Dental Examination Prior to Total Joint Arthroplasty as a Means to Prevent Postoperative Haematogenous Infection

Katsuhiro AOMORI, Yuichiro KAMADA, Nobuyoshi WATANABE*, Yasuhiro FUJIWARA, Motoo HOSOKAWA, Michiaki NAKAI**, Tomoko HASEGAWA**, Yasuo MIKAMI*, Daisaku TOKUNAGA*, Motoyuki HORII*, Toshikazu KUBO*

Department of Orthopaedic Surgery, Nantan General Hospital
25 Ueno, Yagi-cho, Funai-gun, Kyoto, 629-0197, Japan Tel: +81-771-42-2510
* Department of Orthopaedics, Graduate School of Medical Science, Kyoto Prefectural University of Medicine
** Department of Oral and Maxillofacial Surgery, Nantan General Hospital

Abstract

Objective: Post-operative infection is a serious complication following joint arthroplasty. One of its pathologic forms is haematogeneous infection associated with dental treatment such as tooth extraction. The authors examined the frequency of dental diseases in patients who were scheduled to undergo arthroplasty.

Methods: Subjects were 105 patients (113 joints). There were 81 females and 24 males, and their ages ranged between 43 and 87 years (mean: 70 years). Ninety-three joints had osteoarthritis (OA), and 20 joints had rheumatoid arthritis (RA). Surgical procedures were: total hip arthroplasty in 43 joints, total knee arthroplasty in 66 joints, total elbow arthroplasty in 3 joints, and total shoulder arthroplasty in 1 joint. Each patient received dental examination before joint arthroplasty, and dental treatment, including tooth extraction, was administered when necessary. Follow-up periods ranged between 3 and 31 months (mean: 19 months) after surgery.

Results: Dental diseases that needed tooth extraction were present with 25 of the 113 joints (22.1%), or with 17 of the 93 OA joints (18.3%) and 8 of the 20 RA joints (40.0%, p<0.05). Each patient received pre-operative dental treatment as appropriate, and none of them needed additional treatment after surgery.

Conclusion: With pre-operative examination and treatment, our patients did not need invasive post-operative dental treatment such as tooth extraction, which is known as a potential cause of haematogenous infections. No patients had post-operative deep infections originating from oral lesions. Pre-operative dental treatment seems useful in order to prevent late haematogenous infections.

key words: arthroplasty, infection, bacteremia, periodontium, dentistry
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INTRODUCTION

Total joint arthroplasty has proven to be a highly effective procedure for patients with end-stage arthritis, and it brings pain relief and improvement of joint functions. This technique has been well accepted, and there is an increase in the demand for total knee or hip joint arthroplasty procedures. However, post-operative infection has been one of the most serious sorts of complications following to joint arthroplasty. The cure rate has been low, and it negatively affects recovery of joint functions because long-term medications are needed.\(^7\),\(^9\),\(^12\),\(^20\),\(^23\),\(^27\) Infections are classified into early infections caused by operative procedures, and late haematogenous infections originating from other infections lesions in the body. Frequency of early infection markedly decreased with advances in surgical technology and equipment, but late infection remains. Therefore, it is important to eliminate infectious sources in the body prior to joint arthroplasty, in order to prevent deep infections of prosthetic joints, as well as to have good overall clinical results.

Bacteremia is known as a cause of late infections. Reported pathogenic origins include lesions of chronic infectious diseases of periodontal tissues such as serious periodontitis, and dental surgery such as tooth extraction and caries treatment.\(^7\)\(^\text{–}^9\),\(^17\) The authors considered that dental treatment prior to joint arthroplasty would reduce the incidence of late infection. In Japan, however, there have been no large-scale reports on the relationship between oral diseases and late infection following to joint arthroplasty, and frequency of oral diseases in the patients who underwent joint arthroplasty has not been investigated. The purpose of the current study was to investigate the frequency of dental diseases in patients who were scheduled to undergo joint arthroplasty, and of late infection in the patients who had pre-operative dental treatment.

SUBJECTS AND METHODS

Subjects were 105 patients (113 joints) who were able to receive dental examinations and/or treatment prior to total arthroplasty in the period between May 2001 and October 2003. Patients were 81 females and 24 males, and their ages ranged between 43 and 87 years (mean: 70 years). There were 93 joints with osteoarthritis (OA) and 20 joints with rheumatoid arthritis (RA), and surgical procedures were total hip arthroplasty (THA) in 43 joints, total knee arthroplasty (TKA) in 66 joints, total elbow arthroplasty (TEA) in 3 joints, and total shoulder arthroplasty (TSA) in one joint. Follow-up periods ranged between 3 months and 31 months (mean: 19 months).

Dental examination with intraoral panoramic x-ray was performed at the earliest time possible before surgery, and two oral surgeons looked for marginal periodontitis, apical periodontitis, caries, odontitis and jaw lesions (Table 1). Severity of marginal periodontitis was classified into Levels 1～3, i.e., Level 1 (P1) if bone absorption reached 1/3 or less of the root from the margin, Level 2 (P2) if the absorption reached 1/2, and Level 3 (P3) if the absorption reached 2/3. Severity of caries was classified into Level 1 (C1, caries of enamel), Level 2 (C2, caries of dentinum), Level 3 (C3, caries reaching the dental pulp or cavity) and Level 4 (C4, a portion of the root remaining). Patients who had the above-mentioned lesions received dental treatment, and tooth extraction was performed if the patients had P3 marginal periodontitis or apical periodontitis associated with C4 caries. Dental calculus was removed, and proper tooth brushing was taught to every patient. Frequency of dental diseases was examined according to OA/RA and surgical procedure by using Fisher's exact test. P values less than 0.05 were regarded as statistically significant.
RESULTS

There were 10-48 days (mean: 30 days) between the dental examinations and arthroplasty. Eighty-four patients (74.3%) had P1 or P2 marginal periodontitis, 11 patients (9.7%) had P3, 17 patients (15.0%) had apical periodontitis with C4 caries, one patient (0.9%) had an apical periodontal cyst, and 17 patients (15.0%) had no teeth.

Table 2 summarizes dental treatment. Tooth extraction was performed on 25 patients (22.1%) who had apical periodontitis associated with P3 marginal periodontitis or with C4 caries. Curettage was performed on the apical periodontal cyst of one patient. Patients with mild periodontitis (P1 and P2) received calculus removal and instructions on daily tooth brushing, and patients with mild caries (C2 and C3) received appropriate treatment and fillings.

Dental diseases were present in 63 of the 93 (67.7%) OA patients and 15 of the 20 (75.0%) RA patients (Fig. 1). Among them, tooth extraction was necessary in 17 OA patients (18.3%) and 8 RA patients (40.0%, p<0.05, Fig. 2). According to surgical procedure, tooth extraction was performed on 12 of the 43 THA patients (27.9%), 12 of the 66 TKA patients (18.2%, Fig. 3), and one of the TSA patient (100%).

Infections after joint arthroplasty developed in 2 patients. One patient was thought to be a case of early infection, who received TKA due to OA, and infection occurred one week after surgery. The pathogenic organism was Staphylococcus epidermidis. This patient had P3 marginal periodontitis, and had tooth extraction 2 months

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<tr>
<th>Table 1 Dental diseases and their severity</th>
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<tr>
<td>1. Marginal periodontitis</td>
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<td>Level 1 (P1): bone absorption reaches the 1/3 or less of the root from the margin</td>
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<td>Level 2 (P2): bone absorption reaches the 1/2 of the root from the margin</td>
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<tr>
<td>Level 3 (P3): bone absorption reaches the 2/3 of the root from the margin</td>
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<td>2. Apical periodontitis</td>
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<td>Presence or absence of remaining portion of the root</td>
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<td>3. Dental caries</td>
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<td>Level 1 (C1): caries of the enamel</td>
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<td>Level 2 (C2): caries of the dentinum</td>
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<tr>
<td>Level 3 (C3): caries reaching the dental pulp or dental cavity</td>
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<td>Level 4 (C4): parts of the root remain in the jaw</td>
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<td>4. Odontitis and jaw lesions</td>
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<th>Table 2 Summary of dental diseases and treatment</th>
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<tr>
<td>Dental disease</td>
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<tr>
<td>Mild or moderate (P1, P2) marginal periodontitis</td>
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<td>Severe (P3) marginal periodontitis</td>
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<td>Caries (C2, C3)</td>
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<tr>
<td>Apical periodontitis with C4 caries</td>
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<td>Apical periodontal cyst</td>
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<td>No tooth</td>
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prior to the surgery. Immediately before TKA, there were no dental symptoms not signs of infections on biochemical profiles. Dental examination after the development of post-operative infection did not show remarkable lesions. The other patient had OA, and developed infections one year and 10 months after TKA. The pathologic organism was MRSA. This patient had mild marginal periodontitis before surgery, but there were no infectious lesions in the mouth at a post-operative dental examination. Dental diseases were thought to be unrelated to the infection in this case.

DISCUSSION

Bacteremia following surgical treatment or originating from infectious lesions in other organs is known as a cause of deep infection secondary to joint arthroplasty. Dental treatment such as tooth extraction is also known to induce haematogenous infection by oral bacteria. Frequency of clinically reported infections secondary to joint arthroplasty and caused by bacteremia originated from oral bacteria ranged between 0.04% and 0.2%. Waldman et al. reported that post-operative infections developed in 62 of the 3490 TKA patients (1.7%) and 7 of them (0.2% of the total) were related to dental procedures. LaPorte et al. showed post-operative infections were developed in 52 of the 2973 THA patients (1.7%), and 3 of them (0.1% of total) were thought to have infections originating from periodontal tissues. Maderazo et al. reported that 3 patients (0.07% of total) had post-operative infections relating to dental diseases. However, there have been no large-scale examinations on such frequency in Japan. In regard to the causes of bacteremia originating from oral lesions, there
are reports on invasive dental procedures, on a case of infections following THA that developed after non-invasive tooth cleaning,\textsuperscript{14} and on a patient with infections following THA, who had untreated serious periodontitis.\textsuperscript{16} Guntheroth showed that bacteremia derived from dental lesions could occur occasionally in normal life,\textsuperscript{10} and Socransky demonstrated the increase of bacteria in the capillary bed under the gum along with the increase in severity of periodontitis.\textsuperscript{24} In an advisory statement published by the American Dental Association and American Academy of Orthopaedic Surgeons,\textsuperscript{2} dental procedures were classified into groups that could induce deep infection secondary to joint arthroplasty, and the high-risk procedures were tooth extraction, caries treatment, dental implant, local injection into ligaments, and teeth cleaning that causes bleeding from the gum. This statement also stated that patients who are scheduled to have arthroplasty need to receive dental treatment, and patients who already had joint arthroplasty need to maintain good dental conditions through sufficient daily tooth brushing. In Japan, however, the necessity of dental examination before joint arthroplasty has not been well known or practiced. Further, the frequency of dental diseases before joint arthroplasty is not known, and the relationship between dental diseases and infections following to joint arthroplasty has not been reported. In our current study, more than 70\% of patients who underwent joint arthroplasty had periodontitis, and 22.1\% had severe dental diseases that needed invasive treatment such as tooth extraction. Orthopaedic surgeons need to know that the majority of patients have infectious lesions in the mouth and that dental treatment before surgery could prevent post-operative haematogenous infection.

The frequency of severe dental diseases that needed intensive dental treatment was 18.3\% in OA patients and 40\% in RA patients. Rheumatoid arthritis has been regarded as a risk factor for dental diseases\textsuperscript{13,21} as well as the high-risk group of infections secondary to joint arthroplasty\textsuperscript{22,27}, because RA decreases immunity due to steroid administration, and weakened arm functions of the patients results in insufficient tooth brushing. Sjögren's syndrome is also known to induce dry mouth that then deteriorates dental health.\textsuperscript{1,16} The authors consider that dental examination before surgery and instructions to maintain oral hygiene are very important, in particular for RA patients.

In the current study, all patients received dental examination, calculus removal and instruction on teeth-brushing before surgery, and no patients developed post-operative haematogenous infection that would have originated from dental lesions. Although this could be because of the low frequency of such infection, i.e., 0.04-0.2\%, and the limited number of patients in this study, the authors consider that pre-operative dental examination and treatment would prevent post-operative worsening of dental diseases, thus decreasing the risk of bacteremia, and decrease the necessity of post-operative dental treatment that could induce bacteremia. Periodical dental examination and cleaning after surgery would also reduce the risk of post-operative haematogenous infection.

REFERENCES