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Magnetic Resonance Imaging Findings of the Temporomandibular Joint Internal Derangement in a Non-patient Population

Giedre Kobs, Olaf Bernhardt, Thomas Kocher, Georg Meyer

SUMMARY

Objectives. To describe the prevalence of internal derangement of the temporomandibular joint (TMJ) in subjects from a population representative cross-sectional study through the distribution of frequency of the data obtained from MRI findings.

Material and methods. 114 subjects with at least one sign of temporomandibular disorders (tenderness/pain on palpation of the joints or muscles, TMJ sounds, pain or deviation during maximum mouth opening (active/passive)) and 193 controls underwent MRI after proper history taking and assessment of clinical symptoms.

Results. 464 joints with no disk displacement (NDD), 114 joints with reducible displaced disk (RDD), and 36 joints with permanently displaced disk (PDD) were confirmed on magnetic resonance imaging (MRI). Pathological TMJ states such as partially and medially disk displacement with complete reposition and retroplaced condyle were the most frequent forms of the internal derangement of the temporomandibular joint.

Conclusion. The results of this study confirm the concept that musculoskeletal abnormality may not be related to patients' symptoms.

Keywords: temporomandibular joint; temporomandibular disorders; internal derangement; clinical examination; magnetic resonance imaging.

INTRODUCTION

The term "internal derangement" of the temporomandibular joint (TMJ) is used to describe an abnormal relationship between the articular disc, the mandibular condyle and the fossa including the articular eminence [1-3]. Internal derangements are one of the most common causes of orofacial pain and TMD [4-5]. TMJ imaging techniques revealed that a displaced disc is often associated with the following main clinical findings: pain as a symptom, clicking, and dysfunction [6-8]. Differential diagnostic considerations are especially important when examining patients with TMD, since pain in the orofacial region has many different causes. A functional impairment in the masticatory system can also cause diagnostic difficulties since e.g. a reduced mouth opening can be the consequence of disc interference, enlargement of the coronoid process, degenerative changes in the TMJs or trismus. All these factors may result in similar clinical pictures, but treatment regimen in the single patient should, of cause, be on the unique aetiology in that patient, and the treatment of choice is depending on the causative factor [9]. The soft tissue and bone changes that occur in joints represent varying stages of arthritis (osteoarthritis). Some joints progress to degenerative joint disease (DJD) and some do not. Internal derangement may represent a risk factor when it is coupled with other predisposing, initiating, perpetuating factors. However, there are no methods that predict the risk of progressing to DJD. Studies that look at large segments of the population have found that many people have some signs of dysfunction but only a small percentage require treatment [10].

This study describes MRI findings of the temporomandibular joint in subjectively asymptomatic subjects with and without TMD. The prevalence of disk-dislocation findings on sagittal and coronal plane, disk shape changes in closed mouth position, stuck disk, retroplaced condyle and morphological condyle changes, were evaluated.

MATERIALS AND METHODS

Subjects

From a population representative cross-sectional study - "Study of Health in Pomerania" (SHIP) there were 307 subjects (140 males und 167 females) selected for this investigation. The age of subjects ranged from 20 to 54 years old, with a mean age of 35, 4.

The Figure 1 shows sex and age distribution of the examined population.

Due to the clinical diagnosis of „SHIP" 114 subjects had at least one sign of temporomandibular disorders (tenderness/pain on palpation of the joints or muscles, TMJ sounds, pain or deviation during maximum mouth opening (active/passive). 193 subjects served as controls. In this investigation we did subgroup analysis and for the interpretation of results do not rebuild the patient and control groups.

Standardization and calibration of clinicians was performed before the study started and took place twice a year while the study was running. Kappa values for detecting

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palpation pain of the masticatory muscles and TMJ varied from 0.53 to 0.63 in the final calibration session. All subjects underwent MRI after proper history taking and assessment of clinical symptoms. The clinical examination included tenderness on palpation and assessment of joint sounds together with history of joint symptoms.

MRI diagnosis

MRI was performed with 1,0-tesla scanner (Magnetom Impact Expert, Siemens, Germany) using a bilateral TMJ surface coil with 7cm diameter as described by Kobs et al [11].

Bilateral sagittal and coronal MR images were obtained subsequently to establish the corresponding diagnosis of degenerative TMJ disk displacement and changes.

The physiological disk position and groups of disk displacement was considered as described by Kobs et al [11, 12]. The disk is imaged as a hypointensive, homogeneous signal in normal subjects. It was possible to distinguish the normal, dumbbell-like configuration of the disk from pathologic changes, such as string-shaped, thin, wedge-shaped, or lamellar images. Inhomogeneous signals or an increased signal intensity, which may be circumscribed or generalized, indicate morphologic disk alterations.

Osseous changes can be determined from the shape of the condylar head, which may have lost its round shape and developed a flattened, oval surface. A regular spongiosa signal was distinguished from a hypointensive signal, and the existence of osteophytes could also be determined.

The MRI results were independently assessed by two experienced diagnosticians.

RESULTS

Clinical examination

The Figure 2 demonstrates the overall view of clinical examination findings.

From figure 2 it appears, that tenderness or pain of the TMJ or muscles are most frequent clinical symptoms. Limitation of mouth opening (<40mm) was found only in 11 subjects.

MRI findings

The overall view of MRI findings is demonstrated in Figure 2 to Figure 8.

In assessing the disk position findings on sagittal plane, 464 joints were judged to have no disk displacement (NDD), 114 joints RDD, and 36 joints PDD. Delicate classification of disk dislocation findings on sagittal plane is demonstrated in Figure 3. The medial and lateral displacements of the disk were diagnosed in the coronal views (Figure 4).

The results visualised in Figure 2 to Figure 8 indicates, that pathological TMJ states such as partially and medially disk displacement with complete reposition and retroplaced condyle were the most frequent forms of the internal derangement of the temporomandibular joint. Morphological changes, including condylar flattening and arthrotic changes, were found in 107 joints.

DISCUSSION

The results of this study indicated that morphological abnormality may not be related to patients' symptoms: not everybody having disk displacement suffers from it, and not every disk displacement diagnosed is the source of patient's symptoms. Since arthrography and MRI studies have been used to evaluate asymptomatic volunteers, it has been showed, that the prevalence of different forms of disk displacement exists in up to one-third of asymptomatic individuals [13-15]. Disk displacement was present in 33% of asymptomatic children and young adults, which suggests that the soft tissue changes may begin early in childhood. Abnormalities in the absence of pain in other joints (knee,

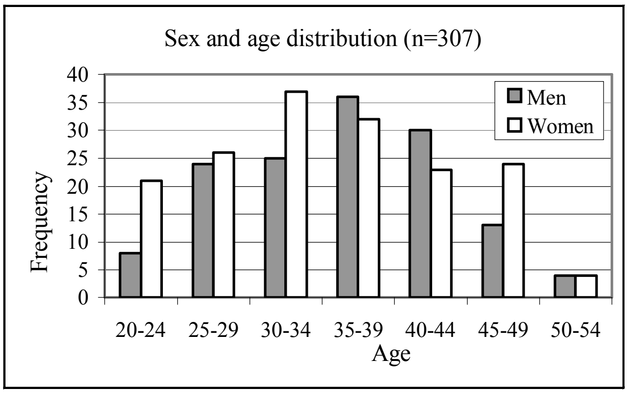

Figure 1. Graphic visualisation of sex and age distribution of the examined population.

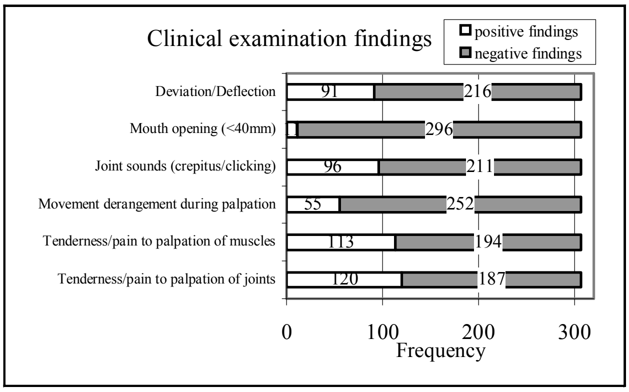

Figure 2. Graphic visualisation of absolute frequency findings from the clinical examination.

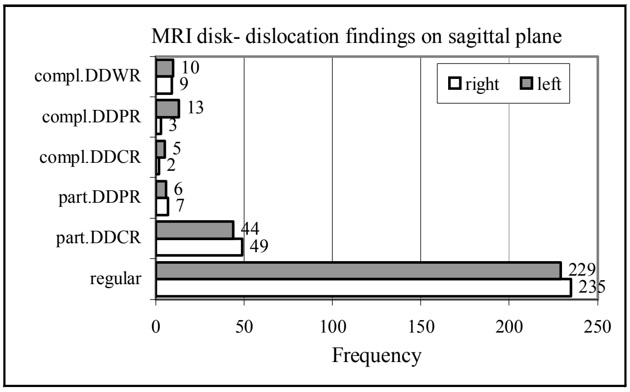

Figure 3. Presentation of disk – position changes on MRI sagittal plane for the right and left joint.

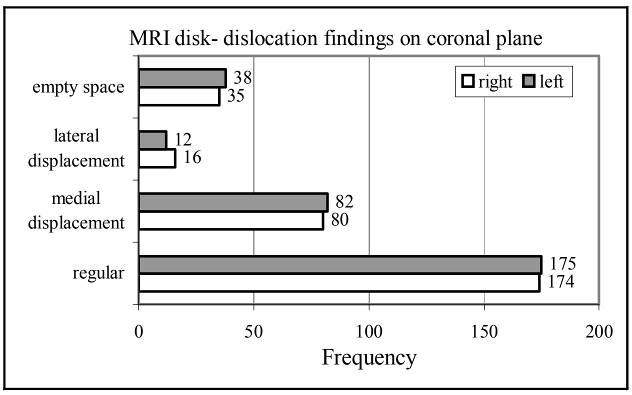

Figure 4. Presentation of disk – position changes on MRI coronal plane for the right and left joint.

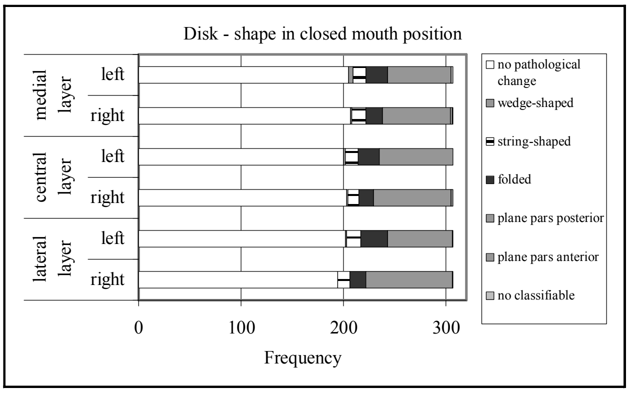

Figure 5. Presentation of disk – shape changes on MRI sagittal plane for the right and left joint.

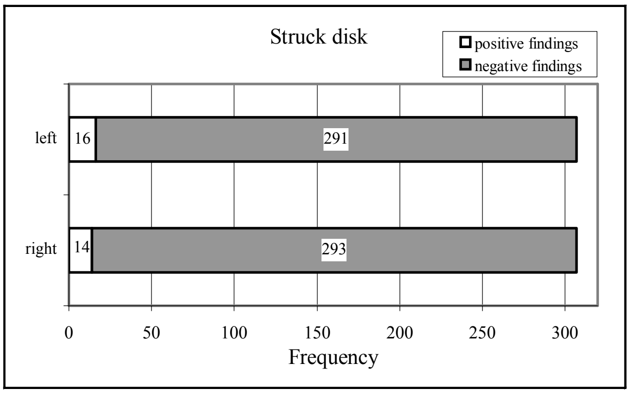

Figure 6. Presentation of struck disk findings on MRI sagittal plane for the right and left joint.

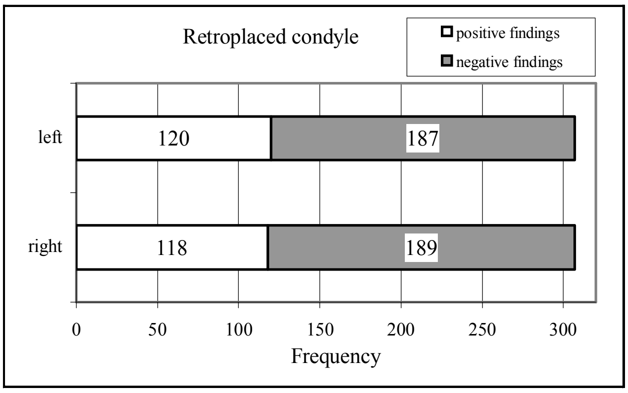

Figure 7. Presentation of retroplaced condyle findings on MRI sagittal plane for the right and left joint.

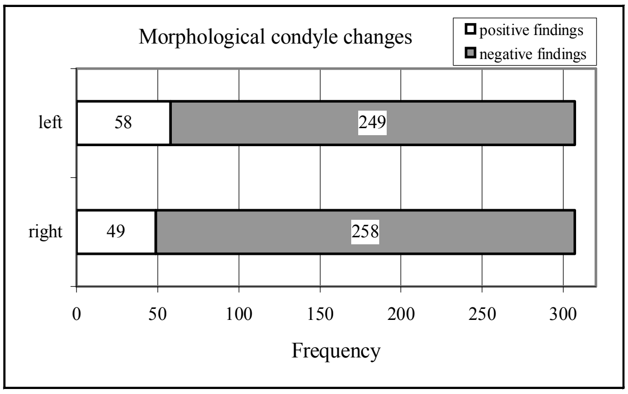

Figure 8. Presentation of condyle deformation findings on MRI sagittal plane for the right and left joint.

cervical spine, and lumbar spine) range from 16% to 33% [16, 17]. Disk herniations and disk bulges in the lumbal spine, degenerative changes in the cervical spine and meniscus injuries in the knee can be seen in a large proportion of asymptomatic individuals as well as in symptomatic patients. The concept that musculoskeletal abnormality may not be related to patients' symptoms may appear confusing. Just because a morphologic abnormality is common does it mean it is normal? What should be considered as normal and healthy? The definition of normal is that which includes "the typical, usual, or healthy, according to a rule or standard [18]." The definition of healthy is "the state of the organism when it functions optimally without evidence of disease or abnormality [18]". The difficulty with using the term normal (or its substitute asymptomatic) is that it relies completely on the standard being applied.

MR imaging has become the gold standard for a thorough assessment of the internal derangement of the TMJ, especially disk position, and it has the major advantage of not introducing radiation or known biologic hazards to the patient that might produce tissue damage [19]. MRI is said to have a diagnostic accuracy of 95% when sagittal plus coronal slices are evaluated [20]. The disadvantages of MRI are non-availability and high cost [19].

However, if we use MRI as gold standard to consider what is normal and healthy, there appears a lot of confusion. Would a person who is free of pain, but has TMJ disk dislocation be considered less "normal" or "ill" than one who doesn't? Do morphological abnormalities seen on imaging studies by themselves need to be treated? Are there some indications that preventive treatment of TMJ disorders would avoid future problems?

The prevalence of TMD is still obscure, and more studies are necessary to allow better understanding of the pathological aspects so as to address effective therapies individually or preventive projects at the population level. To clear this confusion, we agree with Westesson opinion [21], "that if a patient presents with symptoms that can be correlated to the morphologic abnormality diagnosed on imaging studies, the abnormalities are probably responsible for these symptoms. However, if a patient's history and clinical examination do not support such correlation, the imaging abnormalities are probably incidental findings". These data demonstrate this because different stages of internal derangement are present in TMJ with and without objective symptoms. Therefore, "normal" has a wide range of interpretation, especially inasmuch as there has been a uniform consensus.

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