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Clinical Paper
TMJ Disorders

The evaluation of lateral pterygoid muscle pathologic changes and insertion patterns in temporomandibular joints with or without disc displacement using magnetic resonance imaging

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Abstract. Temporomandibular joint (TMJ) disc displacement is a common disorder in patients with internal derangement. Certain anatomic features of TMJ may make the patient prone to this condition, namely lateral pterygoid muscle (LPM) insertion variations. The aim of this study was to investigate LPM attachments and their relationships with disc displacement and subsequent pathologic changes. A total of 26 patients with clinical temporomandibular disorders (TMDs) and a control group of 14 unaffected individuals were studied. Magnetic resonance images (MRIs) were taken to evaluate LPM insertion patterns, superior LPM head pathologic changes, and relative disc to condyle position. Data registration and analysis were done using SPSS v. 16.0. The most common variation (type I) was shown to be the superior head with two bundles, one attached to the disc and another to the condyle. No significant relationship between LPM insertion type and disc displacement or pathologic changes of the muscle was found. However, a link between disc displacement and muscle pathologic changes was established ($P = 0.001$).

Key words: Lateral pterygoid muscle; Temporomandibular joint; Disc displacement; MRI.

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Introduction

Temporomandibular disorders (TMD) are known to be largely responsible for non-dental orofacial pain. They tend to affect the mastication muscles and/or temporomandibular joint (TMJ).[1] There are two distinct clinical variations of TMJ disc displacement: reciprocal click and chronic closed disc, which are distinct in terms of tissue, clinical characteristics, and treatment plan.[2] Although much emphasis has

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been placed on the damage caused by a displaced disc, efforts to explain and understand the influential factor(s) remain scarce.[3,4] Theories and observations have been suggested, blaming disc displacement as the cause of joint pain, limited mandibular movement, joint sounds, and osteoarthrotic changes in the TMJ.[5,6] Increased friction in contiguous parts may well be a major causative factor in the displacement of an articular disc.[7] Understanding the factors that may lead to, or result from, disc displacement is essential not only to permit the choice of optimal treatment, but also to develop preventive treatment modalities.

Anatomic variations of the TMJ, namely lateral pterygoid muscle (LPM) insertion, can increase the likelihood of disc displacement.[8] The LPM is a muscle with two separate heads, the superior originates from the infratemporal surface of the greater wing of the sphenoid as well as infratemporal crest, whereas the inferior head stems from the lateral surface of the lateral pterygoid plate. The former attaches to the anteromedial surface of the TMJ disc and the condylar neck, while the latter enters the pterygoid fossa lateroposteriorly on the anteromedial condylar surface.[9,10]

Anatomical studies by Wilkinson[11] on 26 cadavers showed that the superior head had a single insertion to the pterygoid fovea of the condyle in 30% of cases. In the remaining joints, the major insertion of the superior head was again to the pterygoid fovea, but the uppermost 20% of the superior head fibres had a secondary insertion into the capsule below the attachment point of the disc to the capsule.

The aim of this study was to investigate any possible links between temporomandibular disc displacement and LPM attachment anatomical variations on magnetic resonance imaging (MRI). We also managed to study pathological changes in the superior head of the LPM (SLPM) and their correlation with attachment variations, an area in which research is scarce.

Materials and methods

In a cross-sectional case–control study, subjects were consecutively selected among patients referred to a department of prosthodontics between March 2010 and October 2011. All patients showed clinical signs and symptoms of disc displacement based on research diagnostic criteria (RDC/TMD).[12] Patients with systemic diseases with joint involvement, such as rheumatoid disease, were excluded. The control group comprised TMD-free patients referred to the same department for other complaints. A total of 26 patients (52 TMJs), including 20 females and six males, were registered into the study group; 14 individuals (10 females and four males) constituted the control group. All subjects were well-informed regarding the objectives and procedures of the study, and officially consented to participate.

An MRI was subsequently taken at no extra charge, using a 1.5 T (Siemens Magnetom Avanto superconductive, 32-channel; Siemens AG, Munich, Germany) with a bilateral (6-cm) surface coil for study of both the right and left TMJ. Left and right images were taken separately in all cases and controls. Oblique sagittal images perpendicular to the long axis of the condyles were acquired for each joint.Proton density images (TR (repetition time) = 3400 ms, TE (echo time) = 42 ms, FOV (field of view) = 14 cm, slice thickness = 3 mm, matrix size 512 × 512) and T2-weighted (TR = 3000 ms, TE = 73 ms, FOV = 14 cm, slice thickness = 3 mm, matrix size 512 × 512) bilateral images in both closed mouth and maximum opening mouth positions were made. The latter position was obtained by means of a wooden intermaxillary device.

Variables studied included the LPM insertion pattern, SLPM head morphologic changes, and relative disc to condyle position on sagittal images.

To evaluate the LPM insertion pattern, medial sections in both open and closed mouth positions were evaluated.[13,14] Insertion patterns were categorized into three groups, as follows: (1) type I: superior head consists of two bundles, one attaches to the disc and the other to the condyle, while the inferior head reaches the condyle[14] (Fig. 1A); (2) type II: superior head has one bundle reaching both disc and condyle, whereas the inferior head only involves the condyle[14] (Fig. 1B); (3) type III: superior head with a single bundle attaching to the disc, while the inferior head inserts to the condyle[14] (Fig. 1C).

Pathologic changes in the superior head of the muscle included: (1) normal: when the muscle was isointense having a fan pattern[15] (Fig. 2); (2) hypertrophy: to evaluate hypertrophy, the SLPM head was observed separately on each side; this was defined as an increase in mid-portion muscle size of each lobe, causing both upper and lower edges to bulge[15,16] (Fig. 3); (3) atrophy: high signal on large areas due to fat tissue substitution on proton density and T2 images of the upper lobe on each side was considered strongly suggestive of atrophy[15,17] (Fig. 4).

The relative disc to condyle position on sagittal images was evaluated in three groups, in both open and closed mouth positions, as follows: (1) normal: in closed mouth position, the posterior band keeps a 12 O'clock position in relation to

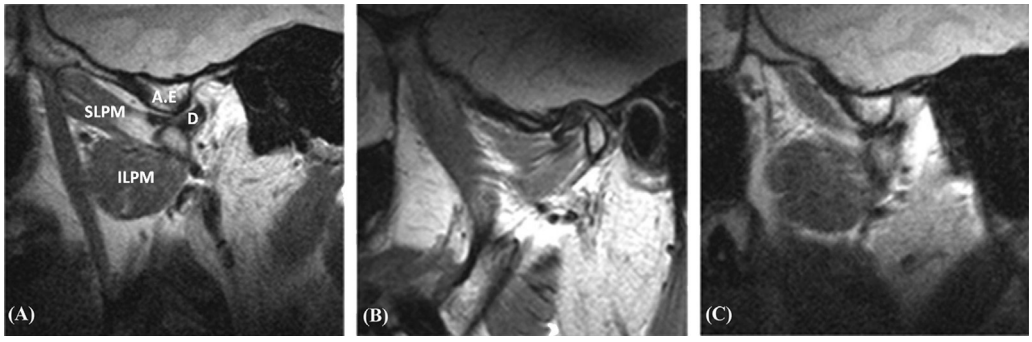

Fig. 1. Different lateral pterygoid muscle insertion patterns. (A) Type I: the superior head (SLPM) consists of two bundles, one inserts to disc 'D' and the other to the condyle, while the inferior head (ILPM) inserts to the condyle and anatomic parts of the TMJ including disc 'D'. (B) Type II: the superior head has one bundle and inserts to both disc and condyle, while the inferior head inserts to the condyle. Anterior disc locomotion and condylar head flattening is present. (C) Type III: the superior head has one bundle and inserts to the disc, while the inferior head inserts to the condyle.