



Condylar signs indicative of temporomandibular degenerative arthropathy analyzed by panoramic radiography

DDS. Acuña Vargas Nathaly Michelle^{1*}; DDS María José Macías Hernández²; PhD Ángela Mercedes Murillo Almache³

^{1*}San Gregorio University of Portoviejo, Dentist graduated, Portoviejo, Dentist at the Alangasí Public Health Center. Quito, Ecuador; Conceptualization, Validation, Formal Analysis, Investigation, Data Curation, Writing – Original Draft Preparation, Writing – Review & Editing ORCID: <https://orcid.org/0009-0007-2680-0240> EMAIL: odontonathaly@gmail.com

²Associate Teacher and researcher at the School of Dentistry, San Gregorio University of Portoviejo, Ecuador. Conceptualization, Methodology, Software, Formal Analysis, Investigation, Resources, Writing – Original Draft Preparation, Writing ORCID: <https://orcid.org/0009-0008-3845-3167> EMAIL: mjmaciash@sangregorio.edu.ec

³Associate Teacher, Head of the Public Health Area, Researcher at the School of Dentistry, San Gregorio University of Portoviejo, Ecuador. Methodology, Validation, Formal Analysis, Writing – Original Draft Preparation, Review & Editing, Supervision, Project Administration ORCID: <https://orcid.org/0000-0003-2158-1871> EMAIL: angmur12000@yahoo.com, ammurillo@sangregorio.edu.ec

***Corresponding author:** Acuña Vargas Nathaly.

***Phone:** +593 968889932. EMAIL: odontonathaly@gmail.com

Abstract

The term temporomandibular disorder refers to dysfunction or pain involving one or both temporomandibular joints. The mandibular condyle, one of the structures that make up this joint, can be affected by the deterioration of the articular surfaces, leading to degenerative conditions classified as arthropathy. **Objective:** To identify condylar radiographic signs indicative of temporomandibular degenerative arthropathy present in panoramic radiographs. **Materials and Methods:** Quantitative, descriptive, observational, cross-sectional, retro-prospective, and deductive study. The most common degenerative signs of the mandibular condyle—such as flattening, cortical erosion, and bone growth associated with osteophytes—were evaluated using panoramic radiographs. Only high-quality radiographs and patients aged between 20 and 64 years were included. Data were processed using the SPSS statistical software, version 26. **Results:** Out of 406 radiographs, 137 showed signs of condylar arthropathy: 73 cases of flattening (53.3%), 23 cases of erosion (16.8%), and 41 cases of osteophytes (29.9%). In 63 radiographs, the left side was more commonly affected; however, when analyzing the relationship between the type of sign and the affected side, flattening on the right side was more prevalent in 31 radiographs. Female patients were predominant, accounting for 106 cases (77.4%). Among adults aged 40 to 64, 90 radiographs showed a tendency toward condylar flattening (54.4%). **Conclusion:** An increase in degenerative signs associated with arthropathy is evident as patient age advances. Panoramic radiography is highlighted as a valuable tool for the presumptive diagnosis of temporomandibular disorders related to degenerative processes.

Keywords: Panoramic X-ray; Joint Diseases; Temporomandibular joint disorders; Osteophyte, Erosion.

Introduction

The temporomandibular joint (TMJ) is one of the most complex joints in the body. The term temporomandibular disorder (TMD) refers to dysfunction or pain involving one or both TMJs, with or without symptoms that limit its function¹. Due to the limited availability of specialized and up-to-date literature, general dentists and patients often do not associate the early predominant signs and symptoms such as facial pain, joint noises, headaches, and difficulty opening the mouth; this has already been observed in countries like Ekiti², Cuba^{3,4}, and Mexico^{5,6}. In Peru, a prevalence of 91.1% for TMD has been reported⁷; and in Chile, it was determined that the older the patient, the lower the effectiveness of treatment, highlighting the importance of early evaluation and diagnosis of TMD⁸.

The mandibular condyle, one of the structures that make up the TMJ, can be affected by TMD. In these cases, deterioration of the articular surfaces is evident, resulting in abnormalities such as bone flattening⁹, condylar erosion, or bony outgrowths called osteophytes. These conditions are classified as arthropathies^{10,11}, which are characterized by bone degradation¹¹. When arthropathy involves degenerative findings not necessarily associated with inflammatory processes, it is called osteoarthritis; in cases where an inflammatory process leads to degeneration, the condition is referred to as osteoarthritis¹¹.

Panoramic radiography (x-ray) is a two-dimensional study of the jaws that allows for the early possible diagnosis of mild morphological abnormalities of the condyle. This has been reported in various studies, including the literature review by Fuentes in 2021, which indicates that despite its limitations, panoramic



radiography has excellent diagnostic potential for evaluating maxillofacial anatomy. For general dentists, it is a commonly used diagnostic tool in clinical practice that enables quick interpretation when TMD is suspected¹². In Ecuador, research on condylar abnormalities is limited, which contributes to an increase in signs and worsening of symptoms due to the adult age when initial suspicions arise, especially in cases with delayed diagnosis. Given this context, the objective of this study was to identify condylar signs of temporomandibular degenerative arthropathy present in panoramic radiographs.

Materials and methods

Study design

This was a quantitative, descriptive, observational, cross-sectional, retro-prospective, and deductive study. The population consisted of panoramic radiographs from patients seen between August and December 2023 at the Imaging Diagnostic Center of the Universidad San Gregorio de Portoviejo.

Data collection.

The sample was selected non-randomly by convenience. After screening according to study criteria for age range and diagnostic quality, 406 radiographs were identified. The most common features of the condition were evaluated: flattening and erosion of the cortical bone, as well as abnormal bone growth associated with osteophytes. The radiographic analysis was performed by the principal investigator after calibration by the second investigator, who verified each of the findings. Other condylar anomalies such as fractures, hyperplasias, hypoplasias, etc., were excluded from the radiographic observation. All data collected were entered and analyzed using the SPSS statistical software, version 26.

Ethical aspects

In accordance with the Declaration of Helsinki, this project complies with protecting the dignity, privacy, confidentiality, and integrity of the sample, and was approved by the Human Research Ethics Committee of the Universidad Técnica de Manabí under registration license CEISH-UTM-EXT_24-04-05_NMAV.

Results

After reviewing the inclusion criteria, the sample focused on 406 radiographs, of which 137 showed signs associated with condylar arthropathy, as confirmed in Figure 1. Flattening was present in 53.3% of cases; erosion in 16.8%; and osteophytes in 29.9%. Among individuals aged 20 to 39 years, 47 radiographs were found, representing 34.7%; in those aged 40 to 64 years, 90 radiographs were identified, accounting for 65.7% of the sample. Additionally, the majority of radiographs, totaling 106, belonged to female patients, representing 77.4%, while 31 radiographs, equivalent to 22.6%, were from male patients.

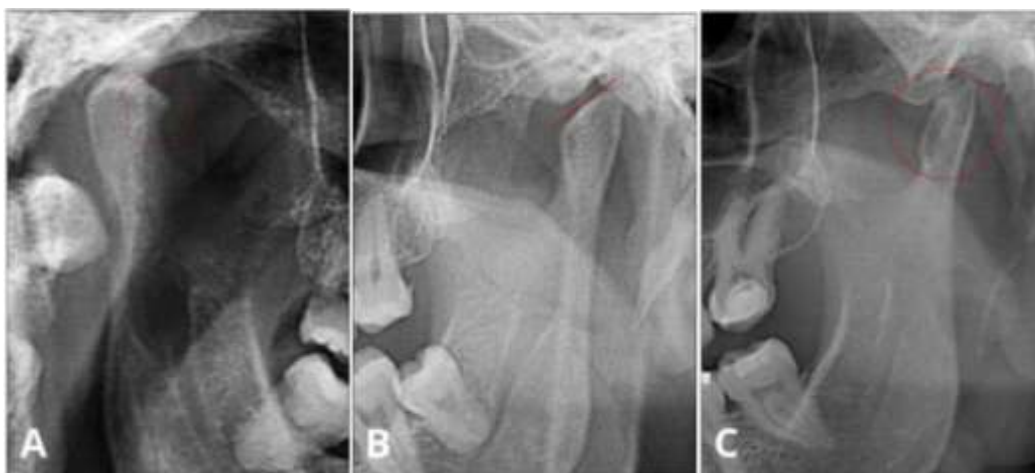


Figure 1. Degenerative condylar signs. (A) Right osteophyte in a 62-year-old patient. (B) Left flattening in a 49-year-old patient. (C) Left erosion in a 46-year-old patient.

As shown in Table 1, the frequency is detailed according to the affected side: right, left, or bilateral. The findings demonstrate a significant predominance of the left side for erosion and osteophytes, while flattening is more prominent on the right side.

**Table 1.** Degenerative arthropathy signs according to the affected side.

		RT	LT	BL	TOTAL
EROSION	Count	10	12	1	23
	% within SIDE	18,9%	19,0%	4,8%	16,8%
OSTEOPHYTE	Count	12	23	6	41
	% within SIDE	22,6%	36,5%	28,6%	29,9%
FLATTENING	Count	31	28	14	73
	% within SIDE	58,5%	44,4%	66,7%	53,3%
Total	Count	53	63	21	137
	% within SIDE	100,0%	100,0%	100,0%	100,0%

Table 2 shows the frequency according to the sex of the participants, revealing a clear prevalence among females, who presented twice as many cases compared to males.

Table 2. Degenerative osteoarthritis signs according to sex.

		MALE	FEMALE	TOTAL
EROSION	Count	5	18	23
	% within SEX	16,1%	17,0%	16,8%
OSTEOPHYTE	Count	10	31	41
	% within SEX	32,3%	29,2%	29,9%
FLATTENING	Count	16	57	73
	% within SEX	51,6%	53,8%	53,3%
Total	Count	31	106	137
	% within SEX	100,0%	100,0%	100,0%

Table 3 presents the frequency in relation to age, highlighting a predominant trend among adults aged 40 to 64 years, with a total of 90 cases, of which 49 show a marked sign of flattening.

Table 3. Degenerative arthropathy signs according to age.

		20 TO 39	40 TO 64	TOTAL
EROSION	Count	9	14	23
	% within AGE	19,1%	15,6%	16,8%
OSTEOPHYTE	Count	14	27	41
	% within AGE	29,8%	30,0%	29,9%
FLATTENING	Count	24	49	73
	% within AGE	51,1%	54,4%	53,3%
Total	Count	47	90	137
	% within AGE	100,0%	100,0%	100,0%

Discussion

Degenerative conditions of the TMJ can be referred to as arthropathy, a term that is not widely used and is more commonly understood as osteoarthritis or arthritis by various authors^{13–22}. Whaites et al.¹¹ identify these anomalies as some of the main pathologies affecting the TMJ. Arthritis refers to an inflammatory process, whereas osteoarthritis involves the appearance of bony signs due to degeneration not associated with inflammation, as affirmed by several sources^{10, 11, 13}. In both cases, it is possible to observe flattening, erosion, osteophytes, and other signs.

The use of panoramic radiography for the diagnosis of degenerative anomalies of the mandibular condyle is less common compared to other three-dimensional imaging studies, such as cone-beam computed tomography (CBCT), which is considered the imaging method of choice^{13–21}. Nevertheless, in daily clinical practice, the prescription of panoramic radiographs is more frequent, allowing for the identification of various orofacial conditions. For this reason, studies using panoramic radiographs are often retrospective²². Although the two-dimensional projection of a three-dimensional object can result in the superimposition of anatomical structures, panoramic radiography undeniably provides an initial impression of clinical cases with suspected



TMD, even in the absence of clear symptoms. This is supported by Cantor⁹ and Tenorio²², who highlight its immediate and accessible usefulness for general dentists, as well as its affordability for patients.

The results of this study show that the most common sign of degenerative anomalies is flattening. Tenorio²² supports findings from other studies regarding the use of panoramic radiography. Furthermore, although not the same imaging method, both panoramic radiography and CBCT have demonstrated consistent and effective diagnostic outcomes, as shown in the research by Singh¹⁴, Matus¹⁵, Derwich¹⁶, Ottersen¹⁷, and Koc¹⁸. However, according to Sotomayor¹⁹, signs of heterogeneous trabeculation are more prevalent, although their evaluation is only possible through CBCT, which represents a limitation of the present study.

Regarding the affected side, overall findings show a predominance on the left side, although the most significant prevalence is observed in right-side flattening. This aligns, in terms of specific signs, with the data reported by Singh¹⁴, and more generally with Kurtuldu¹³, who highlights the relevance of overall findings on the left side. It is worth noting that Tenorio²² reports bilateral involvement as most prevalent, which contrasts with the findings of the present study.

Regarding sex-based prevalence, a higher frequency of signs was observed in females, with 106 radiographs, of which 53.8% showed flattening. This may be associated with hormonal changes that occur in females during adolescence, pregnancy, or menopause. In line with this, other CBCT-based studies also report similarly high percentages, such as 63.9%¹⁵ and 82.8%¹⁹. In terms of age, a predominance of arthropathy was observed among adults aged 40 to 64 years. Arthropathy studies use different criteria for age group classification; however, this research followed Ecuadorian age criteria, defining young adults as those between 20 and 30 years old and adults as those between 40 and 64 years old. These age groups, although defined differently, are similarly considered by decade in other publications^{13-15, 18, 19}.

Following the same criteria, it is noteworthy that the prevalence of arthropathy, related anomalies reported in other studies tends to emerge from the third decade of life^{14, 15, 20, 21}. According to the findings of the present study, age appears to contribute to the development of arthropathy signs, an outcome supported by other studies such as those by Matus¹⁵ and Tenorio²². This is further explained in the conclusions of Koc, who states that the frequent findings are due to bone remodeling processes that naturally occur with aging¹⁸.

Conclusions

The data obtained demonstrate that signs of TMJ arthropathy increase in severity as patients age. The use of panoramic radiography is highlighted as a presumptive diagnostic method for temporomandibular degenerative arthropathy. The inherent limitations of panoramic radiography in evaluating certain signs are acknowledged, while its value as an initial, fast, and cost-effective method for detecting TMD findings is emphasized. Furthermore, it is suggested that the evaluation of arthropathy signs and related symptoms is necessary to better understand their limiting impact on patients' quality of life.

Conflict of interest: Each author declares no conflicts of interest of any kind.

Funding: The authors declare that they have not received any external funding for this study.

Acknowledgments: We thank Universidad San Gregorio de Portoviejo for allowing the use of its facilities for this research. We also extend our gratitude to Specialist in Oral Rehabilitation, José Manuel Cárdenas Sacoto, for his contribution in the initial guidance of the study, to Licentiate in Imaging, Carlos Luis Medina Iturbe, and to Dentist Kevin Velata Guzmán for their bibliographic guidance.

ORCID

Acuña Vargas Nathaly Michelle <https://orcid.org/0009-0007-2680-0240>
María José Macías Hernández <https://orcid.org/0009-0008-3845-3167>
Angela Mercedes Murillo Almache <https://orcid.org/0000-0003-2158-1871>

REFERENCIAS

1. Fehrenbach M. Mosby. Diccionario de odontología. 4ª ed. España: Elsevier; 2022. 907 p. Disponible en: https://www.google.com.ec/books/edition/Mosby_Diccionario_de_odontologia/y41hEAAQBAJ
2. Adegbiyi WA, Olajide GT, Agbesanwa AT, Banjo OO. Otological manifestation of temporomandibular joint disorder in Ekiti, a sub-Saharan African country. J Int Med Res. 2021;49(2):3-5. Disponible en: <https://doi.org/10.1177/0300060521996517>
3. Hernández B, Lazo R, Bravo O, Quiroz Y, Domenech L, Rodríguez S. Trastornos temporomandibulares en el sistema estomatognático del paciente adulto mayor. Arch Méd Camagüey. 2020;24(4):495-6. Disponible en: <https://revistaamc.sld.cu/index.php/amc/article/view/7426/3595>



4. Casanova C, Valdés D, López E, Limonta I, Hernández L. Valor diagnóstico del ancho de apertura bucal en pacientes con trastornos temporomandibulares. *Rev Sal Cienc Tec.* 2022;2(53):3-4. Disponible en: <https://sct.ageditor.ar/index.php/sct/article/view/196/566>
5. Espinosa I, Álvarez J, Romero T. Calidad de vida en adultos mayores con trastornos temporomandibulares. *Rev Inf Cient.* 2019;98(3):320. Disponible en: <https://revinfcientifica.sld.cu/index.php/ric/article/view/2344/4019>
6. Ramírez M, Rodríguez A. Trastornos temporomandibulares según el eje I de los Criterios Diagnósticos de Investigación (CDI/TTM) en una población geriátrica mexicana. *Tamé.* 2019;8(22):855. Disponible en: https://www.uan.edu.mx/d/a/publicaciones/revista_tame/numero_22/Tam1922-02i.pdf
7. Aguilar M, Ramos P. Relación de la desalineación postural y la convergencia ocular con los trastornos temporomandibulares. *Rev Cienc Salud.* 2021;19(2):7. Disponible en: <https://doi.org/10.12804/revistas.urosario.edu.co/revsalud/a.9678>
8. Meeder W, León C, Leissner O, Vergara E, Maulén M, González WA. Estimulación nerviosa eléctrica transcutánea como complemento a la terapia convencional en pacientes con trastornos temporomandibulares: un estudio de casos y controles. *Av Odontoestomatol.* 2020;36(4):7. Disponible en: <https://scielo.isciii.es/pdf/odonto/v36n4/0213-1285-odonto-36-4-208.pdf>
9. Cantor A, Fiori G. Evaluación del aplanamiento condilar en pacientes dentados y no dentados mediante radiografía panorámica. *Rev Cien Odontol.* 2020;8(1):5. Disponible en: https://scholar.google.es/scholar?hl=es&as_sdt=0%2C5&q=Evaluaci%C3%B3n+del+aplanamiento+condilar+en+pacientes+dentados+y+no+dentados+mediante+radiograf%C3%ADa+panor%C3%A1mica&btnG=
10. Firestein GS, Budd RC, Gabriel SE, Korytzy GA, McInnes IB, O'Dell JR. Firestein y Kelley. Tratado de reumatología. 11ª ed. España: Elsevier; 2022 [citado 19 feb 2025]. 815 p. Disponible en: <https://books.google.com.ec/books?id=0u1bEAAAQBAJ>
11. Whaites E, Drage N. Essentials of dental radiography and radiology. 6ª ed. Reino Unido: Elsevier; 2020.
12. Fuentes R, Arias A, Borie E. Radiografía panorámica: una herramienta invaluable para el estudio del componente óseo y dental del territorio maxilofacial. *Int J Morphol.* 2021;39(1):271. Disponible en: http://www.intjmorphol.com/wp-content/uploads/2020/12/art_41_3911.pdf
13. Kurtuldu E, Alkis HT, Yesiltepe S, Sumbullu MA. Incidental findings in patients who underwent cone beam computed tomography for implant treatment planning. *Niger J Clin Pract.* 2020;23(3):329-36. Disponible en: https://journals.lww.com/njcp/fulltext/2020/23030/incidental_findings_in_patients_who_underwent_cone.9.aspx
14. Singh P, Parate AS, Abdul NS, Chandra C, Bagewadi SB, Hirpara DR. Retrospective evaluation of incidental findings of temporomandibular joint region in CBCT scans. *J Contemp Dent Pract.* 2021;22(12):22-5. Disponible en: <https://www.thejcdp.com/doi/pdf/10.5005/jp-journals-10024-3221>
15. Matus J, Gómez B. Prevalencia de alteraciones óseas indicativas de osteoartritis en ATM detectadas mediante TCHC en un centro radiológico de Santiago de Chile, durante el año 2021. *Anu Soc Radiol Oral Máxilo Facial Chile.* 2021;26:22-5. Disponible en: https://sociadradiologiaoral.cl/wp-content/uploads/2023/anuarios_div/2023/Anuario_RX_2023-VOL-20-25.pdf
16. Derwich M, Mitus M, Pawlowska E. Temporomandibular joints' morphology and osteoarthritic changes in cone-beam computed tomography images in patients with and without reciprocal clicking—a case control study. *Int J Environ Res Public Health.* 2020;17(8):3428. Disponible en: <https://www.mdpi.com/1660-4601/17/10/3428>
17. Ottersen MK, Abrahamsson AK, Larheim TA, Arvidsson LZ. CBCT characteristics and interpretation challenges of temporomandibular joint osteoarthritis in a hand osteoarthritis cohort. *Dentomaxillofac Radiol.* 2019;48(4). Disponible en: <https://pmc.ncbi.nlm.nih.gov/articles/PMC6592579/pdf/dmfr.20180245.pdf>
18. Koc N. Evaluation of osteoarthritic changes in the temporomandibular joint and their correlations with age: a retrospective CBCT study. *Dent Med Probl.* 2020;57(1):67-72. Disponible en: <https://dmp.umw.edu.pl/pdf/2020/57/1/67.pdf>
19. Sotomayor C, Mülle R, Rosas C. Frecuencia de signos óseos de osteoartritis en la articulación temporomandibular en una población adulta chilena mediante CBCT, durante 2021-2022. *Int J Odontostomat.* 2023;17(4):507-8. Disponible en: https://ijodontostomatology.com/wp-content/uploads/2023/12/2023_v17n4_017.pdf
20. Firmani M, Cortés M, Burgos C. Valoración de la severidad en enfermedades degenerativas articulares temporomandibulares mediante tomografía computarizada cone beam. *Int J Inter Dent.* 2021;14(1):37-40. Disponible en: <https://www.spch.cl/wp-content/uploads/2022/06/Ijoid-edici%C3%B3n-abril-2021-1.pdf>
21. Moncada G, Paz J. Comparación de sistemas de evaluación diagnóstica de la severidad de la osteoartritis en imágenes de TAC de las ATM. *Int J Inter Dent.* 2023;16(2):147-9. Disponible en: <https://www.scielo.cl/pdf/ijoid/v16n2/2452-5588-ijoid-16-02-146.pdf>



22. Tenorio J, Gonzales H, Huayta T, Ballona P. Prevalencia de los cambios morfológicos de la ATM observados en radiografías panorámicas. Kiru. 2019;16(4):149-54. Disponible en: <https://portalrevistas.aulavirtualusmp.pe/index.php/Rev-Kiru0/article/view/1655>