Detection of Degenerative Changes in the Articular Disc of the Temporomandibular Joint Using Delayed Gadolinium- Enhanced MRI at 3 Tesla – A Case Report

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Abstract: The delayed Gadolinium-Enhanced Magnetic Resonance Imaging of Cartilage (dGEMRIC) is a useful tool for the evaluation of a repair tissue status after cartilage transplantation. A previous study showed the feasibility of dGEMRIC at 3 Tesla in TMJ. This case report describes the application of dGEMRIC to a TMD patient. A 27 years old female patient reported TMJ (VAS 87) with increasing intensity. The examination according to RDC/TMD showed myofacial pain (group I) and arthralgia of the right and left joint (IIIa). The graded chronical pain score showed grade III. The conventional MRI showed no sign of discus dislocation. T2 mapping showed a significant signal in homogeneity in both disci, as well as an increased amount of fluid in both compartments and a flattened disc in the lateral area. The application of dGEMRIC with patients suffering from temporomandibular disorders could be very well suited for early detection of onset pathological change in fibrocartilage.

Keywords: dGEMRIC, TMD, TMJ, MRI, 3 Tesla.

1. INTRODUCTION

The delayed Gadolinium-Enhanced Magnetic Resonance Imaging of Cartilage (dGEMRIC) has been validated as a clinically useful tool for the evaluation of a repair tissue status after different types of cartilage transplantation techniques [1]. T1 mapping provides specific measure of contrast agent uptake, which is inversely proportional to the glycosaminoglycans (GAG) concentration. The missing negatively charged molecules of GAG are replaced by the negatively charged molecules of diethylenetriamin-pentaacetate acid ion (Gd-DTPA(2-)). The more GAG is missing in degenerated cartilage, the higher is the contrast agent uptake and correspondingly the stronger is the T1 contrast enhancement introduced into the MR image. Therefore the dGEMRIC index is considered an indirect measure of GAG concentration in the cartilage.

A previous study showed the feasibility of dGEMRIC at 3 Tesla in TMJ and the optimal delay of 60 min for the measurements of the TMJ disc after i.v. CA (contrast agent) administration [2].

This case report describes the application of dGEMRIC to a TMD patient. The research objective was to analyse the applicability of this method to the discus articularis of a patient, who suffers from TMJ pain and with regard to whom a conventional MRI-diagnosis did not reveal any indication of a pathology.

2. CASE REPORT

A 27 years old female patient reported TMJ pain during load (VAS 87) and pain in rest (VAS 80) with increasing intensity since 06/2013. The examination according to RDC/TMD showed myofacial pain (group I) and arthralgia of the right and left joint (IIIa). The graded chronical pain score showed grade III [3].

The clinical functional analysis determined a click sound of the right TMJ and impressions of the tongue and cheeks. The patient has an angle-class I left and

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E-ISSN: 2311-8695/18

right an angle class I in the range of the canine and an angle class III in the region of the molars.

2.1. Medical History/ Anamnesis

Multiple Sclerosis was diagnosed 2010 (therapy: Immunsuppression); scoliosis.

2.2. OPG

Wide joint gap with rounded condyles. No degenerative changes of the bone were detected (Figure **1**).

2.3. MRI Examination

The conventional MRI showed a steep eminence. There was no sign of discus dislocation. The discus articularis was situated at the 12 o'clock position in mouth close position [4] (Figure **2**).

Figure 1: OPTG May 2013.

On a 3 Tesla whole-body Magnetom Tim Trio scanner (Siemens Healthcare, Erlangen, Germany) the MRI examinations were performed.

Contrast agent administration was performed as a bolus of a double-dose 0.2mmol/kg of Gd-diethylenetriaminepentaacetic acid ion, what was 0.4 mL of Magnevist (Bayer HealthCare Pharmaceuticals, Berlin, Germany) per kg body weight. Initial contrast-free inversion-recovery (IR) examination was followed by the i.v. contrast agent administration and immediate second IR examination.

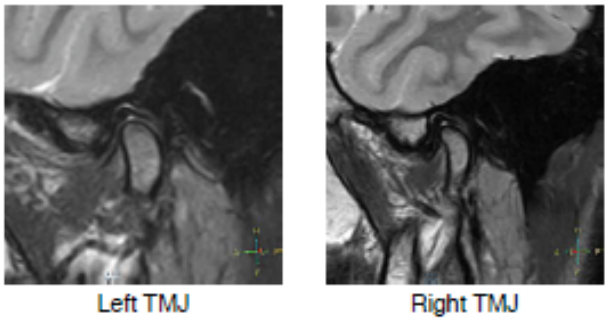

Figure 2: Conventional MRI (3T).

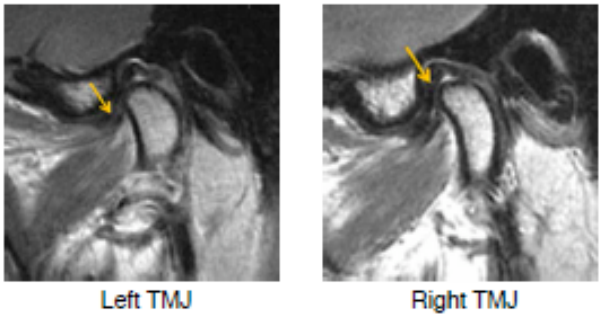

Figure 3: T2 Mapping.

There was a visible decrease of T1 values to less than 50% after contrast agent administration. The distinct concentration of contrast agent in this region points to a lower glycosaminoglycan content. This result is more marked in the right temporomandibular joint than in the left one (Figure **4, 5**).

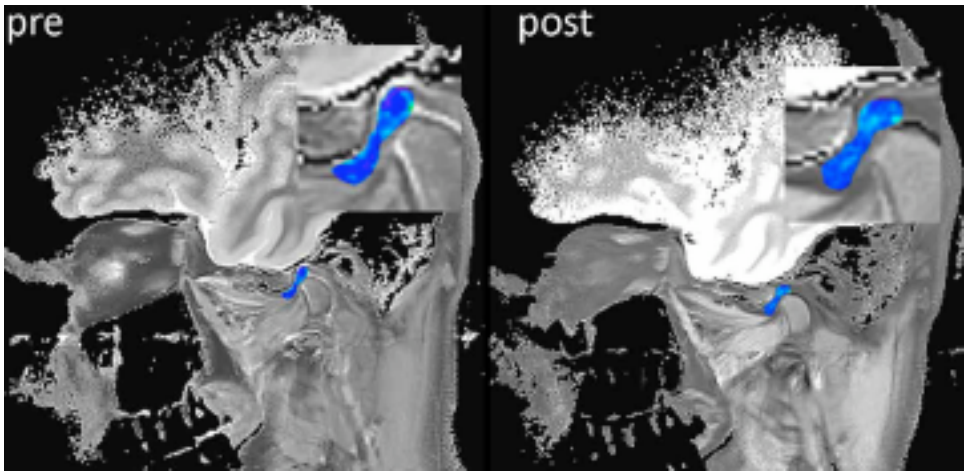

Figure 4: MR 3T Magnetom Tim Trio scanner T1: Left TMJ pre and post contrast agent.

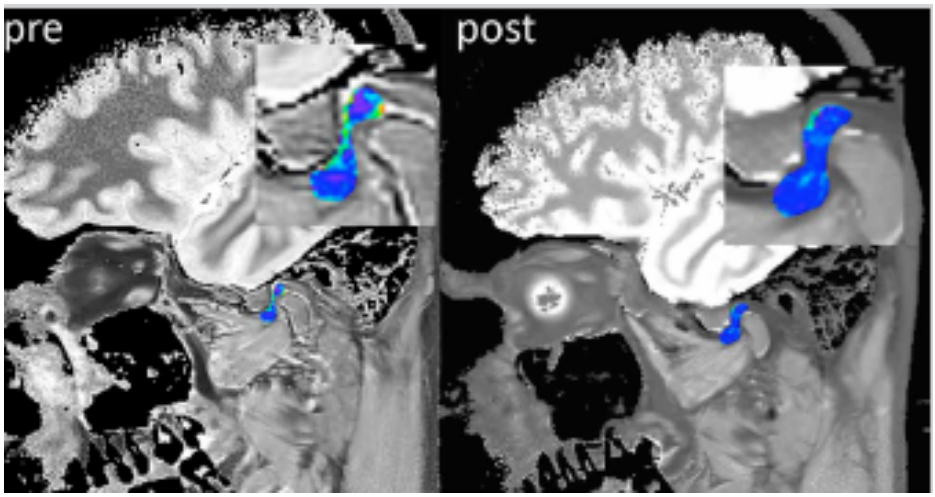

Figure 5: MR 3T Magnetom Tim Trio scanner T1: Right TMJ pre and post contrast agent.

T2 mapping showed a significant signal inhomogeneity in both discs, as well as an increased amount of fluid in both compartments and a flattened disc in the lateral area (Figure **3**).

3. DISCUSSION

These results lead us to the conclusion that the described methodology could be very well suited for early detection of onset pathological change in fibrocartilage.

The application of dGEMRIC with patients suffering from temporomandibular disorders can produce additional information on morphology, and thereby contributes to early detection of damage to the discus articularis. This case study can serve as a point of departure for further research on the structure of the temporomandibular joint through contrast agent MRI.

ACKNOWLEDGEMENTS

The financial support by the Austrian Federal Ministry of Science, Research and Economy and the National Foundation for Research, Technology and Development is gratefully acknowledged.

The financial support by the grant No. APVV-15-0029 of the Slovak Research and Development Agency is gratefully acknowledged.

We would like to thank the volunteers, and we highly appreciate the technical support of Claudia Kronnerwetter.

REFERENCES

[1] Trattnig S, Mamisch TC, Pinker K, Domayer S, Szomolanyi P. *et al*. Differentiating normal hyaline cartilage from post-surgical repair tissue using fast gradient echo imaging in delayed gadolinium-enhanced MRI (dGEMRIC) at 3 Tesla. Eur Radiol 2008; 18(6): 1251-9. https://doi.org/10.1007/s00330-008-0859-3

[2] Pittschieler E, Szomolanyi P, Schmid-Schwap M, Weber M, Egerbacher M, *et al*. Delayed Gadolinium-Enhanced MRI of the Fibrocartilage Disc of the Temporomandibular Joint-a Feasibility Study. Magn Reson Imaging 2014. https://doi.org/10.1016/j.mri.2014.08.008

[3] Dworkin SF. Research Diagnostic criteria for Temporomandibular Disorders: current status & future relevance. J Oral Rehabil 2010; 37(10): 734-43. https://doi.org/10.1111/j.1365-2842.2010.02090.x

[4] Katzberg RW and Tallents RH. Normal and abnormal temporomandibular joint disc and posterior attachment as depicted by magnetic resonance imaging in symptomatic and asymptomatic subjects. J Oral Maxillofac Surg 2005; 63(8): 1155-61. https://doi.org/10.1016/j.joms.2005.04.012

Received on 11-12-2017 Accepted on 20-01-2018 Published on 31-06-2018

DOI: https://doi.org/10.12974/2311-8695.2018.06.4