediante el análisis de estudios imagenológicos. Material y métodos: se realizó un estudio observacional, descriptivo, retrospectivo y de corte transversal, con enfoque cuantitativo. Se analizaron radiografías panorámicas digitales de pacientes atendidos en un centro especializado, seleccionadas mediante un muestreo no probabilístico por conveniencia, de acuerdo con los criterios de inclusión y exclusión. Se evaluó la presencia de calcificación del ligamento estilohioideo, su lateralidad (unilateral o bilateral), el grado de calcificación (parcial o total) y su distribución según el sexo. Para el análisis estadístico se emplearon estadígrafos descriptivos, incluyendo frecuencias absolutas, porcentajes y medidas de tendencia central cuando correspondió. Resultados: se evidenció predominio de calcificación bilateral (81%) y de calcificación parcial (81%), sin registrarse casos de calcificación total. En los casos unilaterales se observó una ligera frecuencia mayor en el lado derecho. Asimismo, la calcificación fue más frecuente en el sexo femenino. Estos hallazgos podrían estar relacionados con factores genéticos, endocrinos o metabólicos, aunque se requieren investigaciones adicionales para confirmar esta

asociación. Conclusión: La calcificación del ligamento estilohioideo presentó una elevada frecuencia de afectación bilateral y predominio de calcificación parcial en la población estudiada. El reconocimiento de esta alteración mediante radiografía panorámica contribuye al diagnóstico diferencial de pacientes con dolor orofacial y a la prevención de complicaciones.

Palabras clave: Ligamento estilohioideo. Calcificación heterotópica. Síndrome de Eagle. Radiografía panorámica. Dolor orofacial.

INTRODUCTION

The stylohyoid ligament is a fibrous structure. Calcification of the stylohyoid ligament is a rare condition in which this ligament undergoes ossification. The calcification process may cause several symptoms, depending on the extent and location of the calcification^(1,2). Furthermore, it may be associated with Eagle syndrome, a condition that causes significant pain in the cervical and oropharyngeal regions, a foreign body sensation, tinnitus, or otalgia^(3,4).

This calcification can be diagnosed through radiographic studies. Although its exact etiology is not fully understood, factors such as aging, idiopathic calcification, and previous trauma may contribute to the development of this anatomical variant. Calcification may range from partial to complete ossification of the ligament^(5,6).

Calcification of the stylohyoid ligament is an anatomical phenomenon with a low incidence. It is characterized by the formation of bone tissue within this structure and is associated with symptoms such as dysphagia, manifested as difficulty swallowing, and orofacial pain, with variations in intensity and location. These symptoms, together with possible complications involving the temporomandibular joint and alterations in voice, highlight the importance of gaining a thorough understanding of stylohyoid ligament calcification⁽⁷⁾.

In studies conducted many panoramic radiographs, a prevalence of 8.42% was reported. Similarly, it has been identified that this condition is associated with factors such as age and sex. It has been reported that between 4% and 28% of the population have elongated styloid processes, of whom approximately 4% exhibit symptoms. Previous reports have also indicated that elongation of the styloid process occurs more frequently in women, although greater lengths have been observed in men^(8,9).

Calcification of the stylohyoid ligament is a condition that is not widely recognized by general dental practitioners, who are often responsible for initially requesting and reviewing imaging studies. Therefore, it is essential for general dentists to have a basic knowledge of radiographic anatomy in order to diagnose anatomical anomalies, normal anatomical variations, and pathological conditions, as well as to perform an appropriate initial assessment and management of patients, avoiding confusion between this entity and other conditions with similar symptoms⁽¹⁰⁾. Although the incidence at the Diagnostic Center of Universidad San Gregorio de Portoviejo may be low, attention to this condition remains essential. Early identification enables effective management of symptoms.

Therefore, the objective of this study was to determine the prevalence and morphological characteristics of stylohyoid ligament calcification through the analysis of imaging studies.

MATERIALS AND METHODS

Study Design

The present study employed a quantitative approach, as it allowed for the collection, measurement, and analysis of data to determine the prevalence and morphological characteristics of stylohyoid ligament calcification. It was designed as an observational study because there was no manipulation of the study variables; descriptive, as it characterized the frequency, laterality, and degree of calcification; retrospective, because previously obtained panoramic radiographs recorded during the 2024–2025 period were analyzed; and cross-sectional, because the images were evaluated at a single point of analysis, without participant follow-up.

Ethical Considerations and Informed Consent

The research protocol was designed in accordance with the ethical principles governing medical research involving human subjects. Each participating patient was provided with an informed consent form, which was signed prior to inclusion in the study. The document explicitly authorized the use of radiographs for research purposes, ensuring anonymity and the protection of personal data.

All ethical considerations were strictly observed in accordance with institutional regulations and international bioethical standards.

Sample Selection

The study population consisted of digital panoramic radiographs of patients treated at a diagnostic imaging center during the 2024–2025 period. The sample comprised 52 panoramic radiographs that met the previously established inclusion and exclusion criteria.

The sample was selected using non-probability convenience sampling, including radiographs available in the center's database that presented adequate diagnostic quality, allowed complete visualization of the stylohyoid complex, and contained the clinical information required for the analysis. Images with distortions, artifacts, a history of surgery in the stylohyoid region, or incomplete records that could interfere with radiographic evaluation were excluded.

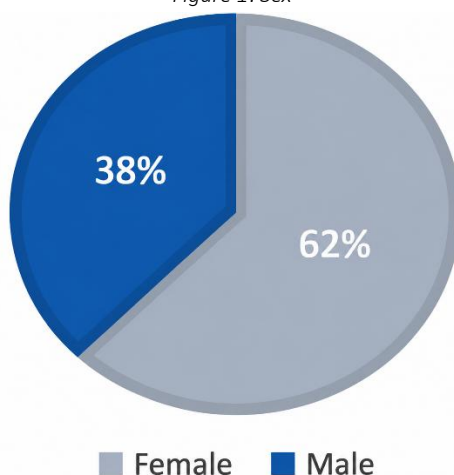
Procedure

The analysis was performed on digital panoramic radiographs processed using Planmeca Romexis diagnostic imaging software. To quantify calcification, the software's calibrated linear measurement tool was used by tracing a line from the base of the styloid process in the temporal bone to the most distal point of mineralization. Calcification or elongation was considered when the measurement exceeded 30 mm, following international standards.

For validation of the diagnostic criteria and discussion of the results, a systematic search of the scientific literature was conducted in the major scientific databases: PubMed, Scopus, Web of Science, and SciELO. Academic search engines such as Google Scholar and ScienceDirect were also used. The findings were categorized according to the Langlais classification, dividing them into the following levels: mild (elongated), partial (pseudoarticulated or segmented), and complete. Laterality (unilateral or bilateral) was also recorded.

RESULTS

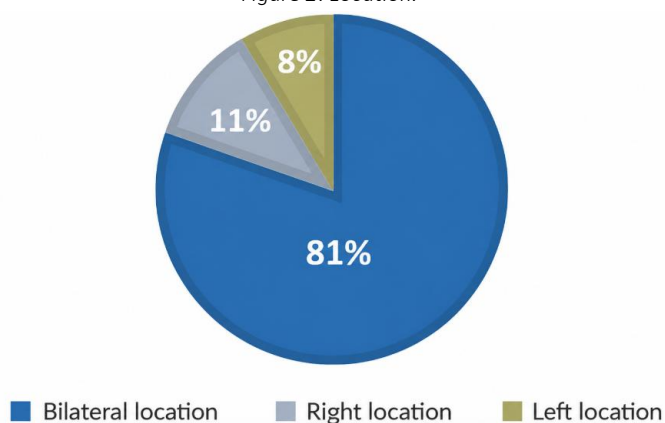
Figure 1. Sex



In the analyzed sample (Figure 1), 62% of the patients were female, while 38% were male. These findings reinforce the trend observed in the literature, indicating a higher frequency among women, who are usually diagnosed after the age of 30.

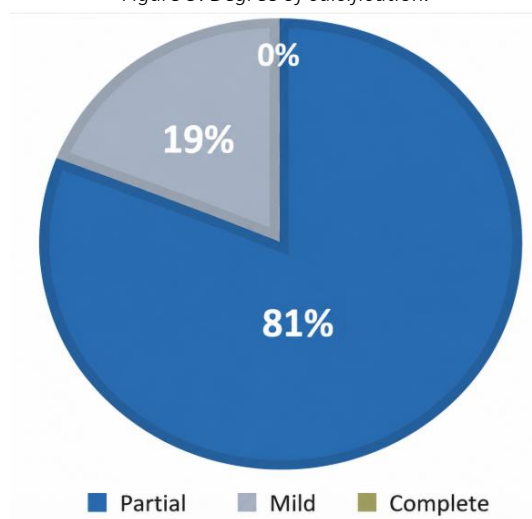
In the study conducted on stylohyoid ligament calcification, the following distribution was observed according to location: there was a marked prevalence of bilateral calcification over unilateral calcification, with a slightly higher frequency of calcification on the right side than on the left among unilateral cases (Figure 2).

Figure 2. Location.



Regarding the degree of stylohyoid ligament calcification, the results showed the following distribution among the patients: partial calcification was the most common finding, observed in 81% of patients. This suggests that most patients presented incomplete calcification of the stylohyoid ligament. In addition, mild calcification was detected in 9% of cases, indicating minimal calcification in this group of patients. Notably, no cases of complete calcification were recorded (Figure 3). These findings highlight that partial calcification was the most common type among the patients, whereas complete calcification was not observed in any of the cases.

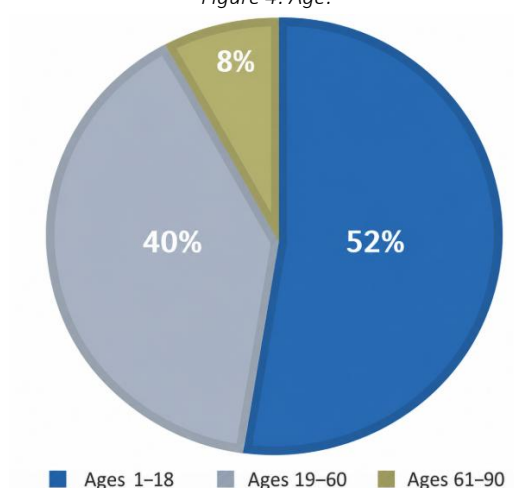
Figure 3. Degree of calcification.



The pie chart entitled “Age” represents the distribution of individuals across three different age groups. The age distribution revealed that the majority, 52%, belonged to the 1–18-year age group, represented in blue. The second-largest group comprised 40% of the population, aged between 19 and 60 years, represented in gray. Finally, 8% of the population fell within the 61–90-year age range, represented in light brown, making it the smallest group in the analysis (Figure 4).

This visual representation suggests that most of the population was young, with a notable majority of individuals under 18 years of age, followed by a considerably smaller adult population and a small proportion of older adults.

Figure 4. Age.



DISCUSSION

An ossified stylohyoid ligament refers to a ligament measuring more than 30 mm in length that has undergone calcification and may compress regional nerves and vasculature, causing symptoms such as pain; however, most patients are asymptomatic. Calcification of the ligament, associated with symptoms such as orofacial and cervical pain during swallowing, mouth opening, and head rotation, characterizes Eagle

syndrome. It may also compress the carotid artery and cause myocardial infarction, a potentially life-threatening condition. Therefore, knowledge of the anatomy and prevalence of these calcifications is essential ⁽¹¹⁾.

In the present study on stylohyoid ligament calcification in patients at the Diagnostic Imaging Center of Universidad San Gregorio de Portoviejo (USGP), clinical and radiological characteristics were observed that are consistent with the existing literature, although some relevant differences were also identified. First, regarding prevalence by sex, our findings are consistent with previous studies indicating that this condition is more common in women. In our sample, 62% of patients were female, while 38% were male. In this regard, the results reported by Savitri et al. ⁽¹²⁾ showed that 416 patients had stylohyoid ligament calcification, with the highest distribution occurring among women, comprising 260 patients (62.5%).

The authors suggested that hormonal influences, particularly among postmenopausal women, may contribute to ligamentous degeneration and subsequent calcification. Likewise, in the study by Darwim ⁽¹³⁾, panoramic radiographs from 1,578 individuals were analyzed. Of the total radiographs, stylohyoid ligament calcification had a prevalence of 2.7%, being significantly higher among women, thus agreeing with our findings.

Several theories have been proposed to explain the occurrence of stylohyoid ligament calcification, including reactive metaplasia, dysplasia, trauma-induced loss of ligament elasticity, and tendon degeneration ⁽¹⁴⁾. According to information reported in the scientific literature, the incidence of calcification of the stylohyoid chain varies widely, ranging from 0.16% to 18%, although only 4% to 10% of patients present associated symptoms, such as stylohyoid syndrome. The pathophysiological mechanisms remain poorly understood, and the etiology is unknown. However, theories have proposed inadequate organogenesis, heredity, trauma, menopause, aging, or tissue degeneration as possible causative factors. Due to its tissue characteristics, the stylohyoid ligament has a greater predisposition to calcification ⁽¹⁵⁾.

Another finding derived from the present study was the distribution of stylohyoid ligament calcification according to location. Bilateral calcification of the stylohyoid ligament was observed in 81% of cases, which is consistent with most studies reporting a higher prevalence of bilateral calcification. Nevertheless, 11% of patients presented unilateral calcification on the right side, while 8% presented calcification on the left side, suggesting that although less frequent, laterality may vary. These results are consistent with those reported by Savitri et al. ⁽¹²⁾, in which bilateral involvement was observed in 341 patients (82%).

Similarly, in the case report by Moussaoui ⁽¹⁶⁾, a routine conventional dental radiograph in a patient revealed bilateral calcification of the stylohyoid complex in the absence of pain. This finding further supports the previously described observation that most patients are asymptomatic and that diagnosis is often incidental.

In our study, partial calcification was the most frequent form, observed in 81% of cases, suggesting that most patients presented incomplete calcification of the ligament. In addition, 9% of cases exhibited mild calcification, while 0% showed complete calcification, highlighting the predominance of asymptomatic or mild cases within our sample. Partial calcification of the stylohyoid ligament is relatively common, occurring in approximately 4% to 28% of the general population, due to its cartilaginous origin. However, complete calcification of the ligament is uncommon. In certain cases, calcification may be associated with elongation of the styloid process, resulting in Eagle syndrome ⁽⁶⁾.

For many years, it was considered that the stylohyoid ligament mineralized during postnatal life. However, it is more likely that the formation of bone tissue within the ligament is associated with calcification of the remnants of Reichert's cartilage. Therefore, in the case reported by Kabak and co-authors ⁽¹⁷⁾, partial calcification of the ligament was described in a patient, exhibiting a radiographic appearance similar to that of a long bone, with a thick radiopaque cortex and central radiolucency.

In contrast, Landers ⁽¹⁸⁾ reported a clinical case of complete calcification of the right stylohyoid ligament, with approximately twice the maximum diameter of the process, detected by contrast-enhanced computed tomography. Reports in the literature have attributed elongation of the styloid processes to partial or complete calcification of the stylohyoid ligament, although the factor or factors triggering this change remain unknown. It has been suggested that the stylohyoid ligament contains predetermined calcification centers or retains general osteogenic potential ⁽¹⁹⁾.

Regarding the distribution of the population by age group, the findings revealed that the majority, 52%, belonged to the 1–18-year age group, followed by 40% of the population aged between 19 and 60 years, and finally 8% within the 61–90-year age range. In considering of these findings, the incidence among young patients has been documented as rare. However, reports such as that by Gárriz-Luis ⁽²⁰⁾ raise the possibility that this condition may develop at younger ages than previously thought, as the authors documented a case in a 9-year-old pediatric patient. At the same time, authors such as Savitri ⁽¹²⁾ and Darwim ⁽¹³⁾ found that stylohyoid ligament calcification predominated in populations

between 25 and 64 years of age, suggesting that this phenomenon may be attributed to anatomical variations, variability in muscle tension, and racial differences among the populations studied.

Similar trends to those reported in the literature were observed in terms of sex, location, and degree of stylohyoid ligament calcification. However, our study also provides important data regarding the low prevalence of symptomatic cases and the possibility of identifying calcification through more advanced technologies, such as digital radiography, which could influence the prevalence reported in future studies.

Although Eagle syndrome is classically described in association with elongation of the styloid process, recent radiological and clinical evidence indicates that elongation or calcification of the stylohyoid complex may contribute to a broader spectrum of pathological conditions ⁽²¹⁾.

Calcification of the stylohyoid complex is an uncommon condition characterized by highly nonspecific clinical manifestations, poorly understood pathophysiological mechanisms, and challenging management, with potentially life-threatening consequences. For this reason, a high degree of clinical suspicion is necessary to establish the diagnosis.

There are currently no studies in the literature comparing diagnostic or therapeutic methods for this condition; consequently, substantial controversy remains regarding its diagnosis and management. Further research in this field is therefore necessary ^(15,22,23).

CONCLUSIONS

The present study demonstrated that stylohyoid ligament calcification constitutes a relatively frequent radiographic finding in the population analyzed, characterized mainly by bilateral involvement and a predominance of partial calcifications. The absence of cases with complete calcification suggests that complete mineralization is uncommon in the evaluated sample.

Likewise, a higher frequency of this alteration was observed among female patients, as well as a tendency toward greater occurrence in older age groups, which may reflect the influence of biological changes associated with the aging process. Among unilateral cases, involvement was slightly more frequent on the right side.

The findings highlight the importance of systematic evaluation of the stylohyoid complex during the interpretation of panoramic radiographs, as its timely identification may contribute to the differential diagnosis of patients presenting with orofacial symptoms compatible with Eagle syndrome and other related conditions.

Therefore, this study provides relevant epidemiological information regarding stylohyoid ligament calcification in the population studied, providing a basis for future research aimed at further investigating the factors associated with this alteration and its potential clinical implications.

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DECLARATION OF CONTRIBUTIONS

Conceptualization and study design: Thainah Santos, María José Macías, Sandra Zambrano; Literature review: Thainah Santos, María José Macías, Sandra Zambrano; Methodology and validation: Thainah Santos and María José Macías; Formal analysis: Thainah Santos, María José Macías, Sandra Zambrano; Investigation and data collection: María José Macías; Resources: María José Macías; Data analysis and interpretation: Thainah Santos, María José Macías, Sandra Zambrano; Writing—original draft preparation: Thainah Santos and María José Macías; Writing—review and editing: Thainah Santos, María José Macías, Sandra Zambrano; Supervision: Thainah Santos and María José Macías; Project administration: Thainah Santos and María José Macías; Funding acquisition: Not applicable.

CONFLICTS OF INTEREST

The authors declare that there were no conflicts of interest during the conduct of the research. The manuscript was submitted exclusively to the Scientific Journal "Especialidades Odontológicas UG" for review and publication.

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