CASE REPORT

Management of Impacted Canine with Surgical Orthodontic Procedures

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ABSTRACT: The permanent canines play a pivotal role in achieving an esthetic smile, functional occlusion and also in establishing the arch form. However, the management of an impacted canine and bringing about its alignment into the arch is often considered to be very challenging because of relapse. The two stage inter-alveolar corticotomy followed by fixed appliance is advocated to minimize the treatment time and reduce the chance of relapse. In this article, two case reports are presented, where labially impacted canine of one patient has been managed by orthodontic movement alone and in another patient a combination of inter-alveolar corticotomy and orthodontic movement has been successfully used.

Key words: *impacted canine, surgical exposure, orthodontic traction, two stage corticotomy, orthodontic appliance*

The maxillary canines are key teeth for both function and aesthetics. They are the most dimensionally stable teeth in the oral cavity because they are the longest, with good labio-lingual thickness and effective anchorage in the alveolar process. However, the incidence of an impacted canine is high which can be due to various reasons. A thorough clinical examination and radiographic evaluation is required to evaluate whether the impacted canine is in a favourable/ unfavourable position for guiding into the oral cavity. Based on this factor, conventional orthodontic treatment or surgical orthodontic management can be planned.

The main objective of surgical orthodontics is to bring about correction of dento-facial abnormalities where neither growth modification nor camouflage can provide acceptable post treatment results. It is also used as an adjunct to conventional orthodontics in correction of malocclusion and stabilization of post orthodontic treatment results.

Surgical management of a labially impacted canine is carried out by either an open eruption or a closed eruption technique followed by application of orthodontic forces through various auxiliary attachments placed on the exposed impacted tooth.

The orthodontic correction of adult malocclusion with

inter-alveolar corticotomy as described by Kole^[1] is an effective method to carry out dento-osseous movements by heavy orthodontic forces to bring out rapid tooth movement and to improve the stability of the results achieved. It is mainly useful in Angle's Class II division 1 and Class I cases where there is severe proclination and large spacing of upper anteriors. It should be assessed radiologically if there is sufficient inter-radicular distance of more than 2 mm^[2].

The orthodontic treatment is started with fixed appliance at the commencement of fourth week after the inter-alveolar corticotomy. Many methods of post operative traction have been described in the literature such as cementing a cap splint with grooving to receive strong elastic bands as described by Barton and Rayne^[3]. Bell and Levy^[4] used edgewise appliance and within 4 months they could close the diastemas. Strong elastics are used and twisted to form one traction band per elastic. Rakosi^[5] also emphasized the heavy force. The anterior spacing is closed using elastic thread or elastic chain. Two orthopedic elastics are hooked labially from canine to canine and heavy elastics for retraction, spanning from canine to first molar on each side is given. The patients are instructed to change the elastics daily.

The tooth movement proceeds at a faster rate following osseous surgery because of rapid turn-over of bone remodeling. The relapse rate is less which can be

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Fig 1: Pre-operative facial appearance

Fig 2: Intra-oral picture showing impacted 23

Fig 3: Surgical exposure of 23 tip

Fig 4: Begg's Fixed appliance in place

Fig 5: Post operative occlusion and facial appearance after 11 months

attributed to the fact that the continuity of the transeptal fibers is broken when the flap is raised. Since the surgical bony cuts heal like a fracture, the cut ends adapt to the new position by compression of weakened cortical bones through heavy forces. The bodily movement achieved by fixed appliance obviates the need for root torquing and up righting springs.

The periodontal status can also be improved by bringing the teeth into juxta position, as the teeth have the support of the appliance as a splint. Hence, this sort of combined procedure is advantageous in adults even with periodontal involvement to prevent further loss of bone due to mechanotherapy. Two types of management of labially impacted canine have been reported here. In one patient only orthodontic movement after surgical exposure of canine has been used whereas in the other patient inter-alveolar corticotomy followed by orthodontic movement has been done.

CASE REPORT I

A 17 year old female patient came to Rajah Muthiah Dental College and Hospital, Annamalai University, India, with a chief complaint of proclined anterior teeth with spacing (Fig 1). On examination, she had Angle Class I malocclusion with an overjet of 4mm and an overbite of 3mm. Radiographic investigation revealed that the patient had an impacted canine on the left maxillary arch.

Surgical orthodontic therapy was planned for the patient. The treatment procedure was explained to the patient and an informed consent was obtained.

Surgical exposure of the impacted canine was done (Fig-2). Begg bracket was placed on the impacted canine after acid etching (Fig-3). The orthodontic traction was given using elastic thread. This procedure was repeated until the impacted canine reached into final occlusion (Fig-4).

Fig 6: Pre-operative facial appearance and occlusal status

The treatment duration was 11 months. The pre and post treatment results are illustrated (Fig-5).

CASE REPORT II

A 25 year old male patient, came to Rajah Muthiah Dental College and Hospital, Annamalai University, India, with a chief complaint of proclined teeth with spacing. On clinical examination, the patient had Angle Class I malocclusion with severe proclination of upper and lower teeth, with a spacing of 16 mm in the upper arch and 13.5 mm in the lower arch (Fig 6).

Since the patient had sufficient inter-radicular distance of more than 2 mm in both the upper and lower arch, it was decided that the two stage inter-alveolar corticotomy in the upper arch and labial procedure alone in the lower arch will be performed. The patient was informed about the treatment procedure and informed consent was obtained.

After preoperative evaluation of the patient, the surgery was performed in two stages with an interval of two weeks between the stages. After achieving good local anaesthesia, a full thickness muco-periosteal flap was raised from the first molar to the opposite side first molar.

The labial and palatal flap with inter-crevicular incisions by excluding the interdental papilla was done. The nasopalatine nerve and vessels were cut and clamped to achieve haemostasis. After careful evaluation, longitudinal bone cuts were marked between the roots of the teeth to be moved with the help of a fine rose head bur. These markings were made radially and are approximately located between the roots of the teeth to be moved onto the mesial and distal sides. These bony cuts were connected with a fine tapering fissure bur till the cuts reached the cortico-cancellous junction to an approximate depth of 2 mm. The longitudinal parallel cuts made along the roots were widened depending upon the diastema. Care was also taken to make the cuts parallel to the roots. Since the cuts are extended only to the cortico-cancellous junction, damage to the roots was minimized. The vertical cuts were connected at the apical area 4-5 mm above the apices of the teeth with a horizontal cortical cut which reached the cancellous portion to the depth of 2 mm.

Low speed cutting with saline irrigation was used to prevent thermal necrosis of the bone. The area was irrigated and the flap was approximated with interrupted

Fig 7 : The inter-alveolar corticotomy procedure done in the palatal and labial aspect of the maxillary arch and in the labial aspect of mandibular arch

sutures at the interdental papillae.

A pressure gauge pack was placed and the patient was asked to hold it for one hour.

The patient was reviewed on the first and seventh post-operative days. On the seventh post-operative day, the sutures were removed. Routine postoperative instructions were given. The flap was very well approximated. Signs of possible postoperative complications like gaping, hematoma and flap necrosis were assessed.

After two weeks, the patient is scheduled for the next stage of treatment on the labial side. The procedure was done the same way as it was done on the palatal side except that where there was little bone above apices, the cuts were made into the pyriform fossa and the floor of the nose but the nasal floor mucosa was left in place rather than being elevated. Derek Handerson^[6] advocated adequate cancellous bone during transalveolar and supra apical cuts for better nutrition. The procedure was done in the lower jaw as well (Fig 7).

The orthodontic treatment was started with fixed appliance at the commencement of fourth week, one week after the second stage. The orthodontic treatment was started with Begg fixed appliance and orthopaedic

elastics to compress the weakened bone (Fig-8). Class I and Class II elastics were used to close the residual space distal to canines simultaneously to retract the proclined anteriors. The patient was instructed to change the elastics daily. The treatment duration was nine months. The pre and post treatment results are illustrated in the Fig-9.

DISCUSSION

The canine impaction is caused by primary and secondary causes

Primary causes are as follows:

1. Rate of root resorption of deciduous teeth.
2. Trauma to the deciduous tooth bud.
3. Lack of availability of space in the arch.
4. Disturbances in tooth eruption sequences.
5. Rotation of tooth buds.
6. Premature of root closure.
7. Canine eruption into the cleft area in cleft palate.

Secondary causes are as follows:

1. Abnormal muscle pressure.
2. Febrile diseases.
3. Endocrine disturbances.
4. Vitamin D deficiency.

It is imperative to assess whether the impacted canine is

Fig 8: Fixed appliance with Begg's technique given

Fig 9: Post operative facial appearance and intra oral appearance after 9 months

in favourable position or unfavourable position for management. If it is in an unfavourable position, the treatment plan will depend on

1. Whether it is symptomatic or
2. Whether it is associated with pathology or
3. Whether it is non-symptomatic without pathology.

The no. 1 and no. 2 situations require surgical extraction (Fig-10) and no. 3 requires observation to assess if orthodontic / prosthodontic management are required.

If the tooth is in a favourable position then the following treatment plan can be considered:

1. Surgical exposure and spontaneous eruption.
2. Surgical exposure and orthodontic traction.

During clinical examination, the presence of retained deciduous canine, canine bulge, malocclusion, migration

of adjacent teeth into canine space, midline shift and mobility of retained deciduous canine, any arch length deficiency and adjacent teeth should be assessed.

Radiographic evaluation plays a crucial role in determining the feasibility for the proper access for the surgical approach and the proper direction for the application of orthodontic forces. Radiographs are also used for proper localization of the impacted tooth, their proximity to the antrum or the nasal floor, to assess the resorption of involved teeth, presence of cyst, infected follicle and any odontome or supernumerary teeth.

Shift cone technique is needed to assess whether impacted canine is labially placed or palatally placed. Labially positioned canines generally have a favourable vertical angulation and there is good prognosis. A minimum of 2 radiographs taken at different angles or

Fig 10: Extraction of unfavorably placed canine

Fig 11: Direct bonded Begg bracket on surgically exposed left upper central incisor and orthodontic traction by ligature wire.

Fig 12: Orthodontic traction by elastic thread on palatally impacted canine

Fig 13: Magnets fixed on surgically exposed impacted canine on the palatal side

more than one radiographic technique is imperative to assess the situation in all dimensions. In Orthopantomogram angulation of long axis of canine greater than 40 degree in relation to the midsagittal plane (midline on orthopantomogram) shows poor prognosis. Canines located mesial to the lateral incisor and distal to premolar have less success rate. A distance of more than 15 mm between the canine cusp tip and the occlusal plane on panoramic x-ray reveals poor prognosis. Occlusal radiograph are also effective in assessing the impacted tooth's position. Recently CT scans are also being used for this purpose.^[7,8]

The treatment methods for favourable impacted canines consist of two aspects. They are the

1. Surgical procedures.
2. Methods of attachment.

Surgical procedures:

Surgical exposure is described to make a tunnel for eruption which allows natural eruption to occur. It is stated that injury to the soft tissue is less when compared with the completed exposure of the crown of canine.

The open eruption technique: This is the exposure of the entire labial aspect of the anatomic crown with total

excision of all keratinized tissue (window approach). It is reported to result in significant loss of periodontal attachment, recession, gingival inflammation, lack of keratinized gingiva and reduced sulcus depth.

The apically repositioned flap is a modification aimed at improving the periodontal outcome by raising a full flap taken from the crest of the ridge and relocating it higher up on the crown of the newly exposed. This method is a recognized and accepted procedure in periodontics^[9].

The closed eruption technique: For a labially impacted canine, a surgical flap is raised from the attached gingival at the crest of the ridge, with suitable releasing cuts and elevated as high as is necessary to expose the unerupted canine. An attachment is then bonded to the tooth and the flap is fully sutured back to its former place. The twisted stainless steel ligature wire that has been placed on the attachment is then drawn inferiorly and through the sutured edges of the replaced flap^[10].

Methods of attachment :

Many auxiliary attachments can be fixed on the exposed impacted canines by which the orthodontic forces can be applied. They are cast gold canine caps, gold chain or

threaded pin drilled into the tooth tip. The orthodontic brackets can be directly bonded to the impacted tooth and extruded by ligature wire ^[11] (Fig-11), elastic thread (Fig-12) and elastic chains. Magnets ^[12] (Fig-13) are also used. U-flex eruption device with flexible base curved to fit incisal edge of upper incisor has also been used.

CONCLUSION

The two stage inter-alveolar corticotomy followed by fixed appliance gives manifold advantages:

1. The duration of active orthodontic treatment is only six to nine months. This is considerably shorter time taken than cases treated by orthodontic means alone.
2. The patient's satisfaction and comfort with this combined procedure are highly encouraging.
3. It is both simple and safe for the patient.
4. No complication such as non-vitality, necrosis of bone and damage to the periodontal ligaments are observed.
5. It obviates the need for root paralleling springs.
6. There is no relapse.
7. This procedure is advantageous even in adults where there is periodontal involvement.
8. Hence, this procedure can be adjunct to orthodontic treatment where there is difficult clinical situation.

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