RESEARCH

Magnetic resonance characteristics of temporomandibular joint disc displacement in elderly patients

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Objectives: The purpose of this study was to evaluate the MR characteristics of temporomandibular joint (TMJ) disc displacement in elderly patients.

Methods: Of the MR images of 1660 TMJs in 847 patients with disc displacement who underwent MRI for suspected temporomandibular disorders, 301 TMJs in 154 patients aged over 50 years were studied as an elderly group. These MR images of the elderly group were compared with those of a control group (1359 TMJs in 693 patients aged under 51 years) concerning disc displacement with or without reduction, joint effusion and osteoarthritis.

Results: The incidence of disc displacement with osteoarthritis was significantly different between the elderly (41.9%) and the control (19.8%) groups ($p = 0.000$). Logistic multivariate regression analysis demonstrated that the osteoarthritis was a significant variable (odds ratio = 2.94, $p = 0.000$).

Conclusions: This study suggests that MR characteristics of TMJ disc displacement in elderly patients includes osteoarthritis.

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Keywords: elderly patients; magnetic resonance; temporomandibular joint

Introduction

Temporomandibular disorders (TMD) represent a major cause of non-dental pain in the orofacial region and are considered to be a subclass of musculoskeletal disorders.¹

Epidemiological research has demonstrated a high prevalence of signs and symptoms of TMD in virtually all examined populations and age groups.² The prevalence of TMD has been extensively examined for various populations, for example in children,³ birth cohorts,⁴ different cultural regions⁵ and environments.⁶ However, the results for older subjects have been inconsistent:^{7–11} some studies have reported that the frequency of symptoms of TMD was similar for various age groups;⁷ others have found that it was lower among older subjects.⁸

MRI is frequently used in the region of the temporomandibular joint (TMJ), particularly to examine

disc position and configuration, posterior disc attachment and mandibular marrow status, and to assess the presence of joint effusion.^{12–17} However, few studies have been concerned with the evaluation of MR characteristics of TMJ disc displacement in elderly patients. The purpose of this study was to evaluate the MR characteristics of TMJ disc displacement in elderly patients.

Materials and methods

Of the MR images of 1660 TMJs in 847 patients (179 males, 668 females; age 6–80 years, mean age 29.9 years) with disc displacement who underwent MRI for suspected TMD in the Nihon University School of Dentistry Hospital, Japan, from January 2001 to December 2004, 301 TMJs in 154 patients aged over 50 years (24 males, 130 females; age 51–80 years, mean age 59.9 years) were studied as an elderly group. As a control group, 1359 TMJs in 693 patients aged under 51 years (155 males, 538 females; age 6–50 years, mean age 23.2 years) were studied. All participants read and signed an informed

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Figure 1 Distribution of temporomandibular joint disc displacement according to age

consent form. Figure 1 shows distribution of TMJ disc displacement according to age.

MRI was performed with a 0.5 Tesla superconductive MR unit (Toshiba Flexart; Tokyo, Japan) with a surface coil for the TMJ. Imaging included proton density-weighted sagittal imaging at the closed mouth position (repetition time (TR)/echo time (TE) 2000 ms/20 ms), the maximum mouth opening position (TR/TE 1500 ms/20 ms) and T_2 weighted sagittal imaging at the closed mouth position (TR/TE 2000 ms/100 ms). T_2 weighted imaging was performed with a double echo in proton density-weighted imaging. Other parameters were as follows: field of view (FOV) 12.0×12.0 cm, matrix size 192×256 , and 1 acquisition. The MRI of the elderly group were compared with those of the control group concerning disc displacement with or without reduction, joint effusion and osteoarthritis. A grading system proposed by Larheim *et al*¹⁶ was used for categorizing the amount of fluid on T_2 weighted images. All images were independently evaluated by two oral radiologists and any differences were resolved by forced consensus.

Statistical analyses for the comparison of MRI finding of TMD, such as disc displacement with or

without reduction, joint effusion and osteoarthritis, between the elderly group and the control group were performed using the χ^2 test with Fisher's exact test. The odds ratios for the elderly group *vs* the control group were analysed using logistic multivariate regression analysis in relation to MRI findings, such as disc displacement with or without reduction, joint effusion and osteoarthritis. These analyses were performed with the statistical package SPSS version 14.0 (SPSS Japan Inc., Tokyo, Japan). $p < 0.05$ was considered to indicate statistical significance.

Results

Table 1 shows MR characteristics of TMJ disc displacement in elderly patients. The incidence of disc displacement without reduction was significantly different between the elderly group (44.9%) and the control group (35.5%) ($p = 0.003$). The incidence of disc displacement with joint effusion was not significantly different between the elderly group (37.9%) and the control group (39.7%) ($p = 0.602$). The incidence of disc displacement with osteoarthritis was significantly different between the elderly group (41.9%) and the control group (19.8%) ($p = 0.000$). Table 2 shows logistic multivariate regression analysis of MR characteristics of TMJ disc displacement in elderly patients. The analysis demonstrated that the osteoarthritis was a significant variable (odds ratio = 2.94, $p = 0.000$). Figure 2 shows MRI of TMJ disc displacement in an elderly patient.

Discussion

MRI is the modality of choice for the assessment of internal derangement of the TMJ in patients with TMD.¹³ TMJ internal derangement describes an abnormal positional relationship between the articular disc, the mandibular condyle and the articular eminence. The disorder has been associated with characteristic clinical findings such as pain, joint sounds and irregular or deviating jaw function.¹⁸⁻²⁰ Harms *et al*¹² showed that disc displacement and arthrosis were the most common findings on MRI of the TMJ in patients with signs and symptoms of a TMD. Westesson and Brooks¹⁴ indicated that TMJ effusions primarily occurred in joints with disc displacement. In this study, MR images of the elderly group with TMD were

Table 1 MR characteristics of temporomandibular joint disc displacement in elderly patients

	Reduction ^a		Joint effusion ^b		Osteoarthritis ^c		Total (%)
	With (%)	Without (%)	With (%)	Without (%)	With (%)	Without (%)	
Elderly	166(55.1)	135(44.9)	114(37.9)	187(62.1)	126(41.9)	175(58.1)	301(100)
Control	877(64.5)	482(35.5)	539(39.7)	820(60.3)	269(19.8)	1090(80.2)	1359(100)
Total	1043(62.8)	617(37.2)	653(39.3)	1007(60.7)	395(23.8)	1265(76.2)	1660(100)

^a $p = 0.003$.

^b $p = 0.602$.

^c $p = 0.000$.

Table 2 Logistic multivariate regression analysis of MR characteristics of temporomandibular joint disc displacement in elderly patients

MR findings	Odds ratio	95% CI	p-value
Reduction	0.97	0.72–1.32	0.862
Joint effusion	1.21	0.92–1.59	0.182
Osteoarthritis	2.94	2.19–3.96	0.000

CI, confidence interval.

compared with those of the control group concerning disc displacement with or without reduction, joint effusion and osteoarthritis.

The prevalence of TMD for older subjects has been inconsistent.^{7–11} Osterberg *et al*⁸ showed that symptoms of craniomandibular dysfunction were reported less frequently with increasing age and the results indicated that there was no increased risk of craniomandibular dysfunction with aging. Ow *et al*⁹ reported that the most common single symptom of craniomandibular disorder among elderly people was occasional to frequent clicking sounds from the TMJs. TMJ clicking, one of the most frequent findings, has been discussed as a potentially severe symptom that may develop into TMJ locking, disc displacement or osteoarthritis.⁴ Schmitter *et al*¹⁰ indicated that older subjects more frequently exhibited objective signs (joint sounds) of TMD and they rarely suffered from pain. This study showed that the incidence of TMJ disc displacement in elderly patients (154 patients) is less than in the control group (693 patients).

Westesson²¹ showed that osseous changes involving the condyle and temporal bone often occurred as a sequel to disc displacement and structural hard-tissue changes frequently occurred in TMJs displaying anterior disc displacement without reduction but seldom in joints showing displacement with reduction. In this study, the incidence of disc displacement without

reduction was significantly different between the elderly group (44.9%) and the control group (35.5%) ($p = 0.003$). The incidence of disc displacement with osteoarthritis in the present study was significantly different between the elderly group (41.9%) and the control group (19.8%) ($p = 0.000$). We therefore consider that disc displacement without reduction is related to osteoarthritis.

TMJ effusion, which typically appears as a bright signal on T_2 weighted MRI, has been recognized as a possible sign related to pain in patients with TMJ disorders. Westesson and Brooks¹⁴ indicated that joint effusions were seen more often in joints with more advanced stages of disc displacement (displacement without reduction) than in normal joints or in joints with earlier stages of disc displacement (displacement with reduction). Joint effusion probably represents an inflammatory response to the dysfunction of the displaced disc. Furthermore, Westesson and Brooks¹⁴ also showed that the prevalence of joint effusion was lower in joints with arthrosis than in those with disc displacement. These results suggested that most effusions were seen before arthrosis developed. In the present study, the incidence of disc displacement with joint effusion was not significantly different between the elderly group (37.9%) and the control group (39.7%).

Osteoarthritis has been considered an age-related degenerative change of the articular cartilage and the subchondral bone in synovial joints, including the TMJs. Widmalm *et al*²² showed that TMJ arthrosis was more frequent in older than in younger people. Ishibashi *et al*²³ indicated that the articular surface of the mandibular condyle morphologically showed severe degenerative changes with advancing age. However, Wiberg and Wanman²⁴ indicated that osteoarthritis of the TMJs was found in 66% of 131 patients ranging in age from 12 years to 30 years and a high prevalence of

Figure 2 MRI of the left temporomandibular joint in a 58-year-old female with temporomandibular disorders. (a) Proton density image. The disc is dislocated anteriorly in the closed-mouth position. (b) Proton density image, open-mouth position. The condyle with osseous changes pushes the disc anteriorly but does not recapture. (c) T_2 weighted image, closed-mouth position, shows joint effusion in the superior joint space

TMJ osteoarthritis in young patients was found. In this study, logistic multivariate regression analysis between the elderly and the control group demonstrated that disc displacement with osteoarthritis was a significant variable (odds ratio = 2.94, $p = 0.000$). These results suggest that MR characteristics of TMJ disc displacement in elderly patients include osteoarthritis. We therefore consider that osteoarthritis is a

degenerative condition associated with advancing age. Furthermore, the follow-up in the younger patients is important for future studies.

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References

1. Kuttilla M, Kuttilla S, Le Bell Y, Alanen P. Association between TMD treatment need, sick leaves, and use of health care services for adults. *J Orofac Pain* 1997; **11**: 242–248.
2. Carlsson GE. Epidemiology and treatment need for temporomandibular disorders. *J Orofac Pain* 1999; **13**: 232–237.
3. Farsi NM. Symptoms and signs of temporomandibular disorders and oral parafunctions among Saudi children. *J Oral Rehabil* 2003; **30**: 1200–1208.
4. Rauhala K, Oikarinen KS, Jarvelin MR, Raustia AM. Facial pain and temporomandibular disorders: an epidemiologic study of the Northern Finland 1966 birth cohort. *Cranio* 2000; **18**: 40–46.
5. List T, Dworkin SF. Comparing TMD diagnosis and clinical findings at Swedish and US TMD centers using research diagnostic criteria for temporomandibular disorders. *J Orofac Pain* 1996; **10**: 240–253.
6. Gaddard G, Karibe H. TMD prevalence in rural and urban Native American populations. *Cranio* 2002; **20**: 125–128.
7. Norheim PW, Dahl BL. Some self-reported symptoms of temporomandibular joint dysfunction in a population in northern Norway. *J Oral Rehabil* 1978; **5**: 63–68.
8. Osterberg T, Carlsson GE, Wedel A, Johansson U. A cross-sectional and longitudinal study of craniomandibular dysfunction in an elderly population. *J Craniomandib Disord* 1992; **6**: 237–245.
9. Ow RKK, Loh T, Neo J, Khoo J. Symptoms of craniomandibular disorder among elderly people. *J Oral Rehabil* 1995; **22**: 413–419.
10. Schmitter M, Rammelsberg P, Hassel A. The prevalence of signs and symptoms of temporomandibular disorders in very old subjects. *J Oral Rehabil* 2005; **32**: 467–473.
11. Johansson A, Unell L, Carlsson GE, Soderfeldt B, Halling A. Risk factors associated with symptoms of temporomandibular disorders in a population of 50- and 60-year-old subjects. *J Oral Rehabil* 2006; **33**: 473–481.
12. Harms SE, Wilk RM, Wolford LM, Chiles DG, Milam SB. The temporomandibular joint: magnetic resonance imaging using surface coils. *Radiology* 1985; **157**: 133–136.
13. Drace JE, Enzmann DR. Defining the normal temporomandibular joint: closed-, partially open-, and open-mouth MR imaging of asymptomatic subjects. *Radiology* 1990; **177**: 67–71.
14. Westesson PL, Brooks SL. Temporomandibular joint: relationship between MR evidence of effusion and the presence of pain and disk displacement. *AJR Am J Roentgenol* 1992; **159**: 559–563.
15. Sano T, Westesson PL. Magnetic resonance imaging of the temporomandibular joint: increased T_2 signal in the retrodiskal tissue of painful joints. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1995; **79**: 511–516.
16. Larheim TA, Westesson PL, Sano T. MR grading of temporomandibular joint fluid: association with disk displacement categories, condyle marrow abnormalities and pain. *Int J Oral Maxillofac Surg* 2001; **30**: 104–112.
17. Mori S, Kaneda T, Lee K, Kato M, Motohashi J, Ogura I. T_2 -weighted MRI for the assessment of joint effusion: comparative study of conventional spin-echo and fast spin-echo sequences. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2004; **97**: 768–774.
18. Marguelles-Bonnet RE, Carpentier P, Yung JP, Defrennes D, Pharaboz C. Clinical diagnosis compared with findings of magnetic resonance imaging in 242 patients with internal derangement of the TMJ. *J Orofac Pain* 1995; **9**: 244–253.
19. Emshoff R, Innerhofer K, Rudisch A, Bertram S. Relationship between temporomandibular joint pain and magnetic resonance imaging findings of internal derangement. *Int J Oral Maxillofac Surg* 2001; **30**: 118–122.
20. Emshoff R, Innerhofer K, Rudisch A, Bertram S. Clinical versus magnetic resonance imaging findings with internal derangement of the temporomandibular joint: an evaluation of anterior disc displacement without reduction. *J Oral Maxillofac Surg* 2002; **60**: 36–41.
21. Westesson PL. Structural hard-tissue changes in temporomandibular joints with internal derangement. *Oral Surg Oral Med Oral Pathol* 1985; **59**: 220–224.
22. Widmalm SE, Westesson PL, Kim IK, Pereira FJ Jr, Lundh H, Tasaki MM. Temporomandibular joint pathosis related to sex, age, and dentition in autopsy material. *Oral Surg Oral Med Oral Pathol* 1994; **78**: 416–425.
23. Ishibashi H, Takenoshita Y, Ishibashi K, Oka M. Age-related changes in the human mandibular condyle: a morphologic, radiologic, and histologic study. *J Oral Maxillofac Surg* 1995; **53**: 1016–1023.
24. Wiberg B, Wanman A. Signs of osteoarthritis of the temporomandibular joints in young patients: a clinical and radiographic study. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1998; **86**: 158–164.