Canadian Agency for Drugs and Technologies in Health

RAPID RESPONSE REPORT:
SUMMARY WITH CRITICAL APPRAISAL

TITLE: Dental Treatment to Correct Dental Caries in Patients Undergoing Surgery: A Review of Clinical Evidence on Safety

DATE: 22 May 2012

CONTEXT AND POLICY ISSUES

Poor dental health is believed to be an important associated risk factor for blood-borne infection in patients undergoing major surgery.[1,2] Dental chronic infections such as periodontitis, periapical lesions or advanced carious lesions can cause the development of infective endocarditis, an infection of the inner lining of the heart chambers and valves.[1,3] Blood-borne bacteria may lodge on damaged or abnormal heart valve tissues causing this specific type of inflammation.[3] There is a general agreement that dental treatment is desirable before heart valve replacement in an effort to decrease the risk of prosthetic valve infective endocarditis.[4] If dental treatment is not given preoperatively, an infection of dental origin may compromise surgical outcomes, although this has not been proven.[1]

Furthermore, invasive dental procedures may pose a significant risk of causing bacteremia and subsequent development of endocarditis in patients with certain heart conditions or structural defects.[5] High risk dental procedures may cause bleeding and tissue damage, and if there are bacteria circulating in the bloodstream, they can attach to the inner rough surface of the heart, which may cause infective endocarditis.[6] Some dental procedures are more likely to cause bacteremia than others.[7] Antibiotics are used in some cases to prevent infection; the decision whether to use antibiotics depends on the procedure or the condition of the heart.[8,9] Recent guidelines from the American Heart Association give recommendations for the prevention of infective endocarditis.[10]

It is unknown whether small dental cavities are associated with risk of infection when patients undergo major surgery. The purpose of this review is to provide clinical evidence on safety and harms in patients undergoing surgery without preoperative dental treatment for dental caries.

RESEARCH QUESTION

What is the clinical evidence on the safety and harms of not undergoing dental treatment to correct dental caries in patients undergoing surgery?

KEY MESSAGE

Limited evidence from three observational studies suggests that patients not undergoing dental treatment have a similar risk of harm compared to those receiving dental treatment or to those for which dental treatment prior to heart surgery is not indicated.

METHODS

Literature Search Strategy

A limited literature search was conducted on key resources including PubMed, The Cochrane Library (2012, Issue 4), University of York Centre for Reviews and Dissemination (CRD) databases, Canadian and abbreviated list of major international health technology agencies, as well as a focused Internet search. Methodological filters were applied to limit retrieval to health technology assessments, systematic reviews, meta-analyses, randomized controlled trials, and non-randomized studies. Where possible, retrieval was limited to the human population. The search was also limited to English language documents published between January 01, 2007 and April 23, 2012.

Selection Criteria and Methods

One reviewer screened the titles and abstracts of the retrieved publications and evaluated the full-text publications for the final article selection, according to the selection criteria presented in Table 1.

Table 1: Selection Criteria

Population	Patients undergoing surgery who have dental caries – particularly surgeries with a high risk of blood-borne infections (e.g. heart valves)
Intervention	No dental treatment (fillings) for dental caries prior to surgery
Comparators	Dental treatment or no comparator
Outcomes	Incidence of blood borne infections post-surgery
Study Design	Health technology assessment, systematic reviews, meta-analyses, randomized controlled trials and non-randomized studies

Exclusion Criteria

Studies not meeting the inclusion criteria, duplicate publications of the same study, or studies that were published prior to 2007 were excluded.

Critical Appraisal of Individual Studies

The quality of the included studies was assessed using Downs and Black checklist.[11]

SUMMARY OF EVIDENCE:

Quantity of Research Available

The literature search identified 448 citations. Upon screening the titles and abstracts, 444 citations were excluded, and four potentially relevant publications were selected for full-text review. Of the four potentially relevant publications, one did not meet the inclusion criteria and thus three publications were included in this review. Three non-RCTs met the inclusion criteria. No relevant health technology assessments, systematic reviews or randomized controlled trials were identified. The Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) flowchart in Appendix 1 outlines the study selection process.

Summary of Study Characteristics

Two prospective cohort studies[12,13] and one retrospective cohort study[14] were retrieved. The characteristics of the included studies are summarized in Appendix 2.

The prospective cohort study by Deppe et al., 2007[12] evaluated the long-term need for dental treatment following non-radical dental treatment modes prior to cardiac valve surgery. The study was conducted in Germany and the source of funding was not specified. A total of 305 adult patients were screened prior to cardiac valve surgery using non-radical criteria for dental treatment, in which tooth extraction was recommended only in cases of carious or periodontal tooth destruction, root remnants, partial retention of teeth or apical osteolysis. Furthermore, periodontal therapy was recommended if attachment loss was found less than ½ of the root length. After an average of 36 months, clinical re-evaluation was directly performed on 80 patients (26% of the total population). The remaining patients were either dead (n=51), dropped-out (n=57) or declined re-evaluation (but provided telephone interviews, n=117). Of the 80 patients in the clinical re-evaluation, there were three groups: Group 1: dental treatment given before heart valve surgery (n=49); Group 2: dental treatment not given before heart valve surgery (n=12); Group 3: no therapy indicated before heart valve surgery. Dental treatment included extractions due to periodontal destruction, and caries treatment. Seventy percent of the dental interventions were carried out with prophylactic antibiotic treatment during the follow-up period. The relevant outcome in this study was the signs and symptoms of endocarditis in all 80 patients who underwent re-evaluation and in all 117 patients who were interviewed by phone.

The prospective cohort study by Bratel et al., 2011[14] evaluated the survival benefit of preoperative elimination of oral infections and oral health after heart valve surgery. The study was conducted in Sweden and the source of funding was not specified. Adult patients (N=252) were divided into two groups; group GP (n=149) had dental treatment performed 3 to 6 months prior to surgery, and group SP (n=103) had no dental treatment prior to surgery. Baseline dental status in terms of number of teeth, number of decayed teeth, periadicular lesions, plaque, and periodontal pocket depth was comparable between groups. The mean value of gingivitis was significantly higher in the GP group. The use of antibiotics perioperatively was not reported. Survival rate at 16 years after heart surgery was the clinical outcome of this study.

The retrospective cohort study by Wu et al., 2008[13] determined whether or not treating chronic dental infection during the admission for cardiac valve surgery would increase the morbidity and mortality of patients. The study was conducted in the USA and the source of funding was not specified. Dental consultation charts from patients (N=156) admitted for cardiac valve replacement or repair procedures were reviewed. Ninety eight patients were included and divided into three groups: Group A (dentally unhealthy and untreated, n=47), Group B (dentally healthy, n=17), and Group C (dentally unhealthy and treated). The duration of follow-up was 6 months after cardiac valve surgery. Dental status was comparable between group A and group B+C in terms of abscess, severe bone loss, impactions, deep caries, and periapical pathosis. Endocarditis and mortality were clinical outcomes in this study. The use of antibiotics perioperatively was not reported.

Summary of Critical Appraisal

Strengths and limitations of the individual studies are provided in Appendix 3.

The quality of the three observational cohort studies was compromised by the nature of the study design, in which allocation of patients to different groups was not specified and therefore selection bias is likely to be a factor in the analysis of the observation. Patients demographics and baseline characteristics were not specified in two studies,[12,14] and were not clearly described in one study.[13] Two studies[12,13] had relatively small patients (<50 patients) in each group. Particularly, in the study of Deppe et al., 2007,[12] only 26% (80/305) participated in the clinical re-evaluation, with 17% of patients dead and 57% of patients declining re-evaluation and dropped-out. Furthermore, the cause of death in non-survivors has not been identified with certainty in all cases, and telephone interviews can be biased from non-compliance and subjective reporting. In the study by Bratel et al., 2011,[14] baseline data were not collected at the same time and patients' dental care after surgery was not recorded. One of the major limitations of the study by Wu et al., 2008[13] was large proportion of patient lost to follow-up after discharge, (27% died by the end of the study and 28% were unreachable). With rare outcomes such as infective endocarditis, all three studies lacked statistical power to detect the true association between dental health and infective endocarditis. In light of those limitations, participants in all studies may not be representative of the larger population.

None of the included studies were conducted in a Canadian setting. Considering the quantity and quality of the available evidence, generalizability of the study results to Canadian patients is uncertain.

Summary of Findings

The overall findings are summarized below, and findings from the individual studies are provided in Appendix 4.

The prospective cohort study conducted in Germany[12] found no signs or symptoms of infective endocarditis in 80 patients participating in the clinical re-evaluation 36 months post-surgery, including those who had received dental treatment using a non-radical approach (Group 1, n=49), those had refused dental treatment (Group 2, n=12), or those for whom therapy was not indicated (Group 3, n=19) before heart surgery. The proportion of patients in Group 1 and Group 2 having caries before heart valve surgery was 90% (44/49) and 50% (6/12), respectively. Of the patients who declined clinical re-evaluation (n=117), telephone interviews were conducted and these patients showed no signs of endocarditis. In addition, there were no

reports of endocarditis in the group of patients that died (n=51). The cause of death was not specified. The information on dental therapy and cardiac complications was gathered from personal interviews with patients (100% participation), family doctors (75% to 90% participation) and family dentists (59% to 85% participation).

The Swedish prospective cohort study[14] found that, at 16-year endpoint, fewer patients (37% vs. 45%, level of statistical significance not reported) survived in the group whose oral health was examined and dental treatment performed 3 to 6 months prior to heart valve surgery (GP group, n=149) compared to the group of patients who did not receive dental treatment prior to surgery (SP group, n=103). The mean survival time was 112.9 months in the GP group compared with 143.3 months in the SP group, the difference being statistically significant (p=0.018). However, there were no significant differences between groups in mortality from heart valve disease or from other heart disease.

The US retrospective cohort study[13] found no statistically significant difference in the incidence of infective endocarditis at 6-month between the group of patients who were dentally unhealthy/untreated (Group A, n=47) and the group of patients who were dentally unhealthy/treated (Group C, n=34). There were no signs of endocarditis in patients who were dentally healthy (Group B, n=17). During the 6-month follow-up and hospital discharge, there were only two confirmed diagnoses of infective endocarditis: one patient in group A who had asymptomatic deeply carious tooth without periapical radiolucency and one patient in group C who underwent teeth extractions before surgery. There was no statistically significant difference between groups in six-month survival.

Limitations

The evidence was limited to three cohort studies. The studies included adult patients of different dental health status including deep caries, abscess, severe bone loss, impactions, periodontitis, and gingivitis. Hence the findings would only be applicable to patients with severe dental problems and not patients with small cavities. The quality of the studies was compromised by different biases (selection, information, and analysis) inherent to cohort studies. How patients were selected for inclusion was unclear. There was a lack of statistical power to demonstrate the true association of dental health and harm outcomes. Confounding factors such as disease severity and duration, co-morbidities, and previous and concomitant treatments were not controlled in all studies.

CONCLUSIONS AND IMPLICATIONS FOR DECISION OR POLICY MAKING:

Evidence from three observational studies suggests that patients not undergoing dental treatment before surgery may have a similar risk of mortality and infective endocarditis compared to patients who have received dental treatment or for whom dental treatment is not indicated prior to heart valve surgery. The studies included adult patients of different dental health status including caries. There were no studies which included only patients with small dental cavities and a conclusion cannot be made with respect to this population.

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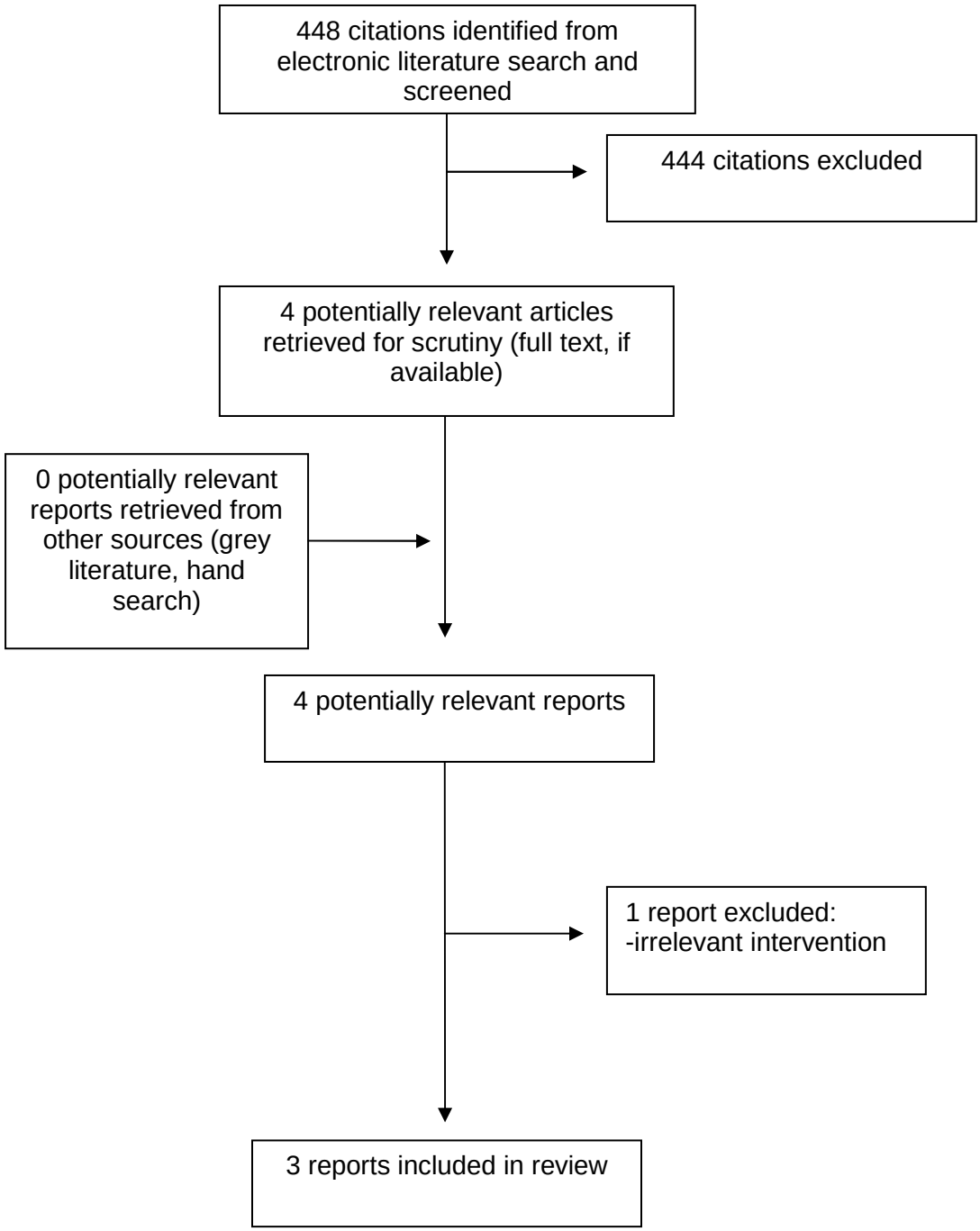
APPENDIX 1: Selection of Included Studies



APPENDIX 2: Characteristics of Included Studies

First Author, Publication Year, Country	Study Design, Length of Follow-up	Patient Characteristics, Sample Size (n)	Intervention	Comparators	Clinical Outcomes
Deppe, 2007[12] Germany	Prospective cohort study Mean duration of follow-up: 36 ± 18 months (range: 5 – 89 months)	• Adult patients (N=305), 65 ± 11.9 years (range 24-89 years), screened before cardiac surgery. • At follow-up, 80 patients (26%) re-evaluated; 117 patients (38%) contacted by telephone; 57 patients (19%) dropped out; 51 patients (17%) dead.	No dental treatment or no indication for dental treatment before heart valve surgery	Non-radical dental treatment before heart valve surgery Non-radical methods: tooth extraction was recommended only in cases of carious or periodontal tooth destruction, root remnants, partial retention of teeth or apical osteolysis. Periodontal therapy was recommended if attachment loss was found less than ½ of the root length	• Signs or symptoms of endocarditis • Clinical and radiographic parameters related to oral health • Dental treatment during follow-up period
Bratel, 2011[14] Sweden	Prospective cohort study Mean duration of follow-up: 16 years after heart surgery	• Adult patients (N=252); mean age at time of heart valve surgery: 63 years • Two groups based on dental treatment prior to dental surgery: • Group GP (N=149): dental treatment was performed 3-6 months prior to heart valve surgery to eliminate oral infections.	No dental treatment before heart valve surgery (Group SP)	Dental treatment was performed 3-6 months prior to heart valve surgery (Group GP)	• Survival rates at 16 years after heart surgery

First Author, Publication Year, Country	Study Design, Length of Follow-up	Patient Characteristics, Sample Size (n)	Intervention	Comparators	Clinical Outcomes
		• Group SP (N=103): no dental treatment prior to surgery. Oral health was examined within 3 weeks postoperatively			
Wu, 2008[13] USA	Retrospective cohort study Duration of follow-up: 6 months post-surgery	• Adult patients (N=98) underwent heart valve surgery • Mean age: 63 years • Three groups based on dental status and treatment prior to surgery: • Group A (n=48): dentally unhealthy, untreated • Group B (n=17): dentally healthy • Group C (n=34): dentally unhealthy, treated)	No dental treatment before heart valve surgery (Group A)	Dental treatment or no indication for dental treatment before heart valve surgery (Group B+C)	• Immediate postsurgical period and 6-month infective endocarditis evaluation • Six-month survival

APPENDIX 3: Summary of Study Strengths and Limitations

Study	Strengths	Limitations
Deppe, 2007[12]	• Objective was clearly stated • Long-term follow-up • Statistical analyses were performed	• Confounding factors were not controlled • Small number of patients (26%; 80/305) participated in clinical re-evaluation • Large number of patients (57%; 174/305) declined clinical re-evaluation and dropped out. • The cause of death in non-survivors (17%; 51/305) had not been identified with certainty in all cases • Not all family doctors or family dentists (only 59 to 90%) provided information on the patients. • Demographics of each group not reported separately • External validity limited; uncertain as whether study patients were representative of all patients
Bratel, 2011[14]	• Reporting (objective, main outcomes, patient characteristics and main findings) was clearly stated • Long-term follow-up • Statistical analyses were performed	• Confounding factors were not controlled • Baseline data were not collected at the same time • Patient's dental care after surgery has not been recorded • External validity limited; uncertain as whether study patients were representative of all patients
Wu, 2008[13]	• Reporting (objective, main outcomes, patient characteristics and main findings) was clearly stated • Long-term follow-up • Statistical analyses were performed	• Confounding factors were not controlled • Small study population (<50 per group) • Lack of statistical power to detect the true association between dental health and infective endocarditis • Potential bias from retrospective design (e.g., 36 patients were excluded due to absence of radiographs) • Large proportion of patient lost to follow-up after discharge: 26 (27%) deaths and 27 (28%) out of contact • Characteristics of patients lost to follow-up were unspecified • External validity limited; uncertain as whether study patients were representative of all patients

APPENDIX 4: Main Study Findings and Authors' Conclusions

Study	Main Findings	Authors' Conclusions
Deppe, 2007[12]	**Therapy groups** • Of the 80 patients who underwent re-evaluation, 49 patients (Group 1: 61%) received dental treatment, 12 patients (Group 2: 15%) refused dental treatment, and 19 patients (Group 3: 24%) had no therapy indicated before heart surgery **Dental treatment prior to heart valve surgery** • Group 1 (Treated, n=49): 44 patients (90%) had caries in 107 teeth; 49 patients (100%) had proposed surgical therapies of 402 teeth • Group2 (Not treated; n=12): 6 patients (50%) had caries in 24 teeth; 12 patients (100%) had proposed surgical therapies of 25 teeth **Interview on signs of endocarditis** • Re-evaluation (N=80): no signs or symptoms of endocartitis from 100% personal interview and 90% family doctor interview • Phone interview (N=117 declined clinical re-evaluation): no signs or symptoms of endocartitis from 75% family doctor interview • Dead (N=51): No endocartitis reported from 76% family doctor interview **Interview in dental therapy** • Re-evaluation (N=80): no local infection reported from 85% family dentist interview • Phone interview (N=117 declined clinical re-evaluation): no local infection reported from 65% family dentist interview • Dead (N=51): no local infection reported from 59% family dentist interview	"Non-radical dental treatment prior to cardiac valve replacement can only be successful over the long-term if adequate dental care is provided including post-operatively" p.300
Bratel, 2011[14]	**Dental status** Both groups had similar oral health (number of teeth, number of decay teeth, periradicular lesions), with only minor differences in terms of gingivitis and periodontal depth. **Heart valve diagnosis** There were no differences in the distribution of heart valve diagnosis between groups. **Survival rates in the SP group vs. GP group** • At 10-year follow-up: 71% vs. 59% • At end-point (16 years): 45% vs. 37% • Mean survival time: 143.3 months vs. 122.9 months (p=0.018)	"At long-term follow-up, the results of the present study show, that it was not possible to demonstrate that dental treatment before heart valve surgery improved survival. Therefore, the need for extensive dental treatment prior to heart valve surgery may be reconsidered." p.49

Study	Main Findings	Authors' Conclusions
	• Death from heart valve disease: 7% vs. 18%, not significant • Death from heart disease (heart valve excluded): 35% vs. 29%, not significant	

Wu, 2008[13]	**Dental status and treatment prior to surgery**
	• Group A (dentally unhealthy, untreated, n=47): 6% had abscess; 79% had severe bone loss; 13% had impactions, 58% had deep caries; 30% had periapical pathosis
	• Group C (dentally unhealthy, treated (n=34): 9% had abscess; 91% had severe bone loss; 3% had impactions, 79% had deep caries; 61% had periapical pathosis
	• Group B+C (dentally healthy , and dentally unhealthy, treated combined (n=51): 6% had abscess; 61% had severe bone loss; 12% had impactions, 53% had deep caries; 43% had periapical pathosis
	• All patients received IV perioperative antibiotics (cephalosporins) from the time preparation for surgery until the removal of chest tubes
	
	Immediate post-surgical period and 6-month infective endocarditis evaluation
	• During 6-month follow-up and hospital discharge, there were two confirmed diagnosis of infective endocarditis
	  • One in group C, received teeth extractions before surgery
	  • One in group A, had asymptomatic deeply carious tooth without a periapical radiolucency, not treated before surgery
	• One patient in group C had multiple teeth extracted prior to surgery and developed infective endocarditis 8 months after surgery
	• Chi-square analyses showed no significant difference between groups in the incidence of infective endocarditis
	
	Six-month survival
	• Group A vs. group B+C: 10 deaths vs. 5 deaths, $X^2 = 2.92$, p=0.09, not significant
	• Group A vs. group B vs. group C: 10 deaths vs. 1 death vs. 4 deaths, $X^2 = 3.20$, p=0.20, not significant
		"there is no need to treat chronic oral infections in patients with compromised cardiac function within 24 to 48 hours prior to cardiac valve replacement surgery since this will not lower the risk of infective endocarditis and death following cardiac valve surgery" p.65