Association of tightly locked occlusion with temporomandibular disorders

M.-Q. WANG, H.-T. CAO, F.-R. LIU, C. CHEN & G. LI Department of Oral Anatomy and Physiology, Stomatological College, Fourth Military Medical University, Xi’an City, Shaanxi Province, China

SUMMARY The association between teeth loss and temporomandibular disorders (TMD) is still inconclusive. A kind of secondary changes of the occlusion after teeth lose called the tightly locked occlusion (TLO), defined as the occluding contact that delivers angled occlusal force on the drifted neighbour and/or the tipped antagonists of the lost posterior teeth, was hypothesized to be association with TMD. The study aimed at investigating the association between the TLO and TMD. A total of 113 posterior-teeth losing patients, 64 with TMD symptoms (group of TMD) and 49 without (group of TMD-Free) were included. Study casts and joint radiographs were made to diagnose the TLO and joint morphological changes. The simultaneous contribution of the potential variables of gender, age, tooth losing number, the TLO, joint symmetry and signs of osteoarthrosis shown on radiographs were tested through binary logistic regression analysis. In women, the TLO entered into logistic model, and had an effect on the incidence of TMD ($P = 0.008$). The odds ratio of with-TLO versus without-TLO is 2.6 (95% CI: 1.2, 5.8) after controlling for the effect of gender. Age, tooth lose number, joint asymmetry or osseous changes had no effect on the incidence of TMD. The tightly locked occlusion is associated with some signs and symptoms of TMD. Randomized controlled trials will be needed in further studies to test the hypothesis that treatment of a TLO, as defined in the present study, will have a beneficial effect on the signs and symptoms of TMD.

KEYWORDS: occlusion, TMD, TMJ, clinical study

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Introduction

The relationship between the occlusion and the temporomandibular disorders (TMD) has been of high interest to TMD researchers. Some authors believed that losing molar support might be associated with the presence and severity of osteoarthrosis (1–3) and the risk of the occurrence of crepitation increased significantly in the patients who had lost more teeth (4). However, free-end removable partial dentures in the lower jaw in shortened dental arches did not prevent TMD and did not improve oral function in terms of oral comfort (5). Moreover, Widmalm et al. (6) found from their autopsy materials that there were no obvious differences in the morphological changes in the joints between people with 10 or more natural teeth in each jaw and people without nature teeth. Tooth loss, reported by Zabarovic et al. (7), could even lead to a greater symmetry and fewer differences between the left and right articular eminence. It is interesting to notice that Whittaker et al. (8), based on Romano-British skull analysis, first reported in 1985 that the changes in form or shape of the condyles were correlated with the number of teeth loss, but then in 1990 they modified their conclusion after analysing the skulls preserved in Christ Church (Spitalfields, London), saying that the tooth loss was not the main factor involved in the remodelling of the condyle, when they found that while the skulls in Christ Church had more lost teeth than Romano-British skulls, the joints had fewer morphological changes (9).

Luder (10) believed that the loss of molar support had a significant effect on TMD, although in his reported results condylar degenerative changes were
not associated with tooth loss. Tallents et al. (11) found a positive correlation between the loss of mandibular posterior teeth and the presence of disk displacement, so that they believed that the loss of mandibular posterior teeth might accelerate joint degenerative changes. Winstanley (12) concluded from his clinical study of 20 patients that the loss of the first molar could be an etiological factor to TMD. Kuwahara and Maruyama (13, 14) also pointed a significant relationship between condylar atrophy and loss of the lower first molars in growth period of the components of temporomandibular joint and left them without any prosthetic restorations from mixed dentition through puberty.

It seemed that not simply the number but the position of the lost teeth, as well as the period of tooth losing without restoration, attributed more to the cause of TMD. It is known that losing a few of non-free-end teeth without restoration for a couple of time, especially at early age, often cause the neighbour tooth/teeth shift in angle and cause their original occluding tooth/teeth supra-erupt from the original vertical or upright position. Kaplan (15) had used the word of drift and tipping to describe the condition. Drift is the medial or distal movement of a tooth through a stable alveolar ridge. Tipping is the movement from a line perpendicular to the alveolar segment that supports the tooth. The result of drift and tipping is to exhibit an angled occlusal force at the occlusal contact area, usually the mesial- or distal-occlusal part of the tooth. This kind of secondary changes of occlusion contact, called tightly locked occlusion (TLO), has been proved by Miheam and Nemetz (16) to be progressional for the reason that once the teeth began to tilt or drift, the vector of force tended to increase the tilting, thus imposing a different biomechanical effect on mandible (17). Therefore, it is reasonable to hypothesis that it was this secondary change, known as tightly locked occlusion, might have more pathological effects on TMJ or on joint functions. The present study was designed to test this hypothesis clinically (Fig. 1).

Materials and methods

Subjects

The subjects included in this study were (i) a consecutive sample of 25 patients (6 men and 19 women) who had lost their posterior tooth/teeth over half a year without any restoring, and consulted in the TMD clinic in Qindu Oral Hospital of FMMU, diagnosed as TMD by the criteria reported in the National Institutes of Health Technology Assessment Conference Statement in 1996 (18), (ii) a consecutive sample of 88 volunteers of posterior-tooth/teeth loss patients (42 men and 46 women) who came to Qindu Oral Hospital for the restoration of their lost tooth/teeth. Thirty-nine (14 men and 25 women) of 88 tooth/teeth loss volunteers had single and soft TMJ click and four of whom had once got slight oral facial pain but recovered soon without any treatment. They together with the 25 TMD patients mentioned above, totally 64, made up the Group of TMD. The other 49 tooth loss volunteers (26 men and 23 women) who showed no symptoms or signs of TMD (18) made up the Group of TMD-Free. All the subjects gave informed consent to the procedures approved by the Human Subjects Ethics Committees of Fourth Military Medical University.

Clinical examinations

Number of pair(s) of lost posterior teeth

Diagnostic casts*† were made for each subject and the number of lost posterior teeth was recorded in pairs. The loss of one pair of posterior teeth (one in maxilla and the other of its occluding tooth in mandible) or the loss of one posterior tooth in the maxilla or mandible was recorded as one, implying that one pair of teeth had lost their occluding function. When neither jaw had the third

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*Examixfine; GC Dental Industrial Corporation, Tokyo, Japan
†Die-Dtone; Heraeus Kulzer Dental Itd, Shanghai, China
molar, it would not be recorded as the loss of the third molar. But if there was a third molar in any quarter of the jaws, the loss of the third molar pair(s) would be recorded by the same method described above. Then the number of the pair(s) of posterior teeth loss ranged from 1 to 10.

**Tightly locked occlusion (TLO)** Any occlusal contacts between the drifted or tilted neighbouring tooth/teeth and the supra erupted or tipped original antagonist of the lost posterior tooth/teeth were taken as TLO. It is a condition of collapse of neighbour tooth/teeth and supra-eruption of antagonist(s) results from no restoring of the lost posterior teeth and is judged to deliver angled bite force vector, usually at the distal- or mesial-occlusal part of the tooth, when bite at intercuspal position (ICP). In the present study, a discussion between two of the authors (Wang and Cao) was taken for making a conclusive diagnosis of the TLO for each subject.

**Radiographic analysis** Lateral oblique transcranial projection and lateral tomogram of bilateral TMJs were conducted in all the subjects. The radiographs were analysed, diagnosed and graded by two of the authors (Cao and Liu) for an agreement of no, mild or severe degrees of the TMJ asymmetry or of the osseous changes. Osteophyte was included in the severe category of osseous changes. The condyle position was not taken into consideration for it had been proved that the joint space dimensions or anterior/posterior position of the condyle in the glenoid fossa could not be accurately or reliably recorded by either of the radiographs adopted in our present work (19, 20). But those radiographs were good for the diagnosis of the joint form symmetry and osseous changes.

**Statistical analysis**

The simultaneous contribution of six potential variables, gender, age, tooth losing number, TLO, joint symmetry and signs of osseous changes shown on radiographs, in the group of TMD and group of TMD-free was tested through binary logistic regression analysis using software of SPSS 11.0. Quantifying of the six variables as: gender_1 for male, 2 for female; age_1 for 0–29, 2 for 30–49, 3 for above 49 years old; tooth losing number_1 for 0–3, 2 for 4–6, 3 for 7–9, 4 for above 9; TLO_0 for no, 1 for yes; joint asymmetry_0 for symmetry, 1 for mild asymmetry, 2 for severe asymmetry; joint ostearthitis_0 for no, 1 for mild, 2 for severe of sign of osseous changes. The variables selection method is forward stepwise (Wald) and the entry level $\alpha$ is 0.05.

**Results**

The results of clinical and radiographic examination are shown in Table 1 and in Table 2. TLO and gender entered into logistic model, and had an effect on the incidence of TMD respectively ($P = 0.017$ and $P = 0.022$). The other variables had no effect on the incidence of TMD. The odds ratio of with TLO versus without TLO is 2.6, 95% confidence interval for OR is (1.2, 5.8). The OR of female versus male is 2.5, 95% confidence interval for OR is (1.1, 5.6).

When the different genders were analysed separately, for female, as shown in Table 2, TLO entered into the logistic model and had an effect on the incidence of TMD ($P = 0.008$). The OR of with TLO versus without TLO is 4.5, 95% confidence interval for OR is (1.5, 12.7). The other variables had no effect on the incidence of TMD. For male no variables entered into the logistic model.

**Discussion**

The present results imply that the joint asymmetry or osseous changes on radiograph do not attribute to the

| Table 1. Results of clinical and radiological examination for the TMD Group and TMD-free Group |
|-----------------------------------------------|------------------|------------------|
|                                           | TMD group        | TMD-free group   |
| Male:female                               | 20:44            | 26:23            |
| Age                                        | 47.89 ± 14.12    | 50.68 ± 11.51    |
| Tooth-lost number                         | 3.94 ± 2.81      | 4.12 ± 2.32      |
| TLO                                        | + 37             | 17               |
|                                           | – 27             | 32               |
| Asymmetry degree of TMJ                   | ++ 7             | 2                |
|                                           | + 27             | 11               |
|                                           | – 30             | 36               |
| Osseous changes                           | ++ 7             | 1                |
|                                           | + 3              | 2                |
|                                           | – 54             | 46               |
TMD diagnosed by the clinic symptoms and signs. On the aspect of occlusion, malocclusion, attrition (2), extraction of all one side of teeth (21), shortening, weaning (22), or extracting (23) of incisors had been proved to be less associated with TMD. In other words, these kinds of occlusion changes are well adaptive by the masticatory system. However, the tightly locked occlusion (TLO), in present report, is proved to be difficult to adapt for female in maintenance of normal masticatory function. The incidence to get TMD for female with the TLO is 4.5 times high to those without TLO. This association was not found in male. That coincides well with the fact in clinic that TMD occurring more in female. It seemed that male has good adaptability to the abnormal occlusion like TLO. Then the results suggest that the tightly locked occlusion is associated with TMD, at least for the female. Randomized controlled trials will be needed in further studies to test the hypothesis that treatment of a tightly locked occlusion as defined in the present study will have a beneficial effect on signs and symptoms of TMD.

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References


Correspondence: Dr Mei-Quing Wang, Department of Oral Anatomy and Physiology, Stomatological College, Fourth Military Medical University, Xi’an City, Shaanxi Province, China. E-mail: mqwang@fmmu.edu.cn