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Difference in Surgical Outcomes between Open and Closed Approach of Palatal Displaced Maxillary Canines: a systematic review

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Difference in Surgical Outcomes between Open and Closed Approach of Palatal Displaced Maxillary Canines: a systematic review

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Abstract

Palatally displaced canines or PDCs are upper permanent canines, are very important teeth that define the aestethics of smile. However, these teeth can be impacted during the long period between gems formation and their eruption. This leave unsightly gaps, cause damage to the surrounding roots (which can be so severe that neighbouring teeth are lost or have to be removed) and, occasionally, result in the development of cysts. PDCs are a frequent dental anomaly, present in 2% to 3% of young people. For treating this problem it necessary surgical exposure (uncovering) followed by fixed braces for two to three years to bring the canine into alignment within the dental arch. Two different techniques for exposing palatal canines have been performed during the years: the closed technique and the open technique. The closed technique involves uncovering the canine, attaching an eyelet tight with a chain and then suturing the palatal mucosa back over the tooth. Therefore the tooth moves under the mucosa. Instead, the open technique involves uncovering the canine tooth and removing the overlying palatal tissue to leave it uncovered. In this way the crown of canine is easily attainable by the ortodontist that align it.

Introduction

Permanent canine teeth in the upper jaw usually erupt into the mouth between the ages of 11 to 12 years, and after its nearest teeth. In about 3% of people, this process stops and the canine teeth fail to erupt (grow down), becoming displaced in the palate. This dental anomaly is caused by several factors: the far position between the formation of germs (under the eye) and its place in the upper arch; so the long period between germs formations and its eruption; the major differences in dimensions between deciduous and permanent teeth; the impossibility to adapt the arch to the canine dimensions because of its tardive eruption in arch. In this way PDCs can leave unsightly gaps, cause damage to the surrounding roots (which can be so severe that neighbouring teeth are lost or have to be removed) and, occasionally, canine stops relate with the development of cysts (generally a follicolar cyst).

Management of this problem is both time consuming and expensive. It usually involves surgical exposure (uncovering), followed by fixed orthodontic braces for two to three years, to move the canine into the correct position. Two surgical techniques are routinely used in the UK: the closed technique involves uncovering the buried tooth, gluing an attachment onto the exposed tooth and repositioning the palatal flap. Shortly after surgery, an orthodontic brace is used to apply gentle forces to bring the canine into its correct position within the dental arch. The canine moves into position beneath the gum. An alternative method is the open technique, which involves surgically uncovering the canine tooth as before, but instead of placing an attachment onto the exposed tooth, a window of gum from around the tooth is removed and a dressing (pack) placed to cover the exposed area. Approximately 10 days later, this pack is removed and the canine is allowed to erupt naturally. Once the tooth has erupted sufficiently for an orthodontic attachment to be glued onto its surface, orthodontic braces are used to bring the tooth in line with the other teeth.

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Description of the condition

Maxillary canine teeth are the third teeth along fromthemidline in the upper jaw, which erupt into the mouth around 11 to 12 years of age (Hagg 1986). Displaced teeth refers to those which have an

abnormal position,whereas impacted teeth are thosewhich cannot naturally erupt, usually because they are impeded by other teeth or bone. After mandibular (lower jaw) third molars or wisdom teeth,

maxillary canines are the most common teeth to be displaced or impacted (Thilander 1973). Canine displacement usually occurs in the roof of the mouth (palate), whereas impaction usually occurs towards the cheek and lip (buccally) or in line with the arch (Counihan 2013). Canine teeth, which are displaced in the palate and cannot erupt naturally, are referred to as â€˜palatally displaced caninesâ€™ or PDCs. Prevalence of PDCs has been reported as between

1% to 3% in different populations. It has been reported that in around 8% of these cases teeth on both sides of the mouth (bilateral) are affected (Bishara 1992; Peck 1994). The male to female ratio ofmaxillary canine displacement varies between studies conducted in different populations. In one study conducted in Italy, palatally displaced canines occurred three times more frequently in females than males (Sacerdoti 2004), whereas Bishara reports that displacements are twice as common in females than in males (Bishara 1992).

The aetiology of PDCs is not fully understood, but is considered multifactorial.Many studies have claimed that they are mainly inherited, with a polygenic mode of inheritance. Family studies have shown that positional abnormalities of canines are more common in relatives than the general population (Peck 1994; Peck 1996; Peck 1997). Local factors may also be a causative factor in displacement, such as missing or small incisor teeth, crowding or a lack of space in the jaw, delayed or early shedding of the primary tooth, presence of cleft in the jaw, fusion of the tooth to the bone

(ankylosis) and trauma to other teeth in the area (Bishara 1992).

Displaced maxillary canines can result in several complications, such as root resorption of adjacent teeth (usually the maxillary lateral and sometimes central incisors (Strbac 2013)), and much more rarely, cystic change of the tissue around the displaced tooth (Manne 2012). Root resorption may become so severe that the neighbouring teeth have to be removed. Also, impaction of these teeth can lead to aesthetic problems (Shafer 1983), owing to a gap in the dental arch where the tooth has failed to erupt. This can lead to an abnormal position of the upper dental midline. Due to the potential severe sequelae, some displaced or impacted canines cannot be left alone and require surgical intervention.

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Description of the intervention

With every patient, a careful discussion between the patient, parent/caregiver, orthodontist and oral surgeon is required. However, the preferred option for many PDCs is surgical exposure under general anaesthesia (or, in some countries, local anaesthetic) and orthodontic alignment. At present, two surgical techniques are routinely used to uncover palatally displaced canines: the open and closed techniques.

The closed technique involves surgically uncovering the tooth and gluing an attachment onto the exposed tooth, often in the form of a gold chain. The palatal flap is then repositioned and sutured, with the chain exiting through themucosa.Historically, this could be seen as quite challenging in the surgical theatre setting; however, with the advent of new self-etch adhesive bonding systems, the bonding technique could be simplified. Shortly after surgery, an orthodontic brace is used to apply gentle forces to bring the canine into its correct position, within the dental arch. The canine then erupts through the mucosa into its correct position (Clark 1971).

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The open technique differs slightly. It involves surgically uncovering the canine tooth, as before, but instead of bonding an attachment on the exposed tooth at the time of the surgery, a window of tissue is removed from around the tooth leaving it exposed. A dressing or â€™packâ€™ is placed to cover the exposed area. The dressing is removed approximately 10 days later. The tooth is then eithe left to erupt naturally, or an orthodontic attachment is placed to enable the tooth to be moved, above the gum, into its correct position in line with the rest of the teeth (Lewis 1971).

Regardless of which surgical technique is used, orthodontic treatmentwill be required following surgical exposure, in order to bring the canine tooth into its correct position. On average, this will take between two and three years.

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Procedure of intervention

Surgical exposure involves removing the bone or fibrous gumtissue (or both) that is impeding the movement of the canine. Without doing this, the tooth is unlikely to erupt. Exposing the canine tooth surgically allows access to the tooth to either allow natural eruption or orthodontic movement. Once sufficiently erupted, then the tooth can be brought into alignment with the rest of the teeth, using orthodontics.

Materials and Methods

During the years, several dentistry works have been published on international literature about the incidence of maxillary canine inclusion and its treatment planning. Many different treatment approaches have been performed and, in particular, two surgical different techniques have been applied apparently without a real theoretical differentiation. Therefore, a detached research of international literature on the use of each surgical approach has been performed using the principal medical databases:

PubMed (Medline), Lilacs and Scopus. The keywords used were: *Palatal Displaced Canine*, *Open and Closed Surgical Exposure*, *Maxillary Canine Inclusion* and *Upper Canine Inclusion Surgery*; to identify all articles reporting on the topic till February 2019. No restrictions of time and languages have been fixed. The results have been filtered and valued following our eligibility criteria and then organized following the PRISMA method. The search identified 194 abstracts, which were reviewed manually and each article of interest was marked for further review. The full text of the marked studies was retrieved and studies that satisfied our eligibility criteria were included in this review. At the end only 4 full articles have been selected which involved a total of 146 patients.

Results

From the sample of these articles, eighty-one participants were analysed; however, 10 were excluded from all analyses. Nine participants were excluded from the periodontal analysis: 7 failed to attend follow-up visits (open, 2; closed, 5) and 2, both in the closed group, abandoned treatment midway through the study. Five participants received the incorrect procedure (open, 4; closed, 1); however, the intention-to-treat principle was adhered to, and they were all analyzed in their original allocated groups. The final sample consisted of 62 participants (open, 33; closed, 29).

Comparation Open vs Closed Surgical Tecniques

One fundamental aspect analysed in this review was 6-point clinical periodontal attachment level measurements. The comparation of the clinical periodontal attachment level values for the unoperated teeth with the clinical periodontal attachment level values for the operated teeth produced a difference between open and closed groups of just 0.1 mm (open, 0.5 mm, SD, 0.8; closed, 0.6 mm, SD, 0.6). Therefore, this difference was not statistically significant.

The mean attachment loss for 3 of 4 sites was found to be marginally greater in the closed group compared with the open group; however, the difference was not statistically significant.

In the midpalate, 8 subjects (28%) in the closed group and 12 subjects (36%) in the open group showed root visibility between 0 and 2 mm. However, on the midbuccal aspect of the operated canine, in the closed group, 9 subjects (31%) had recession of at least 1 mm (7 subjects had recession of 1 mm, 2 had recession of 2 mm). In the open group, 8 participants (24%) showed recession of at least 1 mm (5 had 1 mm, 3 had 2 mm). No significant difference was found between the 2 groups (chi-square test, P 5 0.774).

There was considerable variation in the crown lengths between participants (ranges: operated, 6-

12 mm; unoperated, 7-12 mm). This necessitated the use of â€œdifference in crown heightâ€• between the operated and unoperated canines to compare the open and closed groups (height of operated canine crown minus height of unoperated canine crown). The results are shown in Figure 5. A positive value indicates that the operated canines had slightly shorter clinical crowns than did the unoperated canines and vice versa. No statistical significance was found between the 2 groups.

When the alveolar bone levels taken from the unoperated side were subtracted from the bone levels of the operated side, no significant difference was found between the open and closed groups (independent t test, P 5 0.936); however, the number of radiographs was low (n 5 34: closed, 15; open, 19) because films from some participants were not available. In addition, it was not always possible to see bone levels clearly for assessment.

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Discussion

The previous values analysed in this review showed a small periodontal cost to a maxillary PDC when it is surgical exposed and aligned; however, the periodontal health scores were similar at 3 months after removal of the fixed orthodontic appliances, whether an open or a closed surgical technique was used.

The findings suggest that it makes no difference which technique is used. No evidence of a difference is an interesting finding because previous authors have tended to imply that the closed technique is superior in terms of clinical attachment levels.[8,15,16] Schmidt and Kokich[17] thought that allowing the exposed canine to erupt autonomously before placement of an orthodontic attachment could cause less overall trauma to the periodontium and improve â€œcleansibility.â€•

The only published study that directly compares the periodontal health of open vs closed surgical exposure

is by Wisth et al.[9] They found that the periodontal impact of aligning canines after open exposure was more

detrimental in terms of probing depths (open mean, 2.46 mm; closed mean, 2.06 mm; P\0.05). However,

in regard to the clinical periodontal attachment level, this only reached significance on the palatal surface

(open mean, 1.85 mm [SD, 1.58]; closed mean, 1.09 mm [SD, 0.87]). Unfortunately, this study, which

has been quoted on numerous occasion, has many shortcomings.[5,7,10,17] It was retrospective and therefore

has high risks of selection, allocation, and treatment biases.

However in international literature there is more evidence on the impact of surgical exposure and alignment on the periodontal health. Becker et a[l7] assessed the periodontal health of 23 young people who had had surgical exposure of a unilateral maxillary canine and orthodontic alignment, at an average of 2.3 years after treatment. They found that the mean 6-point pocket depths were significantly greater for the operated canines (2.5 mm; SD, 0.7) compared with the unoperated canines (2.2 mm; SD, 0.5). The surgical technique, as described, appears to be more radical than those used in this study, although their findings were similar. Becker et al did not assess the clinical periodontal attachment level; therefore, it is more difficult to compare results. However, the authors of another retrospective cohort study with children who had 1 or 2 maxillary ectopic canines at an average of 3.5 years after treatment also found significant differences in the pocket depths between the operated and unoperated sides, but again the differences were about 0.5 mm.

In a systematic review, Bollen et al[3] found that orthodontic treatment had a minimal impact on periodontal

health, with 0.23 mm of increased pocket depth (95% CI, 0.15-0.30 mm), but the evidence was weak. From our study, more subjects had significant attachment losses after treatment (at the maximum 3.2 mm for the operated canines and 2.3 mm for the unoperated), but the long-term implications for the health of these teeth are unknown.

Woloshyn et al,[10] using a closed exposure found deeper probing depths on the mesial aspects of the teeth. Our review evidenced that the greatest mean difference in clinical periodontal attachment level was 0.5 mm on both the mesiobuccal and distobuccal aspects of the operated canine.

An important consequence, as reported in international literature, of surgical exposure and orthodontic alignment was mild recession on the palatal and buccal aspects of the canine. Of the few other studies

that have recorded recession, little difference between the operated and unoperated canines has been

reported.[15,16] In a retrospective analysis consisting of 32 patients who had surgical exposure with the closed

technique.

During the surgical technique if the eyelet had been placed on the palatal aspect of the canine during surgery, the canine might erupt in a rotated position. The process of derotating the canine could result in reduced attached gingivae on the buccal aspect and increased length of the crown.

The height of the clinical crown was not significantly different between canines treated with either the open or closed surgical technique, or between the operated and unoperated teeth, although there was more Â variation in height of the operated canines. Considering the finding that more recession was present in operated canines, the implication is that for canines whose crown height is reduced, there must have been considerable reduction to compensate for the canines with recession. This makes clinical sense because we know that PDC are often undertorqued at the end of treatment; this might be a subject for future research.

It was also evidenced significant lower alveolar bone levels on the mesial aspect of the operated canine compared with the unoperated canine. These findings agree with the retrospective study of canines exposed with a closed technique by Woloshyn et al.[10] The results contrast with canines exposed with an open technique by Schmidt and Kokich,[17] who found only a significant difference in bone levels around the lateral incisor adjacent to the operated canine, particularly the distal aspect.

Again, the differences were small (mean, 0.76 mm more bone loss), and it could be questioned whether

this is clinically significant in the long term.[5]

Conclusion(s)

From this review it was possible to observe that exposure and alignment of PDC has a small impact on periodontal health. The magnitude of this impact is not influenced by surgical technique (open vs closed exposure) and is so small that it is unlikely to influence the prognosis of a tooth in the long term in most patients.

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