

# Does smoking increase the incidence of postoperative complications in simple exodontia?

Marcelo Carlos Bortoluzzi<sup>1</sup>, Diogo Lenzi Capella<sup>2</sup>, Tharzon Barbieri<sup>2</sup>, Sabrina Marchetti<sup>2</sup>, Camila P. Dresch<sup>2</sup> and Claiton Tirello<sup>2</sup>

<sup>1</sup>Health Bioscience Postgraduate Programme, Tissue Aspects for Health Prognosis and Intervention Laboratory (LAPROG), School of Dentistry, University of Western Santa Catarina (Universidade do Oeste de Santa Catarina, UNOESC), Joaçaba, Santa Catarina, Brazil; <sup>2</sup>School of Dentistry, UNOESC, Joaçaba, Santa Catarina, Brazil.

**Objective:** To investigate whether smoking has adverse effects in simple exodontia. **Methods:** A single-centre, prospective study of postoperative inflammatory complications in simple exodontia was performed. All procedures were conducted under similar and sterile conditions. Postoperative complications (PCs) in exodontia were classified as alveolar osteitis (AO) or alveolar infection (AI) and their incidences then added. **Results:** A logistic regression model for PCs revealed tooth sectioning [odds ratio (OR) = 4.3, 95% confidence interval (CI) 1.0–18.8;  $P = 0.050$ ], smoking (OR = 4.5, 95% CI 1.0–18.9;  $P = 0.03$ ) and amount of smoking (> 20 cigarettes/day: OR = 12.3, 95% CI 1.0–149.8;  $P = 0.04$ ) to be associated with the occurrence of PCs. **Conclusions:** Tooth sectioning, smoking and degree of smoking are all associated with the development of PCs such as AO and AI after simple exodontia. Dentists must be alert to these factors when performing simple exodontia in smokers in view of the increased risk for PCs.

**Key words:** Alveolar osteitis, dental infection, smoking

Tobacco smoking is widely documented to have several adverse effects and has been implicated in several diseases, mainly those of the cardiovascular and respiratory systems. It is also considered to be associated with surgical outcome and the development of complications during and after many types of surgery<sup>1,2</sup>. The relative risk for complications after surgery is reported to be 1.2–5.5 times greater in smokers than in non-smokers<sup>2</sup>.

Although it is well documented that smoking has deleterious effects in many types of surgery, little recent information is available on whether it has any impact in uncomplicated exodontia<sup>3</sup>.

## METHODS

This research was conducted in full accordance with the World Medical Association Declaration of Helsinki and was approved by the university's Ethical Committee for Human Research [Comitê de Ética em Pesquisa em Seres Humanos e Animais da Unoesc e Hust, Universidade do Oeste de Santa Catarina (<http://unoesc.edu.br/unoesc/pesquisa/comite-de-etica-em-pesquisa>); no. 250/2005]. All participants gave signed informed consent. A single-centre, prospective study of

postoperative inflammatory complications in simple and erupted teeth exodontia was performed. All procedures were conducted by undergraduate students under similar conditions between March 2007 and December 2011. Data were collected using questionnaires administered to patients and to the students who performed the procedures. Questionnaires were completed before, immediately after and 7 days after surgery. Patients were reassessed at 7 days postoperatively or before or after this date as necessary. All procedures were performed in sterile conditions, which included the use of sterile surgical aprons, sheets and gloves. Extractions of third molars that had not fully erupted and/or were classified as difficult for undergraduate students to remove and extractions of deciduous teeth were excluded from this study.

Postoperative complications (PCs) after exodontia were first classified as either alveolar osteitis (AO) or alveolar infection (AI) and were then combined. Criteria for AO and AI were based on clinical conditions previously described by several authors<sup>4–7</sup>.

Statistical analyses were conducted using standard logistic regression in STATA Version 8.0 (StataCorp LP, College Station, TX, USA) to compute odds ratios (ORs),  $P$ -values and 95% confidence intervals (CIs).

## RESULTS

This study prospectively evaluated 793 surgical procedures to remove a total of 1,022 permanent erupted teeth. The sample was composed predominantly of male patients ( $n = 456$ , 57.5%). A total of 62 questionnaires were excluded as a result of lack of information, inconsistency or lack of contact with the patient; none of these questionnaires referred to patients with any PC. The mean  $\pm$  standard deviation (SD) age of the patients was  $41.6 \pm 16.0$  years (range: 9–85 years). The mean  $\pm$  SD time taken to accomplish the surgical procedure from local anaesthesia to final suture was  $41.8 \pm 25.9$  min.

A total of 185 (23.3%) of the sample were smokers. Of these, 160 patients smoked  $\leq 20$  cigarettes/day and 25 smoked  $> 20$  cigarettes/day. Postoperative complications occurred in 10 patients (1.3%); AO was diagnosed in four patients (0.5%) and AI in six (0.8%).

A binary logistical model was created to evaluate several variables of interest (Table 1).

## DISCUSSION

Given that simple tooth extraction is one of the most common oral surgical procedures, it is surprising that the literature gives very little attention to the subsequent occurrence of PCs; this may be because PCs in this context are uncommon, although not rare. This

study recorded a PC rate of 1.3%, whereas Adeyemo *et al.*<sup>5</sup> observed an overall PC rate of 10.5% (AO, 8.6%; AI, 1.9%) in non-surgical dental extractions. Oginni *et al.*<sup>8</sup> reported the development of PCs (only AO) in 4.1% of 3,319 dental extractions. In third molar surgeries, Haug *et al.*<sup>9</sup> observed a PC rate of 15.9% (AO, 14.7%; AI, 1.2%).

In oral surgery, smoking has been associated with the occurrence of PCs (AO) mainly in the context of dental extractions<sup>4,10,11</sup>. Smoking has also been associated with an increased risk for severe discomfort after third molar surgery<sup>12</sup> and increased levels of pain in periapical surgery<sup>13</sup>. However, this has been subject to discussion since Al-Khateeb and Alnahar<sup>14</sup> observed that non-smokers reported significantly higher pain scores than smokers. Although some authors have reported an association between smoking and PCs<sup>4,10,11</sup>, others have not<sup>15,16</sup>. Nusair and Goussous<sup>17</sup> found no difference in the rate of socket healing between smokers and non-smokers.

Heng *et al.*<sup>10</sup> assessed the association of smoking with the occurrence of PCs, including pain, swelling, bleeding and AO, and found smoking to be related to increases in these PCs after dental extraction. Al-Belasy<sup>11</sup> observed an increased rate of PCs (AO) following the extraction of mandibular molars in water pipe smokers compared with non-smokers (26% vs. 7%) and, similarly, found the incidence of AO to be higher in cigarette smokers than in non-smokers (16%

**Table 1** Standard binary logistic model including variables for postoperative complications (alveolar osteitis + alveolar infection) after simple exodontia ( $n = 793$ )

	Postoperative complication		P-value*	OR <sub>adjusted</sub>	95% CI for OR
	No, n (%)	Yes, n (%)			
Gender					
Male	452 (57.0)	4 (0.5)			
Female	331 (41.7)	6 (0.8)	0.2	2.5	0.5–13.3
Age, years					
$\leq 33$	265 (33.4)	6 (0.8)	0.4	3.9	0.3–39.6
34–47	260 (32.8)	3 (0.4)	0.2	1.9	0.1–19.9
$\geq 48$	258 (32.5)	1 (0.1)	0.5		
Tobacco					
User ( $\leq 20$ cigarettes/day)	156 (17.7)	4 (0.5)	<b>0.04</b>	4.5	1.0–18.9
User ( $> 20$ cigarettes/day)	24 (3.0)	1 (0.1)	<b>0.03</b>	12.3	1.0–149.8
Non-user	603 (76.0)	5 (0.6)	<b>0.04</b>		
Oral contraceptive					
Yes	99 (12.5)	3 (0.4)		1.8	0.3–10.7
No	684 (86.3)	7 (0.9)	0.5		
Ostectomy					
Yes	93 (11.7)	4 (0.5)		1.5	0.2–8.0
No	690 (87.0)	6 (0.8)	0.6		
Tooth sectioning					
Yes	93 (11.7)	4 (0.5)		4.3	1.0–18.8
No	690 (87.0)	6 (0.8)	<b>0.050*</b>		
Duration of surgery					
$\leq 25$ min	233 (29.4)	2 (0.3)		0.7	0.1–3.8
$> 25$ min	550 (69.4)	8 (1.0)	0.7		
Intraoperative complications (e.g. tooth fracture)					
Yes	63 (7.9)	2 (0.3)		1.8	0.2–11.6
No	720 (90.8)	8 (1.0)	0.5		

\*Values in bold are significant at  $P \leq 0.05$ .

OR, odds ratio; 95% CI, 95% confidence interval.

vs. 7%). In general, this study's findings support the evidence that smoking cigarettes may increase the risk for PCs following simple tooth extraction.

Smoking has been associated with delayed wound healing as a result, in part, of the actions of nicotine as a vasoconstrictor and promoter of platelet adhesiveness and thrombotic microvascular occlusion, all of which contribute to tissue ischaemia<sup>18</sup>. With regard to bone regeneration, nicotine has been shown to inhibit osteogenesis, vascularity and bone lengthening in mandibular distraction angiogenesis in an animal model<sup>19</sup>.

The present study also identified an association of borderline statistical significance between tooth sectioning and increased risk for PCs. This may be explained by an increase in surgical trauma as 41.2% of the patients who underwent tooth sectioning also underwent ostectomy. In a recent review article, Noroozi and Philbert<sup>20</sup> declared that the majority of the literature supports a link between the development of PCs such as AO and increased surgical trauma. According to Blum<sup>4</sup>, it seems logical that fragments of debris that remain after normal extraction or the surgical removal of teeth may disturb the wound-healing process and thereby possibly contribute to the development of PCs in the form of AO.

## CONCLUSIONS

This study found that tooth sectioning, smoking and degree of smoking (especially > 20 cigarettes/day) are each associated with the development of PCs such as AO and AI after simple exodontia.

## Acknowledgements

The authors wish to thank the Fundação de Apoio a Pesquisa Científica e Tecnológica do Estado de Santa Catarina (FAPESC) and the Universidade do Oeste de Santa Catarina for partial financial support of this research.

## Conflicts of interest

None declared.

## REFERENCES

1. Lotfi CJ, de Cavalcanti C, Costa e Silva AM *et al.* Risk factors for surgical site infections in head and neck cancer surgery. *Otolaryngol Head Neck Surg* 2008 138: 74–80.
2. Gourgiotis S, Aloizos S, Aravosita P *et al.* The effects of tobacco smoking on the incidence and risk of intraoperative and postoperative complications in adults. *Surgeon* 2011 9: 225–232.
3. Bortoluzzi MC, Manfro R, De Déa BE *et al.* Incidence of dry socket, alveolar infection, and postoperative pain following the extraction of erupted teeth. *J Contemp Dent Pract* 2010 11: E033–E040.
4. Blum IR. Contemporary views on dry socket alveolar osteitis: a clinical appraisal of standardisation, aetiopathogenesis and

management: a critical review. *Int J Oral Maxillofac Surg* 2002 31: 309–317.

5. Adeyemo WL, Ogunlewe MO, Ladeinde AL *et al.* Are sterile gloves necessary in non-surgical dental extractions? *J Oral Maxillofac Surg* 2005 63: 936–940.
6. Poeschl PW, Eckel D, Poeschl E. Postoperative prophylactic antibiotic treatment in third molar surgery – a necessity? *J Oral Maxillofac Surg* 2004 62: 3–8.
7. Arteagoitia I, Diez A, Barbier L *et al.* Efficacy of amoxicillin/clavulanic acid in preventing infectious and inflammatory complications following impacted mandibular third molar extraction. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2005 100: 11–18.
8. Oginni FO, Fatusi OA, Alagbe AO. A clinical evaluation of dry socket in a Nigerian teaching hospital. *J Oral Maxillofac Surg* 2003 61: 871–876.
9. Haug RH, Perrott DH, Gonzalez ML *et al.* The American Association of Oral and Maxillofacial Surgeons age-related third molar study. *J Oral Maxillofac Surg* 2005 63: 1106–1114.
10. Heng CK, Badner VM, Clemens DL *et al.* The relationship of cigarette smoking to postoperative complications from dental extractions among female inmates. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2007 104: 757–762.
11. Al-Belasy FA. The relationship of 'shisha' (water pipe) smoking to post-extraction dry socket. *J Oral Maxillofac Surg* 2004 62: 10–14.
12. Grossi GB, Maiorana C, Garramone RA *et al.* Assessing post-operative discomfort after third molar surgery: a prospective study. *J Oral Maxillofac Surg* 2007 65: 901–917.
13. García B, Penarrocha M, Martí E *et al.* Pain and swelling after periapical surgery related to oral hygiene and smoking. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2007 104: 271–276.
14. Al-Khateeb TH, Alnahr A. Pain experience after simple tooth extraction. *J Oral Maxillofac Surg* 2008 66: 911–917.
15. Bergdahl M, Hedstrom L. Metronidazole for the prevention of dry socket after removal of partially impacted mandibular third molar: a randomised controlled trial. *Br J Oral Maxillofac Surg* 2004 42: 555–558.
16. Oginni FO. Dry socket: a prospective study of prevalent risk factors in a Nigerian population. *J Oral Maxillofac Surg* 2008 66: 2290–2295.
17. Nusair YM, Goussous ZM. Quantifying the healing of dry socket using a clinical volumetric method. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2006 101: 89–95.
18. Silverstein P. Smoking and wound healing. *Am J Med* 1992 93 (Suppl): 22–24.
19. Glowacki J, Schulten AJ, Perrott D *et al.* Nicotine impairs distraction osteogenesis in the rat mandible. *Int J Oral Maxillofac Surg* 2008 37: 156–161.
20. Noroozi AR, Philbert RF. Modern concepts in understanding and management of the 'dry socket' syndrome: comprehensive review of the literature. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2009 107: 30–35.

Correspondence to:  
Marcelo Carlos Bortoluzzi,  
Faculdade de Odontologia,  
Universidade do Oeste de Santa Catarina (UNOESC),  
Av. Getúlio Vargas,  
2125 – Bairro Flor da Serra,  
Joaçaba, Santa Catarina,  
CEP 89600-000 Brazil.  
Email: mbortoluzzi@gmail.com,  
marcelo.bortoluzzi@unoesc.edu.br