

USE OF CT FOR DIAGNOSING TEMPOROMANDIBULAR JOINT

Utilização da tomografia computadorizada para o diagnóstico da articulação temporomandibular

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ABSTRACT

The computed tomography plays an important role in the diagnosis of anomalies and pathological conditions of the TMJ, providing a complete visualization of joint region, providing a more accurate diagnosis. For evaluation of the images is necessary to the professional the knowledge of sectional anatomy of the joint region, so he can recognize the structural changes. Therefore, it was explained and described in this study the characteristics of normal CT, morphological and pathological conditions commonly found in the region of the temporomandibular joint. The Computed tomography is an imaging exam superior than the conventional imaging exam for TMJ, because it allows an adequate and accurate three-dimensional visualization of all details of the bone, without the limitation of overlap, providing the real size and shape of the anatomical structures, morphological changes and pathological conditions.

KEYWORDS: Temporomandibular Joint Disorders; Temporomandibular Joint Dysfunction Syndrome; Tomography; Diagnostic Imaging; Osteoarthritis; Bone Diseases

■ INTRODUCTION

The temporomandibular joint (TMJ) has been frequently studied in the field of Speech Therapy to be responsible for jaw movements and the efficiency of functions stomatognathic ¹. The TMJ is one of the most demanded and used joints of the body, consisting of skeletal and soft tissue structures. The bony structures are the condylar head, glenoid fossa and articular eminence of the temporal bone. The components of the soft tissue are the chewing muscles, joint ligaments, articular disc and capsule articular ². The articular surface of the TMJ is covered by fibrous tissue with variable amounts of within cartilage cells.

Temporomandibular disorders affect the stomatognathic system as a whole, so that suits these individuals, depending on the individual physiological tolerance of each one ¹. The cause and pathogenesis of disorders of the temporomandibular

joint are multi factorial, involving psychological, behavioral and environmental factors. Other causes include local trauma or procedures that cause joint stress ³.

The clinical examination is of great value in the diagnosis of temporomandibular disorders, but has its limitations due to the difficulty of being standardized their criteria, which leads to questions of interpretation. Thus, more effective methods are needed to obtain auxiliary data that complement the clinical examination in the diagnosis and treatment of TMJ changes. It is in this context that the exam through images, which provides important additional information for obtaining diagnosis ⁴ is required.

The TMJ is one of the body parts that offer greater difficulty obtaining conventional imaging because the size of the joint being small and the fact that, at least partially, be hidden by the dense bony structures of the skull, generating overlays of images ^{2,5}. The aim of this work is to demonstrate the existence of changes and / or bone lesions of the temporomandibular joint with the use of examinations performed by computed tomography.

For evaluation of tomographic images is necessary that the professional has the knowledge

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of sectional anatomy of the joint region, so that it recognizes the structural changes and pathological conditions. Thus, it will be exposed and described in this paper the tomographic characteristics of normality, morphological changes and pathological conditions most commonly found in the temporomandibular joint region, besides some relevant information.

■ CLINICAL CASES

In the normal aspect, the mandibular condylar process acts as a local of adaptive growth even under functional load supported by its cartilage. The morphology of the mandibular condyle is characterized by a rounded bony projection, with an oval and bi-convex upper surface in the axial plane. Typically, the antero-posterior (or lateral) dimension is smaller than the mediolateral (or frontal) whose terminations are called lateral and medial poles⁶. As any bone, in normal conditions, all the condyle process is covered by a thin and continuous cortical bone (Figure 1).

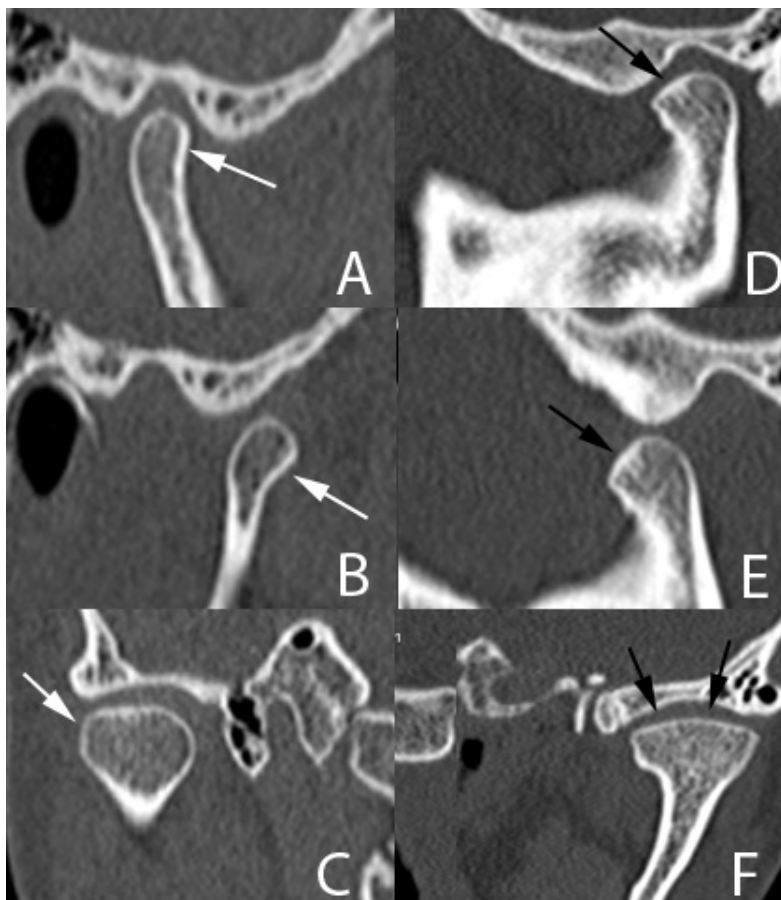


Figure 1 - CT sagittal reconstructions mouth shut (A), sagittal open mouth (B) and coronal on the right (C), showing the appearance of normality of the temporomandibular joint. Note the cortical bone covering the entire condyle process (indicated by white arrows). Already in the sagittal closed mouth reconstructions (D) Sagittal open mouth (E) and the left coronal (F) showing planning indicated by black arrows.

The TMJ **ankylosis** is a rare condition and constitutes, still, a difficult disease to treat, which can cause problems in chewing, digestion, speech, appearance and hygiene, which can also lead to psychological problems⁷. It is characterized by changes in grip of fibrous tissue with bone setting condyle, glenoid fossa, zygomatic arch, and in some cases, the coronoid process of the mandible, promoting calcification of these structures with limited mouth opening and mandibular mobility, usually without painful symptoms. Its etiopathogenesis is associated with condylar fractures, advanced arthritis, infections and traumas^{2,7}, this last one being the main cause of TMJ ankylosis, where there is the hypothesis that the extravasation of blood into the connective along with the disruption

of fibrocartilage integrity, allows the entry of fibrous connective tissue in the joint which, subsequently, results in ossification, leading to fusion of the mandibular condyle to the articular surface of the bone temporal⁷.

As for the tomographic image can be observed that the condyle is filled by temporal bone, and a hipodense area within the lesion, which represents a remaining interarticular disk⁷ (Figure 2). The TMJ ankylosis can be classified according to the type of tissue involved, bone, fibrous or fibro-osseous, or according to the location, intra-or extra-capsular⁷. When it occurs in children can be a deterrent to normal mandibular growth, resulting in a mandibular hypoplasia, especially if there is a bilateral problem⁷.

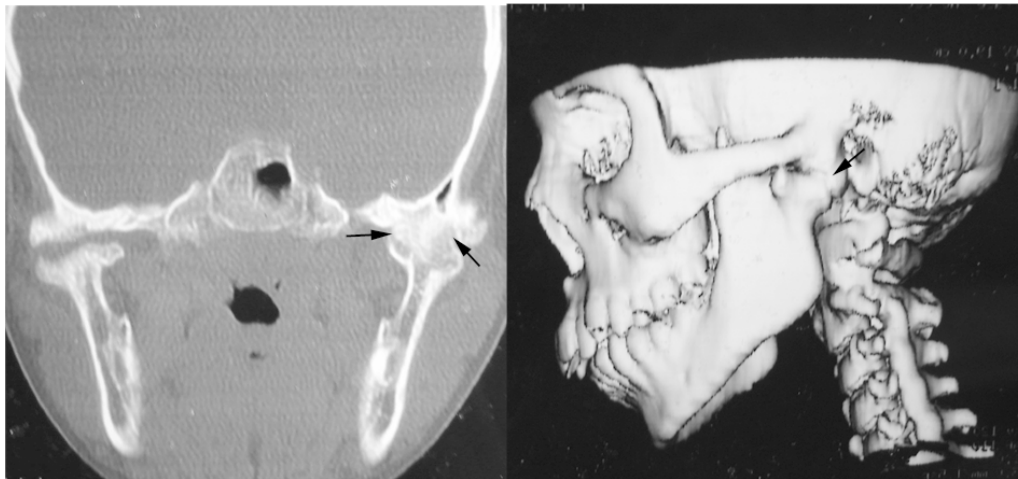


Figure 2 - A. Coronal section(A) and three-dimensional reconstruction (B), demonstrating ankylosis of the left ATM (indicated by arrows).

Planning is the loss of convexity of the condylar processes or articular eminence, as a local defect of the thinning of the compact bone layer⁷. This is an adaptive change to the first change of a disease or a degenerative secondary change to internal derangement or resulting from an overload on ATM. The planning is among the most prevalent degenerative changes⁸ (Figure 1).

The **bifid condyle** has been described in the literature as a structural change of unknown etiology and uncertain pathology. In most cases is asymptomatic, being discovered by imaging tests with

routine goals. It is reported that the presence of bifid condyle is not determined by age or gender, but researches show the occurrence between ages 3 and 67 years old, with an average of 35 years old⁹ (Figure 3).

Subchondral cyst is a well-circumscribed osteolytic bone area adjacent subcortical without cortical destruction⁸, usually found in the anterior region of the condylar head, related to a combination of aging, changes in occlusion and mandibular overload¹⁰ (Figure 4).



Figure 3 - Coronal (A), axial view (B), right sagittal section (C) and left sagittal (D). Presence of bifid condyle of the left side (indicated by black arrows). It was also verified condylar flattening of the right side.

Fractures in the condylar processes represent 17.5 to 52 % of all mandibular fractures, 80 % of unilateral cases, occurring mainly between the ages of 20 to 39 years old, most predominantly in males. They are mainly caused by indirect forces transmitted from a distant point of the condylar area⁴. The most clinical signs found include bone deformities, difficulty opening the mouth, bad occlusion, edema in the peripheral region of the external auditory meatus¹¹. The treatment options will depend on an accurate diagnosis, an imaging test that provides favorable review, as the TC¹² (Figure 5) is required.

Osteophytes are common changes that occur by abnormal bone deposition generally near the joints, resulting from degeneration of the cartilage

that protects the bone^{2,13}. The presence of osteophytes is an indication that the condyle process is adapting, or adapted, the degenerative changes produced in the past to stabilize and expand the bone surface in order to better withstand the load forces^{8,13}. The osteophytes are among the most degenerative prevalent changes^{8,14} (Figure 4).

The **erosion process** represents the initial stage of a bone degenerative process, it is possible to observe the density reduction area and the adjacent cortical bone, which leads deformity in the size or shape of the condyle^{8,12,15}. It is not uncommon for the patient has multiple changes to the same condyle (flattening, erosion, osteophytes and subchondral cysts) (Figure 4).

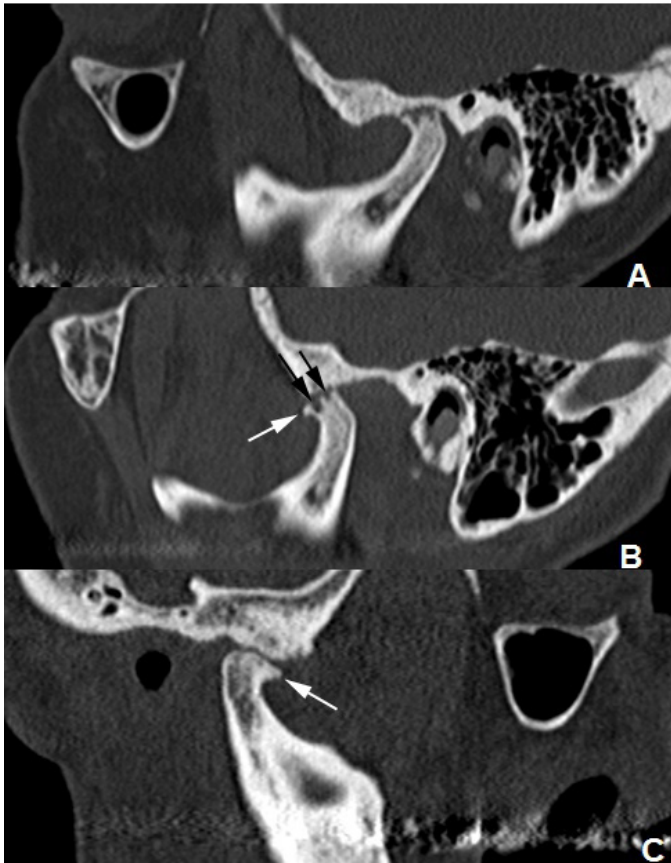


Figure 4 - Sagittal section of the left side mouth closed (A) and open (B). Presence of significant erosion in the condyle process, glenoid fossa and articular eminence of the left hand with the presence of osteophytes (white arrows) and subchondral cysts (black arrows). Sagittal sections of the right hand in his mouth closed (B). Presence of erosion in condyle, glenoid fossa and articular eminence of the right side (C) with the presence of osteophytes (indicated by white arrows).



Figure 5 - Axial (A), three-dimensional reconstruction (B), sagittal view of the right side (C) and coronal (D). Presence of bilateral condylar fractures (showing by arrows).

■ DISCUSSION

According to some authors degenerative bone diseases occur more in females and age of approximately 40 years old. These diseases have increased progression and severity with age in both the condyle as in the mandibular fossa^{8,14}. The greater occurrence in women can be explained by hormonal influences of estrogen and prolactin, which may exacerbate degradation of articular cartilage and articular bone in addition to stimulate a series of immune responses in ATM⁸.

Computed tomography (CT) plays an important role in the diagnosis of anomalies of ATM, since they perform fine cuts of up to 0.5 mm of thick articular structures. Thus, it is possible to eliminate the overlapping images of superficial and deep structures of the TMJ area. The test provides estimation of the distance between the bony components of the TMJ with proportions relative to the actual 1:1, performing a detailed trace of the region. Due to the high resolution image, it is possible to notice differences between tissues of different densities, as in the early stages of an inflammatory and / or infectious process in the articular surface. So this test allows the complete visualization of the joint region, providing a more accurate diagnosis^{2,4}.

The formation of CT images involves three basic steps: data acquisition, disposition of the images (storage and handling) and display of images. Through the images, the axial cuts in CT Multislices and volumetric in Cone Beam CT, it can be reconstruct the desired portion in other planes (multi-planar reconstruction -RMP), allowing to determine, through the intersection of the axes present in the

axial, sagittal and coronal planes, the exact location in the space of the region of interest².

For obtaining the most realistic images of the joint components, it must be held perpendicular and / or parallel along the axis of the condyle, for the sagittal and coronal reconstructions, respectively⁵. Thus, in a central lateral view there is the true position of the condyle in the fossa that often proves possible disc displacements of the joint, and by means of coronal section may obtain additional informations about the condition of the surface of the condylar head, besides evaluating the upper joint space. The pathological changes which are potentially hidden in the images on the side can be better observed in coronal sections, due to their perpendicular orientation to the sides. With 3D reconstruction is possible to have an overview of ATM sometimes valuable in cases of morphological severe abnormalities or for surgical planning. The evaluation of the image of the joint when with the mouth open can be last diagnosis of internal derangement in the articulation and evaluation of the mandibular excursion⁵. Para some authors the most common radiographic findings of degenerative bone changes are erosion, planning and osteophytes¹⁴.

■ CONCLUSION

A CT scan is a test of superior imaging to conventional imaging methods for ATM image by allowing adequate and accurate three-dimensional visualization of all bone detail without limiting overlap, providing real size and shape of anatomical structures, morphological changes and pathological conditions.

RESUMO

A tomografia computadorizada desempenha um papel importante no diagnóstico de anomalias e condições patológicas da ATM, permitindo a visualização completa da região articular, fornecendo um diagnóstico mais preciso. Para avaliação das imagens tomográficas é necessário que o profissional tenha o conhecimento da anatomia seccional da região articular, para que o mesmo reconheça as alterações estruturais. Assim, foi exposto e descrito neste trabalho as características tomográficas de normalidade, alterações morfológicas e condições patológicas mais encontradas na região da articulação temporomandibular. Sendo a tomografia computadorizada um exame de imagem superior aos métodos convencionais de imagem para ATM, pois permite uma visualização tridimensional adequada e apurada de todos os detalhes ósseos sem a limitação das sobreposições, fornecendo o tamanho e formato real das estruturas anatômicas, alterações morfológicas e condições patológicas.

DESCRITORES: Transtornos da Articulação Temporomandibular; Síndrome da Disfunção da Articulação Temporomandibular; Tomografia; Diagnóstico por Imagem; Osteoartrite; Doenças Ósseas

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