A comparative study of student vs supervisor diagnoses of anatomical abnormalities affecting the TMJ

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ABSTRACT

Introduction: The use of modern teaching methods and learning tools by educators to ensure competent graduates has been encouraged. At the Department of Odontology, University of Pretoria, School of Dentistry, four diagnostic screening tests were tested as learning tools, in order to teach undergraduate dental students to diagnose abnormalities affecting the osseous components and associated muscles of mastication of the temporomandibular joint (TMJ). These screening tests are known as joint play, end feel, static pain and dynamic pain.

Objectives: The aim of this study was to determine if dental students would be able to diagnose abnormalities affecting the osseous components and associated muscles of mastication of the TMJ using these four screening tests, as well as to compare their diagnosis with the diagnosis of a prosthodontist.

Methods: One hundred joints were randomly examined for abnormalities by 50 dental students and a prosthodontist. The diagnoses were recorded on a diagnostic form and entered into an electronic Microsoft Excel ® database.

Results: Of the 100 joints examined, 78 of the diagnoses made by the students were in agreement with that of the prosthodontist, which is highly significant ($p < 0.001$). Conclusion: The tests were used successfully by the majority of the students to make a correct diagnosis.

INTRODUCTION

The emphasis on an outcomes-based education at academic institutions is well known.[1-11] Students are required to achieve predetermined exit-level outcomes in order to become competent clinicians. The role of dental academic institutions in ensuring that competent graduates are produced has been emphasised in the literature.[1, 4-9, 11] The use of modern teaching methods and learning tools by educators, to ensure competent graduates has also been encouraged.[3, 5] The competency based philosophy of an institution[7, 8, 10] therefore requires that innovative changes involving teaching and learning tools be introduced. At the Department of Odontology, University of Pretoria, School of Dentistry, four diagnostic screening tests were tested as teaching and learning tools, in order to teach undergraduate dental students how to diagnose abnormalities affecting the osseous components and associated muscles of mastication of the TMJ, usually the anatomical sites that are most frequently affected.[12-17]

The osseous components of the articular surfaces are covered by fibrous tissue and comprise of the mandibular condyle, the glenoid fossa and the articular eminence of the temporal bone. The articular disc is made of fibrous connective tissue and divides the joint space into a superior and inferior compartment. The associated muscles of mastication are the lateral pterygoid, medial pterygoid, temporalis and the masseteric muscles. Abnormalities manifest themselves as changes that adversely affect the normal functioning of the TMJ. The changes in the osseous components of the joint are usually degenerative, not allowing smooth gliding movements of the articular surfaces. The associated muscles of mastication are usually affected by changes that result in stiffness and tension of the muscle fibres. The changes that affect the articular disk may result in displacement, compression, tearing and perforation. The four screening tests used in this study were not appropriate to assess the articular disk for abnormalities.

Diagnostic screening tests that will allow rapid screening and assessment of the osseous components and associated muscles of mastication of the TMJ are useful teaching and learning tools.[5, 12] Joint play, end feel, static pain and dynamic pain tests offer just such rapid assessment in the undergraduate examination and diagnostic clinics.[12] The joint play test determines the condition of the osseous components. The end feel test determines the level of stiffness of the associated muscles of mastication. The static pain test is an indication of pain and spasm that is of muscular origin and the dynamic pain test is an indication of pain of osseous origin.[12] These four diagnostic screening tests

provided an opportunity for undergraduate dental students to participate in an active learning process[3] to improve their diagnostic skills in identifying abnormalities affecting the osseous components and associated muscles of mastication of the TMJ. The aim of this study was to determine whether dental undergraduate students would be able to diagnose such abnormalities using these four screening tests as well as to compare their diagnoses with those of an experienced prosthodontist.

MATERIALS AND METHODS

Each student (n = 50) received a lecture on the anatomy and kinematics of the TMJ and a detailed demonstration by a prosthodontist on how to perform the four diagnostic screening tests. Fifty patients between the ages of twenty and forty and requiring basic dental restorative procedures were randomly selected for undergraduate training procedures at the examination and diagnostic clinic. One hundred joints were assessed. The patients were examined in an upright position and the screening tests were performed by the student as described below.

Joint play

The index and long fingers of one hand is placed over the position of the condyle, anterior to the opening of the external acoustic meatus. The thumb of the manipulating hand is placed over the occlusal surfaces of the mandibular teeth on that side and the forefinger of the same hand is placed underneath the angle of the mandible (Figure 1). The manipulating hand then rotates the condyle of the mandible in the glenoid fossa (Figure 2). If the movement is irregular and jagged, it indicates abnormalities affecting the osseous components of the TMJ. If the movement is regular and smooth, there are no abnormalities affecting the osseous components of the TMJ.

Figure 1: Joint play: left hand side.

Figure 2: Joint play: right hand side.

The thumb is placed on the incisal edges of the maxillary incisors and the index finger of the same hand is placed on the incisal edges of the mandibular incisors (Figure 3). The tip of the thumb and the tip of the index finger are gently extended away from each other (as indicated by the arrow)

Figure 3: Positions of fingers.

Figure 4: Direction of movement.

(Figure 4). Care is taken not to use excessive force. The objective of this test is only to perceive the elasticity of the muscles of mastication. This movement will feel either elastic or stiff. If the movement feels elastic, there are no abnormalities affecting the associated muscles of mastication of the TMJ. If the movement feels stiff, there are abnormalities affecting those muscles.

Static pain test

The occlusal surfaces of the patient's teeth must be brought together firmly. (Figure 5).The palm of the practitioners hand is placed underneath the patient's chin and an upward force is applied as the patient is instructed to open (Figure 6), offering resistance against the forces exerted by the muscles of mastication as they attempt to lower the mandible to an open position. If pain is felt by the patient during this test, there are abnormalities affecting the muscles of mastication and the origin of the pain is muscular. If no pain is felt, there are no abnormalities affecting the associated muscles of mastication.

Figure 5: Patient asked to close.

Figure 6: Patient asked to open.

Figure 7: Mandibular laterotrusion.

Figure 8: Mandible guided open.

Dynamic pain test

The patient's head is supported firmly and the mandible is guided gently to the left and then to the right (Figure 7). The mandible can also be guided to move forward and downward to an open position (Figure 8). If pain is felt, there are abnormalities affecting the osseous components of the TMJ and the origin of the pain is osseous. If no pain is felt, there are no abnormalities affecting the osseous components of the TMJ.

The students were then divided into groups of two. The 50 students were calibrated by allowing each to perform the four screening tests on colleagues under qualified supervision until all 50 students performed the screening tests competently.

Each student performed the four screening tests on an allocated patient at the start of their clinical session after receiving verbal consent. The osseous components and associated muscles of mastication of the TMJ of each patient were examined. The students used the four screening tests to make a diagnosis of any abnormalities affecting these structures and had the option of making one of four diagnoses,

DIAGNOSTIC FORM

Joint play test:
(Condition of the osseous components)

Student	Specialist (prosthodontist)
Smooth/rough	Smooth/rough

Endfeel test:
(Level of stiffness of the associated muscles of mastication)

Student	Specialist (prosthodontist)
Elastic/stiff	Elastic/stiff

Static pain test:
(Indication of pain and spasm of muscularorigin)

Student	Specialist (prosthodontist)
No pain/pain present	No pain/pain present

Dynamic pain test:
(Indication of pain of osseous origin)

Student	Specialist (prosthodontist)
No pain/pain present	No pain/pain present

Student diagnosis:

Osseous Abnormality (OA)	Muscular Abnormality (MA)
Combination Abnormality (CA)	No Abnormality detected (NAD)

Specialist (prosthodontist) diagnosis:

Osseous Abnormality (OA)	Musclular Abnormality (MA)
Combination Abnormality (CA)	No Abnormality detected (NAD)

Figure 9: Diagnostic form.

namely: abnormalities affecting a) the osseous components; b) the associated muscles of mastication; c) a combination of a & b; d) no abnormalities detected (NAD).

A diagnostic form (Figure 9) was used to document the diagnosis that each student made. The students circled their diagnosis after they completed the screening tests. The dental specialist then performed the four screening tests on the same patient and recorded the decision.

One hundred joints were evaluated for abnormalities. The diagnostic form (Figure 9) provided for the completion of the required information.

The information on the diagnostic form was entered into an electronic Microsoft Excel ® database. The diagnosis made by the student for each joint was then compared with that of the specialist prosthodontist, subjecting the data to the appropriate statistical analysist.

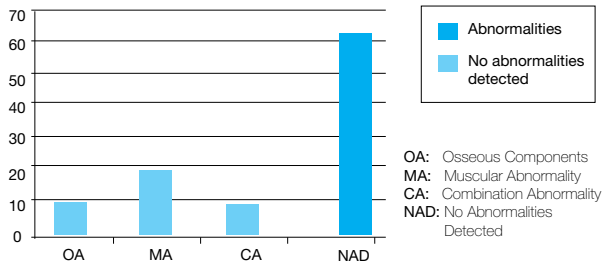

Figure 10a: Mandible guided open.

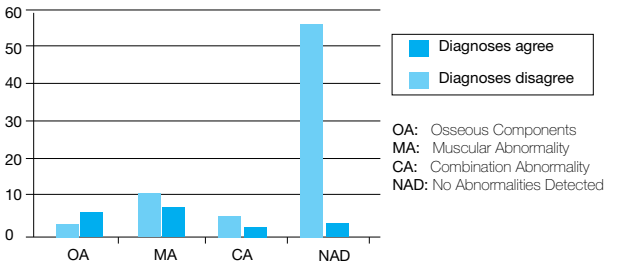

Figure 10b: Graphical illustration of the origin of abnormalities.

Statistical Analysis

The data was analysed using the kappa (k) statistic to determine that level of agreement which was in excess of the amount of agreement that would be expected by chance. A value between 0.41 and 0.60 indicates moderate agreement and a value above 0.8 indicates very good agreement. The z – test was used to test the significance of the percentage of correct diagnoses.

RESULTS

The kappa statistic, k = 0.57 indicated moderate agreement between the diagnoses made by the students and the diagnoses made by the prosthodontist. However, of the 100 joints examined 78 (78%) of the diagnoses made by the students were in agreement with that of the specialist, which is highly significant (z test, $p < 0.001$). These diagnostic agreements were made up of two osseous (OA), 12 associated muscles of mastication (MA), six combination abnormalities (CA) and 58 assessments that did not detect abnormalities (NAD) (Figure 10 a).

In this study there were 62 joints with no abnormalities and 38 with diagnosed abnormalities. According to the diagnoses made by the prosthodontist, (Figure 10 b) 24 % (n = 9) revealed abnormalities in the osseous components (OA), 52 % (n = 20) revealed abnormalities in the associated muscles of mastication (MA) and 24 % (n = 9) demonstrated problems in both the osseous components and the associated muscles of mastication (CA).

DISCUSSION

The majority of patients in this study had no abnormalities affecting the osseous and associated muscles of mastication of the TMJ. The 22 diagnoses made by students that did not agree with the diagnoses of the prosthodontist were described as follows:

a) seven students did not diagnose abnormalities affecting the osseous components;
b) eight students did not diagnose abnormalities affecting the muscular components;
c) three students did not diagnose abnormalities affecting both the osseous components and associated muscles of mastication; and
d) four students incorrectly diagnosed abnormalities affecting the osseous components.

The kappa statistic was used to determine where in the results agreement occurred. The moderate level of agreement

(k = 0.57) was due to the disagreement of diagnoses between the students and the prosthodontist. That 78 % of the diagnoses were in agreement was mainly due to the large number of patients in this study with no abnormalities, accounting for a result that was highly significant. In this study, the dental undergraduates performed the four screening tests competently on patients and the majority made the correct diagnosis. Most diagnostic disagreements, however, involved components of the TMJ that had abnormalities. Hence there is a need to improve the diagnostic skills of the undergraduate students in discerning such abnormalities.

Competency has been defined as the complex behaviour or ability essential for the general dentist to begin independent, unsupervised dental practice.[18] It has been established that teaching students about the TMJ is a fundamental part of their dental education.[18,19] Graduating dentists should therefore have a good understanding of the TMJ in both health and dysfunction.[20,21] However, the quantity of diagnostic and therapeutic skills relative to the TMJ that a dental graduate should possess has not been established.[22] This study encouraged students to understand the concept of competency and why it is necessary for them to achieve predetermined exit-level outcomes before entering the dental profession. The study also conformed to the current learning and teaching theories which state that teachers/lecturers should act as guides and mentors who mediate the learning environment and facilitate learning through interaction with students.[1,3] Construction of knowledge is therefore achieved when students are active in their learning.[3] The University of Pretoria already operates a system of teaching and learning with face-to-face tuition for the majority of students with emphasis on "flexible learning opportunities[23]". This implies the use of educational methods that are focused on using theory, practice and tools to provide learning opportunities that are better aligned with the learning needs of students[2] and the prescribed exit-level outcomes.[23] The introduction and use of effective teaching methods and learning tools which improve a student's competency is essential at dental schools that have a competency-based education programme.[5] This study used innovative education techniques as a research tool to provide a learning opportunity for students.

CONCLUSIONS

In this study the four screening tests were used successfully by the majority of the undergraduate students to make a correct diagnosis. The majority of the abnormalities were located in the associated muscles of mastication, whilst the remainder originated in the osseous components of the TMJ.Further studies on larger samples are required to determine how efficiently the undergraduate students can use and apply these screening tests.

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