BRAZILIAN JOURNAL OF IMPLANTOLOGY AND HEALTH SCIENCES

ISSN 2674-8169

PREOPERATIVE AND POSTOPERATIVE TOMOGRAPHIC ASPECTS OF CONDYLE FIXATION AND MANDIBULAR FRACTURE: AN INTEGRATIVE LITERATURE REVIEW

Mayara Rebeca Martins Viana[1], Ilan Hudson Gomes de Santana[2], Victoria Alice Menezes Gomes[2],Karolayne Dutra Felix[2],Maria Eduarda Batista Henriques[2], José Marcos Pereira Junior[2], Ítalo Quintino Miranda[2], Katia Caetana Pereira[2], Arthur Felipe de Brito Andrade[2], Lucas Elias Silva[2], Andressa De Souza Sobral[2], Bárbara Rachelli Farias Teixeira[2], Patricia de Medeiros Loureiro Lopes[2]

https://doi.org/10.36557/2674-8169.2024v6n9p2516-2522

Artigo recebido em 30 de Julho e publicado em 17 de Setembro de 2024.

REVIEW ARTICLE

ABSTRACT

Introduction: Computed tomography (CT) is crucial for the evaluation of mandibular fractures, especially in complex areas such as the condylar region. Its ability to provide detailed images in multiple planes has improved surgical planning and post-operative monitoring, offering precise information on the location and characteristics of fractures. **Objective:** This integrative review aims to analyze how tomographic aspects impact surgical planning and postoperative monitoring of condylar and mandibular fractures. The study discusses the advantages and limitations of tomographic techniques in order to understand how they influence the clinical outcome and rehabilitation of patients. **Materials and Methods:** An integrative literature review was carried out, without the need for submission to the Ethics Committee, in accordance with the guidelines of Normative Instruction No. 510/2016. The search was conducted in databases such as PubMed, Scopus and Web of Science, and expanded with Google Scholar. **Results and Discussion:** The analysis revealed that cone beam computed tomography (CBCT) provides high-resolution three-dimensional images, which are essential for the accurate assessment of fractures, especially in complex anatomical areas such as the mandibular condyle. **Conclusion:** Cone beam computed tomography (CBCT) is an indispensable tool for the management of condyle and mandible fractures. Its use in preoperative and post-fixation monitoring facilitates detailed visualization of anatomical structures, improving the precision of surgical interventions and contributing to superior functional and aesthetic results.

KEYWORDS: Cone-Beam Computed Tomography; Jaw Fixation Techniques; Mandibular Condyle; Jaw Fractures; Mandible.

Affiliated institution: IPEO - Paraibano Institute of Dental Studies[1]; Federal University of Paraíba [2].
Corresponding author:: *Mayara Rebeca Martins Viana:* mayara.rebeca2@gmail.com

INTRODUCTION

Due to its ability to provide detailed images in multiple planes, computed tomography (CT) has become an essential imaging exam in the assessment of mandibular fractures, especially in more complex areas such as the condylar region, both in surgical planning and in postoperative monitoring. With the evolution of tomographic techniques, surgeons have access to more precise information on the location, extent and characteristics of fractures (AKASHI et al., 2016; AYDIN et al, 2020).

With regard to condylar fractures, the anatomical and functional particularities of this region require detailed surgical planning. Correct alignment and fixation are essential to avoid complications such as mandibular deviation, changes in occlusion and temporomandibular dysfunction. Tomography, with its ability to provide three-dimensional images, allows for a more accurate assessment of the structures involved, helping to choose the most appropriate fixation method and predict possible challenges during surgery (ULAY et al., 2023; LEMES et al., 2021).

In addition to preoperative planning, CT is widely used in postoperative follow-up. After fracture fixation, it is essential to check the position of the fragments, the stability of the fixation and the integrity of the anatomical structures. CT allows us to identify any failures in the bone healing process and the presence of complications, such as condylar resorption or misalignment of the fragments. These findings are essential for therapeutic adjustments and long-term treatment success (YALCIN et al, 2019; AHMED et al., 2020;).

However, the application of CT in mandibular fractures is not without its challenges. Issues such as radiation exposure, high costs and the need for accurate interpretation by the surgeon are factors that must be considered. In addition, the diversity of available tomographic protocols can lead to variations in image quality and clinical results. For this

reason, the standardization of techniques and professional training are crucial aspects for optimizing the benefits of this diagnostic tool (KOÇ et al., 2019; ARAYAPISIT et al., 2023).

In view of this, the aim of this integrative review is to analyze the tomographic aspects that impact surgical planning and postoperative monitoring in cases of condyle and mandible fractures. The advantages and limitations of the different tomographic techniques will be discussed, seeking to understand how these approaches can influence clinical outcomes and the success of patient rehabilitation.

MATERIALS AND METHODS

This is an integrative literature review, so this study did not require submission to the Research Ethics Committee, in accordance with the guidelines established by Normative Instruction No. 510/2016 of the National Health Council (CNS).

The study was conducted and a protocol was drawn up which included identifying the research, defining the guiding question and the search strategy, as well as the databases to be used. The guiding question for this review was: “What are the main tomographic aspects in the preoperative period and after fixation of condylar and mandibular fractures that have an impact on surgical planning and results?”.

The research was carried out in previously selected databases: PubMed, Scopus and Web of Science. To broaden the search for gray literature, Google Scholar was used. The search used controlled descriptors from DeCS/MeSH, such as Cone-Beam Computed Tomography, Jaw Fixation Techniques, Mandibular Condyle, Jaw Fractures and Mandible, combined by the Boolean operators AND and OR. The inclusion criteria included original articles, systematic reviews and meta-analyses published in the last 14 years, available in English, Portuguese or Spanish, which addressed tomographic aspects in the pre- and post-operative period of condyle and mandible fractures. Studies such as dissertations, theses, editorials, conference abstracts and duplicate articles were excluded.

The articles were screened and selected by two independent reviewers using the double-blind method. Divergences in selection were resolved by a third reviewer. In total, 727 articles were initially identified. After removing duplicates and applying the eligibility criteria, 4 studies were included in the final analysis.

The data extracted included information on the methodology of the studies, the main findings and the conclusions related to the tomographic aspects that impact the surgical management of condyle and mandible fractures. The results were analyzed descriptively in order to answer the guiding question and offer a critical view of the importance of tomography in the successful treatment of these conditions.

RESULTS AND DISCUSSION

The use of tomographic techniques, especially cone beam computed tomography (CBCT), offers high-resolution three-dimensional images, allowing a more precise analysis of the structures involved, which is particularly relevant in complex anatomical areas such as the mandibular condyle. Recent studies highlight the relevance of this technology in the assessment, planning and follow-up of these fractures.

The study by Sukegawa et al. (2020) highlights the benefits of intraoperative CBCT in hybrid operating rooms, especially in the real-time assessment of condylar fracture reduction and fixation. The ability to obtain high-quality 3D images during surgery minimizes the uncertainties arising from the anatomical limitations of the operative field, contributing to more precise reduction and fixation. This, in turn, improves prognosis and reduces the need for reoperations, as well as favoring minimally invasive approaches, which is advantageous for patients (SAFI et al., 2018; NITHIN et al., 2021).

Regarding condylar fractures in children, Liu et al. (2020) investigated the correlation between articular disc displacement and condylar remodeling after closed treatment. Using CBCT and MRI, the study showed that, despite persistent disc displacement in some cases, condylar remodeling occurred satisfactorily, with significant differences in condylar depth and height over time. These findings indicate that although CBCT is effective in assessing morphological changes, the clinical impact may vary depending on the development of complications such as ankylosis (KÜÇÜKÇAKIR et al., 2024).

According to Mohamed et al. (2021), three-dimensional assessment in the internal fixation of subcondylar fractures is of great relevance. CBCT analysis made it possible to measure parameters such as condylar position and inclination, joint space and mandibular length, offering a detailed assessment of the effectiveness of surgical reduction. The results showed that CBCT is an accurate tool for post-operative assessment, directly correlating the

measurements obtained with clinical outcomes such as joint function and occlusal stability (AL-GHURABI et al., 2021).

Dölekoğlu et al. (2010) illustrated the clinical use of CBCT in the diagnosis of maxillofacial fractures, highlighting how this technology overcomes the limitations of conventional radiographs. In the case reported, fractures that were not identified by 2D radiographs were clearly visualized by CBCT, demonstrating the superiority of this technique in the diagnosis of complex and multiple fractures. The ability to visualize critical anatomical details in different planes makes CBCT an indispensable tool in the diagnosis of dentoalveolar and mandibular fractures (KIM et al., 2015).

Taken together, these studies show that CBCT plays a crucial role in the tomographic assessment of condyle and mandible fractures, both preoperatively and in post-fixation follow-up. The technology allows a detailed analysis of anatomical structures, contributing to more precise surgical decisions and effective monitoring of results. The use of CBCT improves treatment predictability and enables more assertive interventions, favoring patients' functional and aesthetic recovery.

CONCLUSION

The analysis of the studies shows that cone beam computed tomography (CBCT) is an indispensable tool in the assessment and management of condyle and mandible fractures. Its use in the preoperative period and in post-fixation follow-up allows detailed visualization of anatomical structures, facilitating precise surgical reduction and monitoring morphological changes over time. CBCT improves patient prognosis by providing a solid basis for more assertive clinical decisions, contributing to superior functional and aesthetic results. Therefore, integrating this technology into the treatment protocol for mandibular fractures is essential for therapeutic success and minimizing complications.

REFERENCES

AHMED, N. F. **et al. Cone beam computed tomographic assessment of mandibular condyle in Kennedy class I patients.** *Oral Radiology*, v. 36, n. 4, p. 356-364, out. 2020. DOI: 10.1007/s11282-019-00413-1.

AKASHI, M. **et al. Four-dimensional computed tomography evaluation of jaw movement following mandibular reconstruction: A pilot study.** *Journal of Craniomaxillofacial Surgery*, v. 44, n. 5, p. 637-641, maio 2016. DOI: 10.1016/j.jcms.2016.01.027.

AL-GHURABI, Z. H.; AL-BAHRANI, Z. M. **Cone beam computed tomography evaluation of the morphological variation and width in mandibular condyle.** *Journal of Craniofacial Surgery*, v. 32, n. 5, p. e479-e481, jul./ago. 2021. DOI: 10.1097/SCS.0000000000007465.

ARAYAPISIT, T. **et al. Understanding the mandibular condyle morphology on panoramic images: A cone beam computed tomography comparison study.** *Cranio*, v. 41, n. 4, p. 354-361, jul. 2023. DOI: 10.1080/08869634.2020.1857627.

AYDIN, U.; GORMEZ, O.; YILDIRIM, D. **Cone-beam computed tomography imaging of dentoalveolar and mandibular fractures.** *Oral Radiology*, v. 36, n. 3, p. 217-224, jul. 2020. DOI: 10.1007/s11282-019-00390-5.

DÖLEKOĞLU, S. **et al. Diagnosis of jaw and dentoalveolar fractures in a traumatized patient with cone beam computed tomography.** *Dental Traumatology*, v. 26, n. 2, p. 200-203, abr. 2010. DOI: 10.1111/j.1600-9657.2009.00857.x.

KIM, J. E. **et al. Three-dimensional evaluation of human jaw bone microarchitecture: correlation between the microarchitectural parameters of cone beam computed tomography and micro-computer tomography.** *Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology*, v. 120, n. 6, p. 762-770, dez. 2015. DOI: 10.1016/j.oooo.2015.08.022.

KÜÇÜKÇAKIR, O. **et al. Evaluation of mandibular condyle position in Class III patients after bimaxillary orthognathic surgery: A cone-beam computed tomography study.** *Korean Journal of Orthodontics*, v. 54, n. 4, p. 247-256, jul. 2024. DOI: 10.4041/kjod23.188.

LEMES, C. R. **et al. Mandibular ramus height and condyle distance asymmetries in individuals with different facial growth patterns: a cone-beam computed tomography study.** *Surgical and Radiologic Anatomy*, v. 43, n. 2, p. 267-274, fev. 2021. DOI: 10.1007/s00276-020-02577-6.

LIU, M. **et al. Outcomes of anterior disc displacement and condylar remodelling for sagittal fracture of the mandibular condyle in children after closed treatment.** *International Journal of Oral and Maxillofacial Surgery*, v. 49, n. 1, p. 82-89, jan. 2020. DOI: 10.1016/j.ijom.2019.03.901.

MOHAMED, A. A. S. **et al. Three-dimensional assessment of accuracy for open reduction and internal fixation of the subcondylar fracture and its implications on the TMJ function.** *Journal of Craniomaxillofacial Surgery*, v. 49, n. 11, p. 1035-1043, nov. 2021. DOI: 10.1016/j.jcms.2021.06.009.

NITHIN **et al. Morphological assessment of TMJ spaces, mandibular condyle, and glenoid fossa using cone beam computed tomography (CBCT): A retrospective analysis.** *Indian Journal of Radiology and Imaging*, v. 31, n. 1, p. 78-85, jan. 2021. DOI: 10.1055/s-0041-1729488.

SAFI, A. F. **et al. Volumetric analysis of 700 mandibular condyles based upon cone beam computed tomography.** *Journal of Craniofacial Surgery*, v. 29, n. 2, p. 506-509, mar. 2018. DOI: 10.1097/SCS.0000000000004136.

SUKEGAWA, S. **et al. Evaluation of open reduction and internal fixation of mandibular condyle fracture by intraoperative cone-beam computed tomography in a hybrid operating room.** *Journal of Craniofacial Surgery*, v. 31, n. 3, p. 762-765, maio/jun. 2020. DOI: 10.1097/SCS.0000000000006101.

ULAY, G. **et al. Evaluation of the relationship between the degenerative changes and bone quality of mandibular condyle and articular eminence in temporomandibular disorders by cone beam computed tomography.** *Cranio*, v. 41, n. 3, p. 218-229, maio 2023. DOI: 10.1080/08869634.2020.1853307.

YALCIN, E. D.; ARARAT, E. **Cone-beam computed tomography study of mandibular condylar morphology.** *Journal of Craniofacial Surgery*, v. 30, n. 8, p. 2621-2624, nov./dez. 2019. DOI: 10.1097/SCS.0000000000005699.