

Periodontal health of palatally displaced canines treated with open or closed surgical technique: A multicenter, randomized controlled trial

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Introduction: The aim of this study was to investigate differences in the periodontal outcomes of palatally displaced canines (PDC) exposed with either an open or a closed surgical technique. **Methods:** A multicenter, randomized controlled trial was undertaken in 3 hospitals in the United Kingdom, involving 2 parallel groups. Patients with unilateral PDC were randomly allocated to receive either an open or a closed surgical exposure. Periodontal health was assessed 3 months after removal of fixed appliances. Parameters measured included clinical attachment levels, recession, alveolar bone levels, and clinical crown height. **Results:** Data from 62 participants (closed, 29; open, 33) were analyzed. There was no difference between PDC exposed with an open vs a closed surgical technique (mean difference, 0.1 mm; 95% confidence interval [CI], -0.2-0.5). There was, however, a statistical difference in mean attachment loss between the operated and unoperated (contralateral) canines (mean difference, 0.5 mm; 96% CI, 0.4-0.7; $P < 0.001$). Twenty of the 62 subjects had some recession on the palatal aspect of the operated canine, whereas only 4 subjects had some visible root surface on the palatal aspect on the unoperated side ($P = 0.001$). **Conclusions:** There is a periodontal impact when a unilateral PDC is exposed and aligned. This impact is small and unlikely to have clinical relevance in the short term; however, the long-term significance is unknown. When the open and closed techniques were compared, no difference in periodontal health was found. (Am J Orthod Dentofacial Orthop 2013;144:176-84)

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Ectopia of the maxillary canine is a common clinical scenario; in orthodontic clinics, its prevalence has been reported to be as high as 13%.¹ Most ectopic canines are palatally displaced, and treatment can be complex, time-consuming, and expensive for both the patient and the health care system.² Whereas orthodontic treatment has been found to be mildly detrimental to the periodontium,³ case reports have described severe periodontal destruction in some cases of aligned palatally displaced canines (PDC).⁴

Burden et al⁵ highlighted the controversy in the literature regarding the periodontal outcome of open or closed surgical exposure and subsequent orthodontic alignment of the PDC. Reported periodontal problems included loss of alveolar bone height, increased pocket probing depths, and loss of attached gingivae. Many authors have criticized the open technique because they believe that periodontal health is compromised when the palatal mucosa is excised.⁶⁻⁸ This criticism appears to arise from an article published in 1976 about an inherently weak retrospective study of 56 patients with unilateral PDC but was, until now, the only study to directly compare the periodontal consequences of open vs closed surgical exposure.⁹

The literature contains less criticism of the closed technique in terms of periodontal impact, although some authors have still reported periodontal concerns when canines aligned with a closed technique are compared with unoperated canines.^{10,11} A recent Cochrane systematic review found no robust evidence to support one surgical technique over the other.¹²

The principal purpose of this trial was to explore any differences in periodontal health between canines exposed with an open vs a closed surgical technique. Differences in periodontal health between canines that had an operation (those that were palatally displaced and had been surgically exposed) vs the contralateral canines that did not have an operation (acting as controls) were also examined.

Two null hypotheses were tested: (1) there is no difference in periodontal health of PDC treated with either an open or a closed surgical exposure, and (2) there is no difference in the periodontal health between operated and unoperated canines.

MATERIAL AND METHODS

This was a multicenter, randomized controlled clinical trial involving 2 parallel groups of patients with unilateral PDC, randomized to 1 of 2 surgical exposure techniques and treated in a hospital setting. Ethical approval was obtained from the South Sheffield Ethics Committee (SS02/072) and the North and South Derbyshire local ethics committees (NDLREC ref: 857) in the United Kingdom. Details of our methodology, including the inclusion and exclusion criteria, have been described elsewhere.¹³ Once informed consent was obtained from the participants, they were randomly allocated to 1 of 2 interventions. The randomization was undertaken using computer-generated random numbers to ensure that equal numbers were allocated to each intervention; allocation concealment was done with consecutively numbered, sealed, opaque envelopes as outlined previously.¹³

The 2 surgical techniques are summarized briefly below.

For the open surgical exposure, after exposure of the PDC and excision of the palatal mucosa, a surgical pack was sutured in place. After 10 days, the patient was reviewed and the pack removed.

For the closed surgical exposure, after uncovering of the PDC, an eyelet attachment with a gold chain was bonded to the palatal or buccal surface of the ectopic canine (whichever was the most accessible).

Only patients with unilaterally displaced canines were included, so that the contralateral canine could be used as the control.

A fixed appliance was placed in the maxillary arch either before or shortly after surgery. For both groups,

orthodontic traction was applied using a twin-wire technique or an elastic chain after an 0.018-in stainless steel archwire was in place and there was sufficient space to align the canine. The fundamental difference in orthodontic management was that the canine exposed with the open technique was moved into alignment above the mucosa (Fig 1), and the canine exposed with the closed procedure was moved beneath the mucosa (Fig 2).

Periodontal measurements were recorded at baseline to eliminate the possibility of previous pathology and at 3 months after removal of the fixed appliances. The periodontal outcomes were as follows.

The primary outcome of the trial was the difference in the clinical periodontal attachment level between the PDC treated with the open surgical technique and the PDC treated with the closed technique at 3 months after removal of the orthodontic appliance.

The clinical periodontal attachment level was determined from the 6-point probing depths on the mesial, midline, and distal aspects of the buccal and palatal tooth surfaces, and gingival recession was measured clinically from the visible cemento-enamel junction to the gingival margin. The clinical attachment level was calculated as follows: clinical attachment level = periodontal probing depth + gingival recession.

All measurements were made using a Williams Sensor periodontal probe (Hu-Friedy, Chicago, Ill) to the nearest millimeter. This probe is pressure sensitive, and the force is limited to 20 g. The examining clinician was instructed to insert the probe parallel to the long axis of the canine and gently "walk" it around each surface of the tooth.

The secondary outcomes were palatal gingival recession, crown height, and radiographic alveolar bone levels.

Palatal gingival recession was recorded with the following index: (1) cemento-enamel junction not visible; (2) cemento-enamel junction and less than 2 mm of root surface visible; and (3) cemento-enamel junction and 2 mm or more of root surface visible.

The reason for this categorization was the difficulty of clinically measuring recession on the midpalatal aspect of the canine with precision.

Crown height measurements were recorded with calipers to the nearest 0.5 mm from the 3-month postdebond study models.

Alveolar bone levels were measured from periapical radiographs taken between 3 and 12 months posttreatment using computerized image analysis (Fig 3). Although there was some variation as to exactly when the radiographs were taken, the images of the operated and the unoperated sides were obtained at the same time and compared. Film holders (Rinn XCP; Dentsply, Surrey, United Kingdom) and the long-cone technique were used for standardization.

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