Impact of Smoking Cessation Counseling Prior to Total Joint Arthroplasty

Sina Akhavan, MD; Long-Co Nguyen, BA; Vanessa Chan, MPH; Jamal Saleh, BS; Kevin J. Bozic, MD, MBA

Abstract

Perioperative smoking has been linked to surgical complications including poor wound healing, infection, myocardial infarction, prolonged length of stay, need for mechanical ventilation, and death. This study evaluated the effectiveness of preoperative counseling on smoking cessation for patients undergoing elective total joint arthroplasty. Thirty smokers with hip or knee osteoarthritis seeking hip or knee replacement surgery were enrolled prospectively. Interventions included counseling, referrals to smoking cessation programs including the California Smokers’ Helpline and the Fontana Tobacco Treatment Program, nicotine replacement therapy (NRT), or instructing patients quit through the “cold turkey” method of abstinence. Patients were scheduled for surgery if they demonstrated abstinence from smoking, confirmed via expired carbon monoxide (CO) breath testing. Short- and long-term smoking cessation rates were evaluated. Thirty patients were enrolled; 21 patients (70%) passed the CO test, whereas 9 patients (30%) failed or did not follow up with a CO test. Thirteen of 21 patients (62%) quit using the “cold turkey” method, 5 of 21 patients (24%) quit using NRT, and 3 of 21 patients (14%) quit using outpatient treatment programs. Eighteen of 21 patients (86%) who quit smoking underwent surgery, and 14 patients had surgery within 6 months of smoking abstinence. Nine of the 14 patients (64%) remained smoke-free 6 months postoperatively confirmed through telephone questionnaire. These results suggest that elective surgery offers a strong incentive for patients to quit smoking, and surgeons can play a role offering a teachable moment and motivating this potentially life-altering behavioral change. [Orthopedics. 2017; 40(2):e323-e328.]

Total hip arthroplasty (THA) and total knee arthroplasty (TKA) are among the most common inpatient surgical procedures in the United States.1 These procedures generally are quite effective in terms of improving physical function and health-related quality-of-life dimensions in patients who suffer from disabling hip and knee arthritis.2 However, individual patients still have complications and poor outcomes after surgery.3-5 Studies have shown the importance of biomedical, behavioral, and psychosocial factors on recovery after joint replacement, but these factors do not fully account for the variability in outcomes.2,6-9

Perioperative smoking is linked to many surgical complications including wound infection, respiratory failure, cardiac arrest, myocardial infarction, prolonged hospital stay, stroke, sepsis, and shock.10 Smokers also are more likely to experience pneumonia, unplanned intubation, mechanical ventilation, and death. Several studies have demonstrated smoking is associated with a significantly higher risk of postoperative complication and mortality following TKA or THA.11-13

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In a retrospective analysis of 33,336 patients at Veterans Affairs facilities, Singh et al. found smokers undergoing TKA or THA had higher rates of pneumonia, surgical site infections, stroke, and mortality than patients who had never smoked. Lindsay et al. suggested that failing to quit smoking before arthroplasty surgery was comparable to omitting antibiotic prophylaxis in terms of risk of complications. Khullar and Maa reported that surgeons at Veterans Affairs facilities, Singh et al. found that 4 to 8 weeks of smoking abstinence substantially reduces perioperative complications and the need for repeat surgery.

A key component of determining whether a patient has abstained from smoking is measuring exposure. Self-reports of smoking are accurate in most studies, but to improve reliability and validity, biochemical assessment should be considered. Cotinine, a metabolite of nicotine, is the most widely used biochemical measure of tobacco use and can be measured in blood, saliva, or urine. It is quite specific for use of tobacco or for use of nicotine-containing medications. Although cotinine is an excellent biomarker for tobacco use, it is not a valid marker in individuals using nicotine replacement therapy (NRT) such as gum, transdermal patches, nasal sprays, or inhalers. There is no evidence suggesting the use of NRT among abstinent smokers has a detrimental effect on postoperative outcome.

Growing evidence suggests that quitting smoking before surgery significantly reduces the risk of perioperative complications, potentially leading to long-term benefits of smoking abstinence. Given the relatively short half-lives of nicotine and carbon monoxide (CO), there is good reason to believe that even brief abstinence can be beneficial, especially for cardiovascular complications. Most trials have found that 4 to 8 weeks of smoking abstinence substantially reduces perioperative complications and the need for repeat surgery.

Exhaled CO is a simple, reliable method for testing recent tobacco smoke and is a good indicator for carboxyhemoglobin in blood. The presence of CO in exhaled air suggests current tobacco smoking, irrespective of whether the individual is on NRT. The purpose of this study was to evaluate the effectiveness of having a surgeon counsel smokers about the benefits of smoking cessation prior to elective THA or TKA.

**Materials and Methods**

After receiving institutional review board approval for this prospective cohort study, 30 patients who self-identified as current smokers and were candidates for elective THA or TKA provided informed consent and were enrolled in the study. At patients’ initial clinic visit, the surgeon explained that as part of preoperative optimization, due to the risk of complications, patients must stop smoking prior to surgery. Patients who elected to participate in the study received a 1-page handout with information on the many negative impacts associated with smoking and surgical outcomes.

Patients were asked to complete a 1-page questionnaire specific to their smoking history (Figure 1). In addition, patients were given several resources to aid them with smoking cessation and were encouraged to use any and all resources to help them stop smoking. One resource was a card for a Tobacco Treatment Center that offered a stop-smoking group program meeting once weekly for 2 hours for 4 consecutive weeks. The weekly sessions covered issues related to smoking, health, information about medications, addiction and the brain, and tools for building motivation. The classes were led by health care professionals with years of experience helping smokers to stop smoking.

Participants also were given an information card for the California Smok-
ers’ Helpline, 1-800-NO-BUTTS, which is a free statewide quit smoking service operated by the University of California San Diego’s Moores Cancer Center. The Helpline provides self-help materials, referral to local programs, and one-on-one telephone counseling to quit smoking. Helpline services have been proven in clinical trials to double a smoker’s chances of successfully quitting.31

Finally, patients were encouraged to make an appointment with their primary care physician to discuss NRT and pharmacologic medication to aid with quitting. NRT increases the likelihood of quitting smoking and involves the use of products that provide low doses of nicotine but do not contain the toxins found in smoke. The goal of therapy is to relieve cravings for nicotine and ease the symptoms of stopping cigarette use.32

Patients returned 8 weeks after their initial visit, and their expired CO was measured. The CO in each patient’s breath was tested using a standard calibrated CO gas-monitoring device connected to a disposable mouthpiece. When measuring CO levels, patients were instructed to blow into the mouthpiece for approximately 5 seconds. The presence of CO greater than 6 parts per million in the exhaled breath suggested recent tobacco smoke. During this visit, patients also were asked to complete a brief 1-page questionnaire specific to their attempt to quit smoking (Figure 2). Six months after their surgery, patients were asked via telephone to complete a brief questionnaire regarding their smoking status (Figure 3). The primary outcome of this study was the proportion of study participants who achieved smoking cessation as defined by a negative exhaled CO test.

### RESULTS

A total of 30 patients (16 men and 14 women) were enrolled in the study. Average patient age was 54.4 years. At the time they started smoking, 5 patients (17%) were 12 years or younger, 12 patients (40%) were 13 to 18 years old, 7 patients (23%) were 19 to 22 years old, 3 patients (10%) were 23 to 30 years old, and 3 patients (10%) were 31 to 40 years old. The average number of years patients smoked was 34.64 years, and the average number of cigarettes smoked per day was 11 (median, 10) (Table 1).

In the 30 days before enrollment in the study, 73% of patients had been smoking daily. The average number of quit attempts was 3.8. Twenty-one of 30 patients (70%) passed the CO test at a follow-up visit prior to scheduling surgery. Of the 21 patients who passed the CO test, 18 patients (86%) passed it on their first at-

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**Table 1**

<table>
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<th>Demographic</th>
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<td>Age, average, y</td>
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<tr>
<td>Male</td>
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<td>Female</td>
<td>14</td>
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<tr>
<td>Smoking, average, y</td>
<td>34.64</td>
</tr>
<tr>
<td>Quit attempts, average, No.</td>
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</tbody>
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Figure 2: Follow-up visit smoking survey.

Figure 3: Second follow-up visit smoking survey.
The current study’s preoperative setting, therefore, appears to be a window of opportunity that should be capitalized on by health providers.

In the current study, 70% of patients who received brief counseling with information regarding the effects of smoking on postoperative recovery as well as referral to a telephone counseling hotline and local tobacco treatment center prior to setting a surgical date were able to quit smoking. Perioperative smoking cessation studies in various surgical specialties have reported various success rates depending on the intensity of the intervention. A 2005 Cochrane Review of interventions of perioperative smoking found cessation rates ranging from 64% to 89%.

A 2014 Cochrane Review further provided promising results by reporting a pooled relative risk (RR) of 10.76 (95% confidence interval [CI], 4.55-25.46) for smoking cessation prior to surgery using intensive interventions compared with control groups, with the cessation rate of the intervention group ranging from 40% to 64%. The pooled estimate, however, for the trials using brief interventions was smaller, with an RR of 1.47 (95% CI, 1.27-1.70).

Lee et al used a brief intervention similar to the current study (counseling prior to surgery and NRT) and reported a 14% cessation rate in their intervention arm. Intensive interventions included weekly meetings, telephone counseling, face-to-face counseling, and tailored self-help materials. The current study’s design of providing patients with educational material and referral for smoking cessation counseling was considerably less intensive, yet similar smoking cessation rates were observed to those that used more intensive interventions.

Possible reasons for the observed success rates in the current study may involve the approach. Unlike other similar interventions used in prior studies, the participants in the current study were not sched-

### Table 2

<table>
<thead>
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<tr>
<td>“Cold turkey”</td>
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</tr>
<tr>
<td>Nicotine replacement therapy</td>
<td>5</td>
</tr>
<tr>
<td>Fontana Treatment Center</td>
<td>1</td>
</tr>
<tr>
<td>California Smokers’ Helpline</td>
<td>1</td>
</tr>
<tr>
<td>E-cigarettes</td>
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</tbody>
</table>

e-cigarettes, and 1 patient quit using the California Smokers’ Helpline (Table 2).

Of the 18 patients who had surgery, 14 patients (78%) underwent surgery before June 2014 and were contacted 6 months postoperatively. Of these 14 patients, 9 patients (64%) reported continued abstinence from smoking 6 months postoperatively; all 9 of these patients said that they planned to continue to refrain from smoking. The remaining 5 patients (36%) reported they had started smoking again at 6 months postoperatively; however, 3 patients reported they had reduced the number of cigarettes smoked per day to at least half the number they smoked prior to enrollment in the study.

### DISCUSSION

The preoperative context offers an appealing opportunity for smoking cessation; it provides unique motivators, a favorable environment, and a tangible incentive to quit smoking. The potential smoking-related risks of anesthesia and surgery, along with its possible adverse effects on recovery, may serve as a powerful inducement for patients to stop smoking. Wolfenden et al identified 3 characteristics that make preoperative clinics a favorable setting for smoking cessation interventions: (1) smoking behavior questions are a part of standard preoperative assessment, (2) patients are in consistent contact with many different health professionals who can deliver smoking cessation advice, and (3) patients have continued contact with health professionals long after surgery, allowing for ongoing support.

The preoperative setting, therefore, appears to be a window of opportunity that should be capitalized on by health providers.

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![Figure 4: Patient flowchart.](Image 41x560 to 370x695)
uled for surgery unless they had a negative CO test, indicating a smoke-free state. Patients who failed the CO test were asked to return in 6 to 8 weeks for a subsequent CO test before surgical scheduling.

If surgeons recommend against surgery in patients who are smokers, patients may gain a stronger appreciation of the surgical risks that smoking could impose on them. Patients also may sense commitment from the surgeon to their general health maintenance as well as their musculoskeletal disease, thus feeling more compelled to commit to enhance their own well-being. The intervention used in the current study was not the first time any of the participants attempted to quit; most of the patients had attempted to quit approximately 4 times, which may have facilitated the process of smoking abstinence prior to surgery.

A strength of the current study is that the approach was pragmatic and inexpensive. This model for smoking cessation can easily be adopted by community orthopedic surgeons; by implementing a simple education and referral protocol, patients are informed and motivated to quit smoking prior to surgery and to stay smoke-free after their surgery.

Although many studies have demonstrated that preoperative smoking cessation is effective in helping patients to stop smoking in the short-term, there are only a few studies with long-term follow-up. In the current study, 64% patients who underwent surgery remained smoke-free for up to 6 months after their surgery and 60% of patients who returned to smoking had markedly reduced the amount smoked, which is higher than the reported rates of studies that examined long-term cessation rates. Myles et al reported that only 8% of enrolled patients continued to abstain from smoking at 6 months postoperatively. Ratner et al reported a 31.2% continued abstinence rate at 6 months after surgery. Such conflicting findings require further long-term studies and suggest that additional smoking cessation support should be made available after surgery in an effort to improve long-term cessation rates.

Perioperative smoking cessation has been proven to be critical in reducing surgical complications. In a Swedish study, researchers observed that 40% of patients who underwent elective surgery (orthopedic and general surgery) were able to quit smoking at least 3 weeks before their procedure, with complication rates of 41% in the control arm and 21% in the intervention arm. In a randomized clinical trial, 36 of 60 patients were able to quit smoking 6 to 8 weeks prior to surgery with complication rates of 18% in the intervention group compared with 4 of 60 patients who quit smoking in the control arm, which had a complication rate of 52%. Interestingly, this reduction in postoperative smoking-related complications was observed only in trials using intensive interventions. In a Cochrane review, intensive smoking cessation intervention resulted in a pooled relative risk of 0.70 (95% CI, 0.56-0.88) for developing any postoperative complication compared with controls; however, there was no difference in postoperative complications in a pooled group of studies using less intensive interventions. Although the current study demonstrated a fairly high rate of smoking cessation, postoperative complications were not assessed. Further studies are needed to assess the effect of simpler smoking cessation interventions on postoperative complications.

The health problems associated with smoking have estimated costs of approximately $96 billion in direct medical expenses and $97 billion in cost of workdays lost and productivity every year in the United States. Dimick et al estimated that the pulmonary complications alone associated with perioperative smoking result in an additional cost of $52,000 per surgical episode. In an already stressed health care system, seizing the opportunity to provide smoking cessation interventions would be of great benefit to society.

However, actual implementation has been poor. Shannon-Cain et al found surgical patients were not routinely informed of the risk of tobacco use or the potential benefit of abstinence prior to surgery. Owen et al found patients generally were not referred preoperatively to smoking cessation services, and nonvascular surgeons underestimated the potential benefit of preoperative smoking cessation on postoperative outcome. Given the unique opportunities that surgeons have to promote smoking cessation among potential elective surgical candidates, approaches for delivery of preoperative smoking interventions that address implementation barriers are needed. The current authors’ approach suggests even a relatively simple counseling session by the surgeon may improve smoking behaviors.

Limitations of the current study include the small number of patients. There also was no control group that received only standard care without any smoking counseling. In addition, smoking status follow-up at 6 months was not verified by a CO breath test but rather was ascertained by a phone interview. Another limitation is the generalizability of the study; all data were derived from the patients of surgeons in a tertiary referral academic center where patients may be committed to receiving surgery from that surgeon alone.

**Conclusion**

The perioperative period remains a critical opportunity to promote smoking cessation. Not only does smoking cessation reduce postoperative surgical complications, it also improves the overall health status of patients. The partnership created by committing to general wellness in addition to orthopedic wellness during this “teachable moment” in a patient’s care exemplifies ways orthopedic surgeons can play an important role in improving the overall health and wellness of the patients they treat.
Feature Article

References


