

## The influence of disc wear on the behavior of the temporomandibular joint: a finite element analysis in a specific case

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**Abstract.** The aim of this study was to evaluate the influence of disc thickness on the normal behavior of the temporomandibular joint. Based on a specific patient case, CT scan images showing accentuated wear in the right disc were reconstructed and the geometrical and finite element model of the temporomandibular joint structures (cranium, mandible, articular cartilages and articular discs) was developed. The loads applied in this study were referent to the five most relevant muscular forces acting on the temporomandibular joint during daily tasks such as talking or eating. We observed that the left side structures of the temporomandibular joint (cranium, mandible and articular disc) were the most affected as a consequence of the wear on the opposite articular disc (right side). From these results, it was possible to evaluate the differences in the two sides of the joint and understand how a damaged articular disc influences the behavior of this joint and the possible consequences that can arise without treatment.

**Keywords:** articular disc wear; finite element models; muscular forces; numerical analysis; temporomandibular joint

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### 1. Introduction

The temporomandibular joint (TMJ) is a very complex joint; it combines a wide hinge motion range and high frequency of motion, about 2000 cycles per day (Guarda-Nardini *et al.* 2011, Ramos *et al.* 2014). Although the TMJ is used in many daily activities, it is during mastication that the highest forces are transmitted (Chowdhury *et al.* 2011).

This joint is composed of skull, mandible and articular cartilages and discs. These articulating surfaces are highly incongruent, and this is the main reason for the large mobility of this joint. Between the articular cartilages of the mandible and the mandibular fossa is the cartilaginous articular disc which works as a shock absorber, decreasing the contact pressure between surfaces (Beek *et al.* 2000).

Due to the loads on daily activities to which this joint is subjected, it is estimated that TMJ

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