



ELECTIVE EDENTULATION AFTER 7 EPISODES OF INFECTIVE ENDOCARDITIS: A CLINICAL REPORT

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A 3-year clinical follow-up is presented of a patient who underwent elective extraction of the remaining natural dentition, followed by rehabilitation with maxillary and mandibular complete dentures after 7 documented episodes of infective endocarditis. The patient was diagnosed with congenital ventricular septal and valvular defect and was treated in 1984 with a prosthetic aortic valve replacement secondary to idiopathic infective endocarditis due to *Haemophilus influenzae*. From 1984 to 2007, the patient experienced 7 episodes of infective endocarditis associated with various microorganisms, all of oral flora origin. In the 3 years after elective extraction of the remaining natural dentition, the patient had not experienced any episodes of infective endocarditis. In light of recent changes and controversy in the recommendations for the prevention of bacterial endocarditis, the question arises as to whether the efforts of dental providers to maintain the dentition of high risk patients outweighs the associated increased risks of morbidity and mortality. While the guidelines attempt to assist health care providers in clinical decision making, there are certain instances where a patient-centered approach necessitates alternative options.

INTRODUCTION

Infective endocarditis (IE) contin-

ues to be a diagnostic and management challenge for medical teams because of its variable clinical symptom presentation.¹ The associated morbidity and mortality rates remain high with 1 of every 5 patients dying during initial hospital admission.² The inability to predict the short term and long term course of the disease makes it difficult for the medical and dental practitioner to pursue clinically and ethically acceptable management strategies for patients with recurring episodes of IE related to oral flora. Current practice guidelines from the American Heart Association (AHA) for the prevention of infective endocarditis (April 2007) include many revised recommendations questioning the effectiveness of antibiotic prophylaxis that have been common practice since the 1950s.³ The committee concluded the following: (1) Antibiotic prophylaxis, even at 100% effective, can only prevent a few IE cases from occurring during dental procedures. (2) IE prophylaxis should be recommended only for patients with underlying cardiac conditions associated with a high risk of IE while undergoing dental procedures. (3) For these high risk patients, antibiotic prophylaxis is recommended for all dental procedures involving manipulation of gingival tissue or the periapical region of teeth or perforation of the oral mucosa. (4) Antibiotic prophylaxis is not recommended solely based on

an increased lifetime risk of acquiring IE. (5) Prophylaxis is not recommended for patients who undergo a genitourinary or gastrointestinal tract procedure.

A large body of literature has focused on dental procedures as a cause of IE, together with antibiotic prophylaxis as a primary measure to prevent IE in high risk patients. Interestingly, one of the primary reasons for the 2007 AHA revision of the IE prophylaxis guidelines was that the maintenance of optimal health and hygiene was determined to be a key measure in reducing the incidence of bacteria and was considered more important than prophylactic antibiotics as a dental procedure to reduce the risk of IE.

More than 700 microbial species have been shown to colonize the oral cavity, with more than 100 of them having the ability to grow in culture and colonize distant sites.⁴⁻⁶ In a double blind, placebo controlled study of 194 patients, Lockhart et al⁷ found that oral hygiene and gingival disease indexes were significantly associated with IE-related bacteremia after toothbrushing, while oral hygiene or the disease status of a tooth was not significantly associated with bacteremia after its extraction. Furthermore, it was concluded that generalized bleeding after toothbrushing was associated with an almost eight-fold increase in the risk of developing

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TABLE I. Frequency of bacteremia associated with dental procedures and daily activities of oral hygiene. Adapted from 2007 Prevention of Infective Endocarditis: Guidelines from American Heart Association³

| Dental Procedure | | Oral Hygiene Daily Activity | |
|-----------------------|--------------------------|-----------------------------|--------------------------|
| Procedure | Bacteremia Frequency (%) | Activity | Bacteremia Frequency (%) |
| Tooth extraction | 10-100 | Toothbrushing/flossing | 20-68 |
| Periodontal surgery | 36-88 | Wooden picks | 20-40 |
| Scaling, root planing | 8-80 | Water irrigation device | 7-50 |
| Teeth cleaning | Up to 40 | Masticating food | 7-51 |
| Rubber dam/wedge | 9-32 | | |
| Endodontics | Up to 20 | | |

TABLE II. Incidence, duration, and magnitude of bacteremia from endocarditis related bacterial species. Adapted from Lockhart et al⁷

| Bacteremia | Toothbrushing (n=98) | Extraction & Antibiotic (n=96) | Extraction & Placebo (n=96) |
|------------------------|--------------------------------|--------------------------------|--------------------------------|
| Cumulative incidence | 23% | 33% | 60% |
| Duration at 20 minutes | 1% | 1% | 20% |
| Duration at 60 minutes | 9% | 2% | 2% |
| Magnitude | < 10 ⁴ CFU/ml blood | < 10 ⁴ CFU/ml blood | < 10 ⁴ CFU/ml blood |

bacteremia. Routine oral hygiene may result in as much as 5.6 million times greater cumulative exposure to bacteremia during one year than to a single tooth extraction, which is the one dental procedure reported to most likely cause bacteremia.⁸ Transient bacteremia occurs frequently with routine oral hygiene activities unrelated to dental procedures (Table I).

Although it has been shown that toothbrushing is associated with a lower incidence of bacteremia than tooth extraction, toothbrushing has a larger percentage of positive blood cultures at 60 minutes than tooth extraction (Table II).⁹ Considering the average person in the United States has fewer than 2 dental visits every year, there is a much greater frequency of bacteremia associated with the recommended twice daily toothbrushing and other

routine daily activities.

A diagnosis of IE is based on the combination of positive blood cultures, fever, presence of vegetations, and history of previous IE.^{10,11} The following clinical report describes a high risk patient who experienced 7 IE episodes associated with oral-microorganisms, and who after complete edentulation experienced no occurrence of IE for 3 years. This raises the question of whether such aggressive dental treatment is an appropriate preventive strategy for avoiding IE and its associated systemic complications.

CLINICAL REPORT

A 60-year-old white male presented to the Mayo Clinic Division of Prosthetic and Esthetic Dentistry in November 2007 for a consultation

regarding fabrication of maxillary and mandibular complete dentures after undergoing elective extraction of his remaining natural dentition in September 2007. At the same time, he was hospitalized for the 7th episode of IE since 1984. During the consultation, the patient reported that he underwent elective extraction of his remaining natural dentition to eliminate the IE episodes which reportedly occurred after he followed routine dental procedures.

The patient was diagnosed at birth with asymptomatic ventricular septal defect. He underwent aortic valve replacement with a prosthetic heart valve in 1984. This was secondary to spontaneous infective endocarditis due to *Haemophilus influenzae* (Table III) with confirmed positive blood cultures for gram negative bacilli in conjunction with partial repair of the ventricular

septal defect (VSD), and after presenting to the emergency room with a fever of unknown origin. The right coronary cusp of the aortic valve had a large perforation in its base below the right coronary ostium. Behind the valve, large vegetations, which appeared to be fibrotic were present. The aortic valve was removed along with the vegetations. The pathological report of the specimens obtained revealed an aortic valve with resolving-infective endocarditis with basal (annular) perforation (0.5 x 0.3 mm) of one cusp, mild focal cuspid fibrosis, clinically moderate aortic insufficiency with VSD, and a history of endocarditis. No bacteria or fungi were isolated by special stains.

In 1987, he presented to the emergency room with a low grade fever of 2 days' duration. Positive blood cultures for *Streptococcus sanguis* were identified at that time. In 1988, the patient presented again to the emergency room with a low grade fever. Positive blood cultures for *B Streptococcus* in addition to *Haemophilus pharyngitis* were detected. In 1993, *Streptococcus mitis* was identified by positive blood cultures after the patient presented to the emergency department with complaints of low grade fever, decreased appetite, and diaphoresis. This fourth episode of bacteremia was further complicated with osteomyelitis, secondary to infected embolus, and septic emboli to the buttock and sacral bone. The patient experienced yet another episode of bacteremia in 1996, which was associated with positive blood cultures for *Streptococcus viridans*. In 2004, the patient presented to the emergency department with a low grade fever of several days' duration and a dental abscess associated with the left mandibular first molar. The last episode of positive blood cultures for *Streptococcus viridans* occurred in 2007. He was placed on vancomycin 15 mg/kg every 12 hours while hospitalized for 6 weeks after negative blood culture results. Following this episode, the patient sought elective extraction of his remaining natural dentition.

TABLE III. Bacteria isolated from positive blood cultures for each episode of IE

| Year of IE Incidence | Bacteria |
|----------------------|-------------------------------------|
| 1984 | <i>Haemophilus influenzae</i> |
| 1987 | <i>Streptococcus sanguis</i> |
| 1988 | <i>Beta Hemolytic Streptococcus</i> |
| 1993 | <i>Streptococcus mitis</i> |
| 1996 | <i>Streptococcus viridans</i> |
| 2004 | <i>Streptococcus viridans</i> |
| 2007 | <i>Streptococcus viridans</i> |



1 Pre extraction panoramic radiograph.

Despite the numerous episodes of bacteremia documented by positive blood cultures and always accompanied by fever, the patient had not had infections of the prosthetic valve or other heart valves. Regularly performed echocardiograms and transesophageal assessments throughout the years, demonstrated that the prosthetic aortic valve functioned appropriately with no evidence of vegetations.

Furthermore, the dental history reveals that he had followed regular 6 month hygiene and dental maintenance. Yet the patient's dental history was significant in that it revealed gingivitis with generalized pockets of 2 to 3 mm and caries. According to the patient's report, his periodontal health was maintained with supra-gingival scaling, and home care included daily brushing with a manual

toothbrush and flossing 2 or 3 times a week. The patient received restorative treatment to address caries, including amalgam and composite resin restorations, crowns, and extractions (Fig 1). He was prophylaxed 30 minutes before the extraction of the abscessed left mandibular first molar in 2004. The procedure was done in a hospital setting with either oral clindamycin 600 mg or gentamycin 120mg IV.

The patient was rehabilitated with maxillary and mandibular complete dentures 8 weeks after the extraction of the remaining natural dentition. At the time of the prosthodontic consultation, the patient reported that he chose elective extraction of his remaining dentition in an effort to decrease the IE episodes. He inquired about the potential for denture wear as a cause of IE as it relates to *Strepto-*

coccus species, since the majority of IE episodes were associated with this microorganism. He was informed that the literature is scant regarding an association between complete denture wear and bacteremia. The expectation was that without the presence of teeth, the oral cavity microflora would minimize the presence of the microorganism, but it could not be affirmed that the risk of encountering IE associated with these microorganisms would be eliminated.

The treatment options discussed included no further prosthetic treatment, fabrication of complete dentures, or implant-retained overdentures or implant-supported fixed prostheses. A discussion ensued regarding the use of dental implants to support or retain a dental prosthesis in one or both arches. Because of the consequence of periimplant sulcus formation and the potential for colonization by bacterial species previously associated with one or more of the 7 IE episodes, the patient declined dental implant therapy and opted to proceed with complete denture fabrication. The patient was informed of the limitations of wearing complete dentures. In addition, the patient was informed of the need to present promptly for adjustments if he were to experience denture sores.

The patient was seen for a reevaluation in December 2010, more than 3 years after the extraction of his remaining natural dentition and complete denture fabrication. At this time, the prostheses demonstrated some decreased stability and retention. A laboratory processed relines was accomplished for both maxillary and mandibular dentures.

The patient has not experienced any IE episodes since the fabrication of the prostheses over a 3 year period. After the denture relines procedures, the patient expressed satisfaction with the increased stability and comfort of the prostheses.

DISCUSSION

The oral cavity is heavily populat-

ed with bacteria and contains more than 700 microbial species, with more than 100 of them able to grow in culture and infect distant sites.⁴⁻⁶ Patients with diagnosed IE present with variable and inconsistent signs and symptoms. Because fever exists in 92% of the patients and immunologic phenomena are present in 50%, the classic findings of IE may not be seen in every patient.¹² The patient in this clinical report met the Duke criteria for diagnosis of IE in all 7 episodes of recurrent infective endocarditis.¹⁰ Yearly transesophageal and transthoracic echocardiograms revealed a normal aortic valve mechanical prosthesis with a systolic mean Doppler gradient in the upper limits of normal and no evidence of valvular vegetations. The patient's left ventricular ejection fraction ranged between 62% and 72%. There has been no evidence of intracardiac masses or thrombi. In addition, there has been no significant hemodynamic compromise. According to the patient's medical record, he underwent either dental hygiene procedures or routine dental treatment several weeks to months before the IE episodes. The recommended antibiotic prophylaxis was administered at each visit. While dental procedures can certainly cause transient bacteremia of varying degrees, it has been estimated that the cumulative bacteremia induced by daily oral hygiene activities is about 6 million times higher than bacteremia occurring after dental extractions.¹²⁻¹⁵

The 2007 AHA guidelines suggest that there may not be a clinically significant difference in the frequency, nature, magnitude, or duration of bacteremia associated with a dental procedure and that resulting from routine daily activities.³ In 2008, Lockhart et al⁹ showed that although toothbrushing has a lower incidence of bacteremia than tooth extraction, toothbrushing was associated with a larger percentage of positive cultures at 60 minutes (9% versus 2%) with extractions. The most significant proportion of oral flora is composed of

Streptococci, which are found not only around teeth, but are also most commonly associated with IE.³ Consistent with this finding, 6 of the 7 episodes of IE in this patient were also associated with the *Streptococcus* family. Furthermore, toothbrushing and periodontal maintenance for his gingivitis likely resulted in minor but repeated trauma to the gingival tissue and increased daily incidences of bacteremia. From positive blood cultures, it is clear that the patient's recurrent IE episodes were associated with oral microorganisms and that his susceptibility to IE was significantly reduced after complete edentulation. Therefore, this high risk patient benefitted from edentulation. The question arises of whether this or similar treatment strategies should be considered for other high risk patients.

While, since 1950, there has been a focus on the use of antibiotic prophylaxis before dental procedures for high risk patients as the exclusive method of prevention, other preventive management strategies for the high risk patient have not been suggested. The preservation of natural teeth continues to be a focal point of daily practice, but the edentulation of a patient at high risk for IE may become a clinically and ethically acceptable treatment option.

Transient bacteremia is common when manipulating periodontal tissues and tooth structure, and there is a wide variation in frequency of bacteremia associated with dental procedures and daily oral hygiene activities (Table 1). Perhaps by eliminating the teeth as the major source of the microorganisms associated with this patient's IE episodes, the cumulative daily effect of oral bacteremia was decreased. For clinicians, the patients' clinical and ethical needs should be considered first and they should be involved as active participants in the treatment decision making and education process. Three years after extractions and rehabilitation with complete dentures, the patient said that he wished he had chosen edentulation

after his first IE episode to avoid any further life-threatening incidents.

SUMMARY

A clinical report was presented of a patient with a congenital valve defect, a prosthetic heart valve, a history of 7 IE episodes and a high risk of further IE episodes. The patient experienced no bacteremia or IE for 3 years after elective extraction of his remaining natural dentition and rehabilitation with maxillary and mandibular complete dentures. Although, in his situation, the patient initiated treatment, elective edentulation may be an appropriate treatment for patients at high risk for development of infective endocarditis.

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