Available online at www.sciencedirect.com
ScienceDirect
British Journal of Oral and Maxillofacial Surgery xxx (2017) xxx–xxx
BRITISH Journal of Oral and Maxillofacial Surgery
www.bjoms.com

Fate of mandibular canals displaced by enlarged cystic lesions: does the inferior alveolar neurovascular bundle relocate to its original position?

Y.-S. Han [a,b,1], H. Lee [a,b,1], B.-M. Seo [b,*]

[a] *Department of Oral and Maxillofacial Surgery, SMG-SNU Boramae Medical Center, Seoul, Republic of Korea*
[b] *Department of Oral and Maxillofacial Surgery, School of Dentistry and Dental Research Institute, Seoul National University, Seoul, Republic of Korea*

Accepted 21 February 2018

Abstract

Our aim was to identify the positional changes of the inferior alveolar neurovascular bundle and evaluate the relocation of the displaced mandibular canal after enucleation of a cyst. Seventy patients (72 sites) who had had cysts enucleated were divided into three groups based on the degree of encroachment of the cystic lesion into the mandibular canal and whether a bone graft had been inserted after the cyst had been enucleated. The mean (range) of patients' ages was 45 (18–75) years, and there were 29 male and 41 female patients. Group A comprised cysts with encroachment on the mandibular canal that were enucleated without a bone graft; Group B consisted of cysts with no encroachment of the mandibular canal, but were enucleated without a bone graft; and Group C comprised cysts with encroachment of the mandibular canal that were enucleated with a bone graft. The displacement of the mandibular canal was identified from analysis of computed tomographic (CT) images. Changes in the position of the mandibular canal were measured on panoramic radiographs. The mandibular canal was repositioned superiorly by a mean (SD) of 2.4 (1.65) mm after enucleation of the cyst, which was significant in Group A ($p < 0.001$), but not in Groups B and C. These results indicate that the displaced inferior alveolar neurovascular bundles that were not surrounded by bony canal tended to relocate towards a supposedly normal position, and after enucleation of the cyst the mandibular canal was remodelled in this new location. This tendency to relocate was blocked by bone grafting. Bone grafts are therefore recommended in cases where enough bony height is required for future insertion of implants.

Keywords: Mandibular cysts; Mandibular canal; Inferior alveolar neurovascular bundle; Displacement; Relocation

Introduction

Cysts are often encountered in the oral and maxillofacial area, and those that develop in the jaw bone are cavities that include fluid or semifluid materials surrounded by an epithelial lining. Cystic fluid has a higher osmotic pressure than the surrounding environment, which results in the inflow of tissue fluids into the cystic cavity. This causes the size of the cyst to increase, thereby displacing or destroying the neighbouring hard tissue.[1–3]

Cysts in the mandible displace the adjacent teeth and the mandibular canal, or encroach on the cortical lining of the canal. Although some reports insist that the cause of damage to the inferior alveolar nerve (IAN) is the high pressure exerted on the nerve by an enlarging cyst,[4,5] this may not be

* Corresponding author at: Department of Oral and Maxillofacial Surgery, School of Dentistry and Dental Research Institute, Seoul National University, 101 Daehak-ro, Jongno-Gu, Seoul 03080, Republic of Korea.
Tel.: +82 2 2072 3369; Fax: +82 2 766 4948.
E-mail address: seobm@snu.ac.kr (B.-M. Seo).
[1] The first two authors (Yoon-Sic Han and Ho Lee) contributed equally to this work.

https://doi.org/10.1016/j.bjoms.2018.02.013
0266-4356/

the true cause of dysfunction of the IAN. Rather, infection of the cyst or surgical trauma may be responsible.

Many reports have emphasised the importance of complete removal of the cyst, protection of the adjacent structures such as teeth, IAN, maxillary sinus, and floor of the nasal cavity, and prevention of recurrence of the cyst.[6–8] Few reports have presented morphological or positional changes of adjacent, anatomically important structures over time after enucleation of the cyst.[9,10]

The purpose of this study was to identify the changes in position of the inferior alveolar neurovascular bundle after enucleation of the cyst, and the specific aim was to evaluate the pattern of displacement of the mandibular canal by cysts and the repositioning of the mandibular canal after enucleation. We hypothesised that the displaced mandibular canal would be relocated toward the supposedly normal position after enucleation, which would eliminate compression by cysts. More specifically, we wanted to identify the influences of the intact mandibular canal cortex and the bone graft after enucleation in the relocation of the mandibular canal.

Patients and methods

Design of study

Patients with mandibular cysts who had them enucleated between 2006 and 2015 at two university hospitals were included in this retrospective cohort study (IRB No. S-D20150027 at SNU, IRB No. 20161101/26-2016-152/112 at SMG-SNU Medical Center). Patients under the age of 18 were excluded to rule out the influence of mandibular growth. Recurrent cysts were also excluded. All patients who had their cysts enucleated were followed up for five years to rule out recurrence. To analyse changes in the pattern and formation of bone, patients were included in the study if they had had postoperative panoramic radiographs taken after at least 12 months. Postoperative biopsies were taken and all cysts were diagnosed histopathologically.

The subjects were divided into three groups: Group A comprised patients with cysts that encroached on the mandibular canal (a discontinuity in the bony inferior alveolar canal caused by the invasion of the cystic lesion), which were enucleated without a bone graft (Fig. 1); Group B comprised patients with cysts that did not encroach on the mandibular canal, and were enucleated without a bone graft (Fig. 2); and Group C comprised cysts that did encroach on the mandibular canal, and were enucleated with a bone graft (Fig. 3). Cysts that did not encroach on the mandibular canal but were enucleated with a bone graft were excluded because there were too few for analysis.

Assessment and measurement of radiographic images

To compare the infection rates in the groups who did and did not have bone grafts, we evaluated suppuration, wound dehiscence, swelling, and tenderness to palpation at the site of operation during follow-up periods.

Each subject had computed tomography (CT) preoperatively. The images were used to assess the site and size of cysts, and the position of the mandibular canals relative to the cysts. Cystic encroachment and displacement of the mandibular canals were also recorded. In some cases in Group B there was clear distance from the mandibular canal on the panoramic radiograph, and these did not have CT preoperatively.

All panoramic radiographs were taken before and after operation with the head in standard positions using the same type of radiographic machine (OP100, Instrumentarium Co., Tuusula, Finland) and the same value set. To identify the distortions of the anatomical structures and the position of the mandibular canal on the images, the height of the mandibular canal (C) and three lengths (L1, L2, L3) were measured according to the following criteria (Fig. 1A): first, the height of the mandibular canal (C), which was the height from the lower cortex of the mandibular canal to the mandibular lower border parallel to L1, L2, and L3. Secondly, L1 was the length from the tip of the cusp to the apex of the root of the tooth adjacent to the cyst. Thirdly, L2 was the length from the apex of the root of the adjacent tooth to the mandibular lower border that extended from L1. Finally, L3 was the length from the distal cementoenamel junction of the tooth adjacent to the cyst to the mandibular lower border, in parallel with L1 and L2.

All measured data were recalculated in accordance with the actual size, with reference to 130% magnification. One investigator (first author) graded and measured the radiographs in this study. To evaluate intraclass correlation coefficients (ICC), 20 of the 72 subjects were randomly selected and measured twice with a 10-week interval.

Statistical analysis

As the data were normally distributed with homogeneity of variance, the significance of differences between results was assessed using analysis of variance or the Kruskal–Wallis test. The significance of changes in the height of the mandibular canal before and after operation were assessed using the Wilcoxon signed rank test or a paired *t* test.

The postoperative changes in the height of the mandibular canal were the primary outcome variable. Multiple linear regression analysis was used to identify variables that had a significant influence on the postoperative changes in the height of the mandibular canal. The independent variables were the patients' sex and age, pathological diagnosis, and group (encroachment compared with no encroachment on the canal or bone graft).

All data analyses were made with the help of IBM SPSS Statistics for Windows, (version 22, IBM Corp, Armonk, NY, USA). Probabilities of less than 0.05 were accepted as significant.

Please cite this article in press as: Han Y-S, et al. Fate of mandibular canals displaced by enlarged cystic lesions: does the inferior alveolar neurovascular bundle relocate to its original position? *Br J Oral Maxillofac Surg* (2017), https://doi.org/10.1016/j.bjoms.2018.02.013