

Implant Therapy and Temporomandibular Disorder

Young-Kyun Kim¹, Pil-Young Yun²

1 Associate Professor, Department of Oral and Maxillofacial Surgery, Section of Dentistry, Seoul National University Bundang Hospital, Korea

2 Assistant Professor, Department of Oral and Maxillofacial Surgery, Section of Dentistry, Seoul National University Bundang Hospital, Korea

Corresponding Author

Pil-Young Yun, D.D.S., M.S.D., Ph.D.

Department of Oral and Maxillofacial Surgery, Section of Dentistry, Seoul National University Bundang Hospital 300, Gumi-dong, Bundang-gu, Seongnam-si, Gyeonggi-do, 463-707, Korea
Tel: 82-31-787-2780, 7545, FAX: 82-31-787-4068, E-mail: pilyoung@snubh.org

• Abstract

Though implant treatment is considered as a common treatment option for edentulous patients, there have been few studies on the temporomandibular disorder (TMD) related with implant treatment. The purposes of this study were to evaluate the relevance of TMD to the implant patients and to evaluate the risk factors of TMD in relation with implant treatment.

For the evaluation of various risk factors of TMD in relation with implant therapy, clinical evaluation focused on patient factors and implant factors.

From a group of 694 patients, 25 patients (3.6 %) were included in this study. The majority of the patients were included in the asymptomatic 'adaptive' group. Parafunction was detected in 11 patients, 8 patients were male. Four patients having parafunction showed complications such as implant failure or fracture of the suprastructure.

From the results, it is possible that TMJ related symptoms are developed or aggravated after implant therapy, which requires relatively more chair time; so TMJ examination should be included in the pre-operative evaluation for dental implant patients. Also, it is important to treat patients after they sign an informed consent that includes a detailed explanation on the possibility of TMD during treatment.

• Keywords : implant, temporomandibular disorder,

• J Kor Dent Sci. 2009; 2(1) : 4 - 10

Introduction

Some patients complained of temporomandibular disorder (TMD) related symptoms after dental treatment. In those cases, if there was inadequate preoperative explanation about and evaluation for temporomandibular joint (TMJ), the patients may consider that their TMD related symptoms were caused by dental treatment. The patients may insist that the direct cause of their TMJ problem is dental treatment because the onset of their symptoms occurred immediately following dental treatment, which often leads to a greater incidence of legal problems. Delcanho¹⁾ recommended TMJ evaluation for screening on every patient prior to dental treatment because the majority of patients had one or more TMD related symptoms. Actually, TMD related symptoms are usually detected in the normal population. In the 1980s, Pullinger et al²⁾ reported that only 42% of men and 36% of women were free of subjective symptoms from a sample population (composed of 437 young adults) and 12% of men and 15% of women had eccentric TMJ position on tomogram in a clinically asymptomatic group (n=54). Limitation of jaw movement and joint noise were found in 40-75%, TMJ pain was detected in 28-33% of the American normal volunteers not having any clinical symptoms in the TMD epidemiologic study of the early 1990s. Also, they reported that 5% of the normal patients experienced bouts of TMJ pain during the previous 6 months³⁾. Dental implant treatment is grossly divided into surgical and prosthetic procedures. Each procedure has multiple steps so more time is necessary compared with conventional prosthodontic treatment. This means that patients are required to keep their mouths open for extended periods during treatment. Therefore, especially in the patients with potential or subclinical TMD related symptoms, symptoms may be developed or aggravated. Patients having parafunctional habits (i.e. bruxism, clenching) can be potential candidates for TMD. Also, these habits can be considered as risk factors in implant failure. Though implant treatment is considered a common treatment option for edentulous patients, there have been few studies on TMD related with implant treatment. The purposes of this study were to evaluate the relevance of TMD to implant patients and to evaluate the risk factors of TMD in relation with implant treatment.

Materials and Methods

From the patients who had undergone implant treatment at Seoul National University Bundang Hospital from June 2003 to December 2007, those having TMD related symptoms were included in this study. For the evaluation of various risk factors of TMD, clinical evaluation focused on patient factors and implant factors. Initial TMJ status, clinical diagnosis of TMJ, radiographic abnormality, oral parafunction, and previous TMD treatment history were included as patient factors. Duration of implant treatment, the number of implants, and type of prosthesis were included as implant factors. TMJ screening was performed on all implant patients to determine their initial TMJ status. Initial TMJ status of new patients was classified into four groups on the basis of criteria described by Delcanho¹⁾; I: healthy, II: asymptomatic adaptive, III: temporomandibular dysfunction, IV: temporomandibular disorder (Table 1). Clinical diagnosis was made on the basis of clinical symptoms and radiographic findings. Basically, research diagnostic criteria (RDC) were used as reference. The criteria were suggested by the Japanese Association for TMJ (Table 2). Oral parafunctions (i.e., clenching, bruxism, etc.) were admitted in cases where a definite description was provided by patients (or family members) on the parafunction or in cases of objective evidence (i.e., attrition, cervical abfraction, etc.).

Table 1. Classification of TMJ status (Delcanho, 1994)

Groups	Definition
I. Healthy	No abnormal findings
II. Asymptomatic 'adaptive'	The group of patients having subclinical symptoms which are not recognized and well adapted. The patients can be regarded as 'unknown' risk group.
III. Temporomandibular dysfunction	The patients are aware of symptoms indicative of a TMD yet the problem severe enough to warrant them seeking care for those symptoms
IV. Temporomandibular disorder	The patients present with the complaint of TMD symptoms and so are actively seeking treatment of a TMD

Young-Kyun Kim et al : Implant therapy and temporomandibular disorder. J Kor Dent Sci 2009.

Table 2. Diagnostic classification (Japanese Association for TMJ)

Classification	Major target area	Pathology
I	Masticatory muscle	Myospasm, myositis
II	Articular capsule, ligament, disc	Extension, contusion of articular capsule, ligament, meniscus
III	Articular disc, synovial membrane	Disc displacement, deformity, perforation, fibrosis
IV	Articular cartilage, disc, synovial membrane, mandibular condyle, glenoid fossa	Cartilage destruction, bone remodeling and/or degeneration
V	Psychological problem, others	

Young-Kyun Kim et al : Implant therapy and temporomandibular disorder. J Kor Dent Sci 2009.

Results

From the 694 patients, 25 patients (3.6 %) were included in this study. The patients' age ranged between 19 and 70 (mean: 48). From the 25 patients, 13 were male and 12 were female. In this study, in the aspect of pre-operative TMJ status, there was no difference in the ratio of men:women in the healthy and TM dysfunction groups. However, the male:female ratio was 8:3 in the asymptomatic 'adaptive' group. Five of six patients in the TMD group were women.

1) Initial status of TMJ

The majority of the patients were included in the asymptomatic 'adaptive' group (11 patients) (Table 3).

Table 3. Classification of TMJ status (Delcanho, 1994)

Group	Number
I. healthy	6 (M: 3, F: 3)
II. asymptomatic 'adaptive'	11(M: 8, F: 3)
III. TM dysfunction	2(M: 1, F: 1)
IV. TMD	6(M: 1, F: 5)
Total	25(M: 13, F: 12)

Young-Kyun Kim et al : Implant therapy and temporomandibular disorder. J Kor Dent Sci 2009.

2) Clinical diagnosis

Eight patients were included in the mixed type (included in more than 2 types). Seven patients were in the normal group

Table 4. Clinical Diagnosis of TMD (Japanese Association for TMJ)

Types	Number
1	2
II	4
III	4
Normal	7
Combined	8
II + III	1
II + III + IV	1
III + IV	2
I + III + V	1
I + V	1
II + V	1
III + IV + V	1

Young-Kyun Kim et al : Implant therapy and temporomandibular disorder. J Kor Dent Sci 2009.

category (Table 4).

3) Clinical symptoms and signs

Major symptoms were joint pain (60.0%) and noise (36.0%). Miscellaneous symptoms such as teeth attrition (28.0%), headache (16.0%), and occlusal problem (12.0%) were also detected in the patients. Multiple symptoms were present in one patient (Table 5).

Table 5. Clinical symptoms and signs

Types	Number
Joint pain	15
Noise	9
Teeth attrition/fracture	7
Headache	4
Occlusal problem	3
Muscle tenderness	2
Limitation of jaw movement	2
TMJ locking	2
Facial change	2
Mouth opening deviation	2
TMJ subluxation	1
Cervical abfraction	1
Facial parasthesia	1

Young-Kyun Kim et al : Implant therapy and temporomandibular disorder. J Kor Dent Sci 2009.

4) Radiographic findings

In 5 cases, bony changes (i.e., flattening, hyperplasia, hypoplasia, deformity) were detected in the radiographs.

TMD treatment was provided before implant treatment to 3 of them. In the asymptomatic group, 2 patients complained of TMD symptoms during implant treatment.

5) Oral parafunction

Parafunction was detected in 11 patients, 8 of whom were male. Initial TMJ status included the asymptomatic 'adaptive' group with 9 patients and the TMD group with 2 patients. Clinical diagnosis was classified as normal in 7 patients, TMD in 4 patients (previous TMD in 1 patient, post-treatment TMD in 3 patients) (Table 6). Splint therapy had been performed on 3 patients before implant treatment and on all patients after implant treatment. In the evaluation of the effect of parafunction on implant treatment, four patients showed implant related complications. Examinations detected osseointegration failure in 3 patients, repeated falling off of the suprastructure in 1 patient, and damage to the prosthesis in 2 patients.

Table 6. TMJ status and clinical diagnosis of the patients with parafunction

	Number
Initial TMJ status	
II. asymptomatic 'adaptive'	9
IV. TMD	2
Clinical Diagnosis	
II, V	1
I, V	1
II, III	1
II	1
Normal	7

Young-Kyun Kim et al : Implant therapy and temporomandibular disorder. J Kor Dent Sci 2009.

6) Type of TMD treatment before implant surgery

In 9 patients, TMD related treatment was performed before implant surgery. Pre-operative TMJ status of the patients were one asymptomatic 'adaptive', 2 TM dysfunction, and 6 TMD patients. Instruction, medication, and physical therapy were provided to the 4 patients and a splint was applied to 5 patients. Among the 4 patients who received instruction, medication and physical therapy, 3 patients experienced no specific symptoms related with TMJ during the treatment. However, splint therapy was recommended in a patient because the symptom persisted during implant therapy. Among the patients who had undergone splint

therapy, parafunction was detected in three of them. Pre-operatively Splint therapy had been applied to one of the five patients for the prevention of bruxism. splint therapy was continued after implant treatment. There were no TMD symptoms. In a patient who showed TMD related symptoms in the pre-treatment period, the symptoms were completely alleviated by splint therapy. However, in three patients, the symptoms persisted. So, splint therapy, hyaluronic acid, and botulinum toxin injection therapy were followed in a step-by-step manner (Table 7).

Table 7. Type of TMD treatment before implant surgery

Types	Number
Counseling, medication, physical therapy	4
Counseling, medication, splint	5
Total	9

Young-Kyun Kim et al : Implant therapy and temporomandibular disorder. J Kor Dent Sci 2009.

7) TMJ treatment during or after implant treatment

TMD treatment was performed on 14 patients. TMD related symptoms occurred during the implant treatment in 11 patients (male : female = 4 : 7). In 3 patients, pre-operative TMD persisted and combined approaches with medication, hyaluronic acid injection, botulinum toxin injection, and splint were performed. In 11 patients, TMD occurred 0.5 ~ 37 months after implant surgery. Counseling, medication, and splint therapy were applied to those patients. All TMD related symptoms were relieved in 10 patients after 1-12 months of treatment. The case of a 50-year-old female patient included in the asymptomatic group preoperatively did not respond to the treatment during 20 months and resulted in a medical dispute. Among those cases where TMD related symptoms developed after implant treatment, Group I initial TMJ status included 6 patients, Group II (asymptomatic 'adaptive' group) had 4 patients, and the

Table 8. TMD occurrence in the course of implant therapy

Types	Number
Persistent TMD (Pre-existing TMD)	3 (all female)
Newly developed TMD (0.5-37 months)	11 (M: 4, F: 7)
I	6
II	4
IV	1

Young-Kyun Kim et al : Implant therapy and temporomandibular disorder. J Kor Dent Sci 2009.

TMD group had 1 patient. (Table 8).

8) The duration of implant treatment

The time from implant placement to completion of prosthesis ranged from 4 to 30 months (mean: 11.4 months). The duration of implant treatment of the 14 TMD-related patients who had TMD ranged from 6 to 30 months (mean: 12 months). The duration of implant treatment of the 11 TMD-free patients ranged from 4 to 28 months (mean: 11 months).

9) Medical dispute (Legal problem)

An asymptomatic 'adaptive' female patient complained of persistent pain, MOL, intermittent locking during the implant treatment. There was no response to splint therapy. A medicolegal problem ensued.

10) The relation between TMD and type prosthetic component / implant site

A single implant prosthesis was used in 8 patients and a fixed partial prosthesis in 17 patients. Considering the number of implants, more than 4 implants were placed in 9 patients. Among them, previous TMD symptoms were detected and treated in 1 patient and TMD developed after implant surgery in 3 patients. 3 or less implants were placed in 16 patients. Among them, pre-operative TMD treatment was performed on 5 patients, and TMD occurred after implant treatment in 8 patients. In this study, there was no significant difference in the TMD incidence rate between single implant cases and multiple implant cases (more than three implants). It was suspected that the number of implants was not associated with TMD.

Discussion

It is possible that overloading on the masticatory muscle and TMJ was induced by prolonged chair time and mouth opening and that temporary medial pterygoid muscle spasm or myositis resulted from the block anesthesia of IAN. Also, a prosthesis that is inadequate for masticatory function may be considered as one of the TMD causes. In those cases, patients may complain of various TMD related symptoms

such as mouth opening limitation or pain. In the worst case scenario, failure to adequately inform the patient of the potential risks and consequences of the procedure may result in legal action by the patient⁴⁾.

Lundeen⁵⁾ reported that the prevalence of clinically significant physical TMD symptoms ranged from 17 to 35% among denture wearers. Because denture wearers usually have subclinical symptoms, there is a high possibility of TMD incidence during dental treatment including implant therapy.

Dworkin⁶⁾ reported that about 50% of the normal population showed joint noise, deviation in mandibular movement, and that intervention was needed in 3.6~7% of cases. Alexander⁷⁾ reported that 9-13% of healthy patients having asymptomatic TMJ showed disc displacement on MRI. Pereira⁸⁾ et al reported that 91% of TMJ showed disc deformation, disc displacement, and TMJ degenerative change in cadaver study.

Johansson et al⁹⁾ evaluated the risk factors of TMD in elderly patients. Some TMD pain was reported by 12.1% of the sample. The prevalence of mouth opening difficulty was 11.1%, and those with a combination of TMD pain and/or difficult mouth opening comprised 19.2% of the sample. Women, and those who reported impaired general health, dissatisfaction with dental care and with their teeth, dental fear, bruxism, intraoral problems, and those with removable dentures had significantly higher risk for both pain and dysfunction symptoms.

There have been many reports on TMD with dental treatment. Huang and Rue¹⁰⁾ reported that there were 391 patients complaining of TMD related symptoms following 3rd molar extraction from among 34,491 patients studied. They also commented that preoperative explanation on the possibility of TMJ complications and care to protect against TMJ during surgery are important. Lee¹¹⁾ reported clinical cases of TMD with headache in the course of periodontal treatment. However, McNamara et al¹²⁾ suggested that TMD related symptoms occur in healthy individuals and increase with age, particularly during adolescence; thus, TMD symptoms that originate during various types of dental treatment may not be related to the treatment but may be a naturally occurring phenomenon.

There are high possibilities of medical dispute in the cases of TMD where symptoms developed after dental treatment. If the patient pursues legal action, it is difficult to improve his/her subjective symptoms. Also, dentists should be

careful in dealing with lawsuit-related patients because they may exaggerate their symptoms and respond to treatment poorly. Previous studies of direct trauma TMD patients demonstrate that litigating patients have a higher number of pain sites and more complaints of pain than nonlitigating patients¹³.

Delcanho¹⁾ recommended that TMJ evaluation should be performed on all the patients before dental treatment and that information should be served on the possibility of TMD development. Asymptomatic 'adaptive' patients (group II) meant a group of patients with subclinical symptoms that are not recognized and well adapted. The patients can be regarded as an 'unknown risk' group. If TMD related symptoms develop in group II patients without pre-treatment TMJ evaluation and explanation, there may be significant problems with their management. Those patients aware of mild TMJ related symptoms but remain without treatment are classified as temporomandibular dysfunction patients (group III). If there is adequate TMJ evaluation and explanation before treatment, there will be no legal problem in group III patients. TMJ treatment should be done prior to any dental treatment for TMD patients (group IV).

It will be time-consuming work to examine TMJ of all the patients in detail. However, evaluation for pain free range of mandibular movement, active range of movement, palpation for preauricular TMJ tenderness, TMJ sound evaluation, palpation for masseter and temporalis muscle tenderness, symmetry and alignment of the face and jaws, intraoral inspection for parafunction should be performed.

An osseointegrated implant has direct bone contact and there are no periodontal receptors. It has been demonstrated that tactile perception is reduced at osseointegrated oral implants compared to teeth with more than 8-fold higher

threshold values for tactile perception^{14,15}. The risk for high occlusal loading without warning from the receptors, therefore, may be higher for implants. Parafunction such as clenching and bruxism considerably increase the stresses affecting dentition or implants. Nonaxial loading induces increased stress levels in implant components and superstructure but also in the portion of the implant-bone interface receiving the load. Although a causative relationship between occlusal overload and loss of osseointegration of oral implants and TMD has not been definitively demonstrated, it seems justified to minimize stress in implant-retained prostheses to reduce the risk of technical and biological complications¹⁶. Though there has been debate on the theory that parafunction (bruxism, clenching, unilateral biting, etc) is a direct cause of TMD, it is possible that parafunction induces hyperactivity of masticatory muscles, tooth attrition and TMJ overloading. Regardless of TMD, parafunction results in harmful effects to the implant through hyperactivity of masticatory muscles during the healing period, destruction of osseointegration by nonaxial loading, peri-implantitis, and implant fixture fracture. So, it is recommended to screen and correct parafunction preoperatively or to apply a protection splint after implant therapy.

From these results, it is possible that TMJ related symptoms are developed or aggravated after implant therapy, which requires relatively more chair time. So, TMJ examination should be included in the pre-operative evaluation for dental implant patients. Also, it is important to treat patients after they have signed an informed consent and received a detailed explanation on the possibility of TMD during the treatment.

References

1. Delcanho R. Screening for temporomandibular disorders in dental practice. *Australian Dent J.* 1994; 39: 222-227.
2. Pullinger AG, Hollender L, Solberg WK, Petersson A. A tomographic study of mandibular condyle position in an asymptomatic population. *J Prosthet Dent.* 1985; 53: 706-713.
3. Lipton JA, Ship JA, Larach-Robinson D. Estimated prevalence and distribution of reported orofacial pain in the United States. *J Am Dent Assoc.* 1993; 124: 115-121
4. Korean Association for Temporomandibular Joint Corporation : Temporomandibular disorder. 1st ed. Seoul : Narae Publishing Co.; 2004.
4. Johansson A, Unell L, Carlsson GE, Söderfeldt B, Halling A. Gender difference in symptoms related to temporomandibular disorders in a population of 50-year-old subjects. *J Orofac Pain.* 2003; 17: 29-35.
5. Lundeen TF, Scruggs RR, McKinney MW, Daniel SJ, Levitt SR. TMD symptomology among denture patients. *J Craniomandibular Disorders.* 1990; 4: 40-46.
6. Dworkin SF, Huggins KH, LeResche L, Von Korff M, Howard J, Truelove E, Sommers E. Epidemiology of signs and symptoms in temporomandibular disorders: Clinical signs in cases and controls. *J Am Dent Assoc.* 1990; 120: 273-281.

References

7. Alexander SR, Moore RN, DuBois LM. Mandibular condyle position: Comparison of articular mountings and magnetic resonance imaging. *Am J Orthod Dentofac Orthop.* 1993; 104: 230-239.
8. Pereira FJ Jr, Lundh H, Westesson PL, Carlsson LE. Clinical findings related to morphologic changes in TMJ autopsy specimens. *Oral Surg Oral Med Oral Pathol.* 1994; 78: 288-295.
9. Johansson A, Unell L, Carlsson GE, Söderfeldt B, Halling A. Risk factors associated with symptoms of temporomandibular disorders in a population of 50- and 60-year-old subjects. *J Oral Rehabilitation.* 2006; 33: 473-481.
10. Huang GJ, Rue TC. Third-molar extraction as a risk factor for temporomandibular disorder. *J Am Dent Assoc.* 2006; 137: 1547-1554.
11. Lee GC. Attack of headache and TMD symptoms during periodontal treatment: A treatment case report. *J Kor Assoc Temporomandibular Joint Corp.* 2007; 3: 134-145.
12. McNamara JA, Seligman DA, Okeson JP. Occlusion, orthodontic treatment, and temporomandibular disorders: A review. *J Orofacial Pain.* 1995; 9: 73-90.
13. Burgess JA, Dworkin SF. Litigation and post-traumatic TMD: how patients report treatment outcome. *J Am Dent Assoc.* 1993; 124: 105-110.
14. Jacobs R, van Steenberghe D. Comparison between implant-supported prostheses and teeth regarding passive threshold level. *Int J Oral Maxillofac Implants.* 1993; 8: 549-554.
15. Hämmerle CH, Wagner D, Brägger U, Lussi A, Karayiannis A, Joss A, Lang NP. Threshold of tactile sensitivity perceived with dental endosseous implants and natural teeth. *Clin Oral Implants Res.* 1995; 6: 83-90.
16. Isidor F. Technical and biological complications related to occlusal loading. *Forum Implantologicum.* 2007; 3: 120-125.