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CASE REPORT

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Management of a permanent lateral incisor with a talon cusp and immature apex: A case report

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Key Clinical Message

This case report focuses on the diagnosis and treatment of a maxillary lateral incisor affected by a talon cusp, a rare developmental dental anomaly. The case presented with irreversible pulpitis and an immature apex. The article discusses the prevalence, etiology, classification, and treatment options for talon cusps, highlighting their clinical significance and potential complications. Clinical and radiographic findings obtained from a periapical radiograph and a cone-beam computed tomography (CBCT) scan are outlined. The treatment approach involved the removal of the talon cusp, endodontic therapy including apexification with mineral trioxide aggregate, and aesthetic restoration of the tooth. The report underscores the value of precise diagnosis, careful treatment planning, and the utility of CBCT scans in effectively managing talon cusps.

KEYWORDS

apexification, MTA, talon cusp

1 | INTRODUCTION

A talon cusp is a developmental dental anomaly first described by Mitchell[1] in 1892 as "a process of horn like shape, curving from the base downward to cutting edge." The term talon cusp was later coined by Mellor and Ripa,[2] due to its resemblance to an eagle's talon. During a recent systematic review by Decaup et al.,[3] it was concluded that talon cusps occurs in approximately 1.67% of the population and has various clinical implications. The authors also proposed a new definition for a talon cusp as "a vertical ridge or cusp that projects labially or lingually from an anterior permanent or primary tooth."[3]

1.1 | Etiology

The exact etiology of the talon cusp is unknown; however, it is believed to be associated with genetic factors, environmental factors and endocrine disturbances.[4–9] Disturbances during the morphodifferentiation stage of odontogenesis is suggested as the most probable etiology, as it will still allow continued function of ameloblasts and odontoblast, but it may result in different teeth shapes and sizes.[10] This abnormal outward folding or focal hyperplasia of the inner enamel epithelium during the morphodifferentiation phase is believed to result in the characteristic morphology of talon cusps.[11] A possible hypotheses is that an additional cusps form due to the merger of two tooth

germs or an increase in the number and distribution of enamel knots facilitated by a larger sized tooth germ.[12]

The possibility of genetics as an etiological factor is supported by familial presentation of talon cusps.[11,13] The co-occurrence of a talon cusp with other dental anomalies and genetic syndromes have been described and comprehensive examination of patients presenting with a talon cusp is therefore essential.[14] Syndromes that have been documented with talon cusps include Rubinstein–Taybi syndrome, Sturge–Weber syndrome, Ellis–van Creveld syndrome, and Mohr syndrome, among other.[14]

1.2 | Classification

Several classifications have been suggested. Talon cusps have been classified by Schulze[15] by the appearance from an occlusal view as either a T- or Y-type. Hattab et al.,[16] suggested standardization of talon cusps into three types, according to the extent of projection from the cemento-enamel junction (CEJ) toward the incisal edge, with a grading system of 1–3, of which 1 being the most extreme projection. Type 1: Talon cusp—present as an additional, well delineated, cusp projecting from the palatal aspect of primary and permanent anterior teeth, extending at least half the distance from the CEJ up to the incisal edge. Type 2: Semi talon—present as an additional cusp of a millimeter or more extending less than half the distance from the CEJ to the incisal edge. The cusp might blend in with the palatal surface or it may project away from the crown. This cusp is however still easily identified. Type 3: Trace talon—present as an enlarged or prominent cingulum with variations. These variations include conical, bifid or tubercle-like projections. Neither Type 3 talon cusps does not usually reach the CEJ nor the incisal edge and is often seen by adjusting the light to form a shadow. Talon cusps usually present radiographically as a superimposed, V-shape.[17]

Hattab's classification only included palatal/lingual cusps, although attempts have been made to apply this classification to labial talon cusps as well.[16,18,19] Mallineni et al.[18] suggested that classifications of talon cusps should be done according to the surface on which they were found: facial, lingual, and facial and lingual types. Mayes[20] documented the various stages of labial talon cusps, inverting the scale of Hattab so that the score goes 1–3 from least to most prominent as well as its association with double-shoveling among American Indians.[20]

1.3 | Prevalence

Incidence and prevalence reports vary widely, perhaps due to the various classification systems based on different morphological features. The prevalence among Mexican children was reported as 0.6% in 1989[21] and 0.34% in 2016,[19] these low numbers may be attributed to the method used for diagnosis or even the low reporting of mild to moderate talon cusps. Another reason for the low prevalence might be the misdiagnoses of talon cusps as gemination, fusion, and dense in dente. The prevalence studies on archeological collection tend to be much higher, for example 40.8% on Hungarian skulls.[22] Other prevalence studies range between 0.5% in Hong Kong[23] and 8.86% in Turkey,[24] and a systematic review and meta-analysis by De Caup et al.[3] reported a prevalence of 1.67%. Accurate prevalence reports can only be obtained once definitions, classification, and calibration of examiners are standardized worldwide.

Talon cusps are most commonly found on maxillary lateral incisors, followed by central incisors and lastly mandibular centrals.[25] Talon cusps are mostly seen palatal or lingual however the rare finding buccal talon cusps have been reported.[26] The cusp like projections are most commonly reported on permanent compared to primary teeth. Mallineni et al.[18] conducted a systemic review in 2014 and found that talon cusps were more common in males than females; however, no significant association between the formation of talon cusps and gender has been established during a recent systemic review.[3]

The following case report details the diagnosis and clinical management of a maxillary lateral incisor with a talon cusp in a female patient presenting with an irreversible pulpitis and an immature apex. The case was successfully managed by removing the talon cusp, endodontic treatment by means of apexification and an aesthetic restoration of the access cavity and palatal surface of the tooth. Written informed consent for this case report was obtained from the patient.

2 | CASE PRESENTATION

The 11-year-old female patient was referred for the treatment of irreversible pulpitis on the maxillary right lateral incisor. After receiving informed consent, a detailed extraoral and intraoral, and radiographic examination were performed, and the diagnosis of irreversible pulpitis was confirmed with sensibility tests. A clinical examination revealed the presence of a large accessory cusp on the palatal aspect of the tooth (Figure 1). The cusp was the only contact point in occlusion. An orthodontic consultation revealed that the anterior maxillary teeth will have to be retracted to ensure proper occlusion after the accessory cusp had to be removed. A periapical radiograph revealed a “V”-shaped radiopaque structure superimposed on the regular structure of the crown, originating from the cervical third of the root and extending up to the incisal edge

of the tooth (Figure 2). The shape and size of the cusp can be altered by changing the angle of the radiograph. A limited field of view cone-beam computed tomography scan (CBCT) (Carestream 8200, Carestream Dental) (Figure 3) confirmed the presence of a well-defined projection of enamel and dentine on the palatal aspect of the maxillary right lateral incisor on an axial level 5 mm from the incisal tip. At the cervical level an axial and sagittal slice showed the main root canal system in the center of the root as well as an accessory canal on the palatal aspect of the root branching from the main root canal system. An axial slice 0.5 mm from the root tip revealed an immature, open apex.

FIGURE 1 Preoperative photograph of the maxillary right lateral incisor showing the presence of a large accessory cusp on the palatal aspect of the tooth.

FIGURE 2 Preoperative periapical radiograph photograph of the maxillary right lateral incisor showing a "V"-shaped radiopaque structure superimposed on the regular structure of the crown, originating from the cervical third of the root and extending up to the incisal edge of the tooth.

According to the clinical and radiographic findings, a Type 1 talon cusp associated with irreversible pulpitis were diagnosed on the maxillary right lateral incisor. The patient was scheduled for non-surgical endodontic treatment and removal of the talon cusp to allow for optimal orthodontic treatment.

At a subsequent visit, local anesthesia was administered, and the tooth was isolated with a rubber dam. Reduction of the talon's cusp was initiated, using a coarse diamond bur until the correct shape of the palatal aspect of the tooth was achieved. Carious tooth structure was visible (Figure 4A) in the access cavity preparation region. The carious tooth structure was removed and the pulp was exposed (Figure 4B).

Root canal treatment was initiated and during length determination it was confirmed that the apex of the tooth was open up to an ISO size of 55. It was decided to complete root canal preparation using a manual ProTaper Ultimate FXL instrument (Dentsply Sirona). Heated 3.5% sodium hypochlorite was used in the EndoVac system (Sybron Endo) for chemical debridement of the prepared root canal system. A stainless steel endodontic plugger attached to an electronic apex locator was used to confirm the exact position of the open apex and the apical position where an mineral trioxide aggregate (MTA) plug will be created to seal the apex of the root canal system. This position was also confirmed radiographically (Figure 5A). Incremental packing of MTA (ProRoot MTA, Dentsply Sirona) was performed using the micro-apical placement system (MAP, Produits Detaires SA) until a 5 mm apical barrier was achieved (Figure 5B).

The remainder of the root canal system was obturated using bioceramic sealer (AH Plus Bioceramic Sealer, Dentsply Sirona) and the warm gutta-percha (Gutta Smart System, Dentsply Sirona). The enamel margins surrounding the access cavity and preparation, where the talon cusp was removed, was polished with a carbide bur. The access cavity was air-polished using 29 μm aluminum oxide (Aquacut, Velopex International) to remove any remnants of bioceramic cement and gutta-percha. A matrix band was placed (Figure 6A), and the access cavity and palatal surface of the tooth was restored using a total-etch technique with bonding resin (Prime and bond Universal, Dentsply Sirona), a bulk fill flowable material (SDR, Dentsply Sirona) and shade A2 composite resin (Spectra ST, Dentsply Sirona). Figure 6A,B depict the final clinical outcome after removal of the talon cusp and the periapical post-operative radiograph of the case at a 4-month follow-up visit.

3 | DISCUSSION

The clinical presentation, including the location, size, interference with function, aesthetics, the presence of

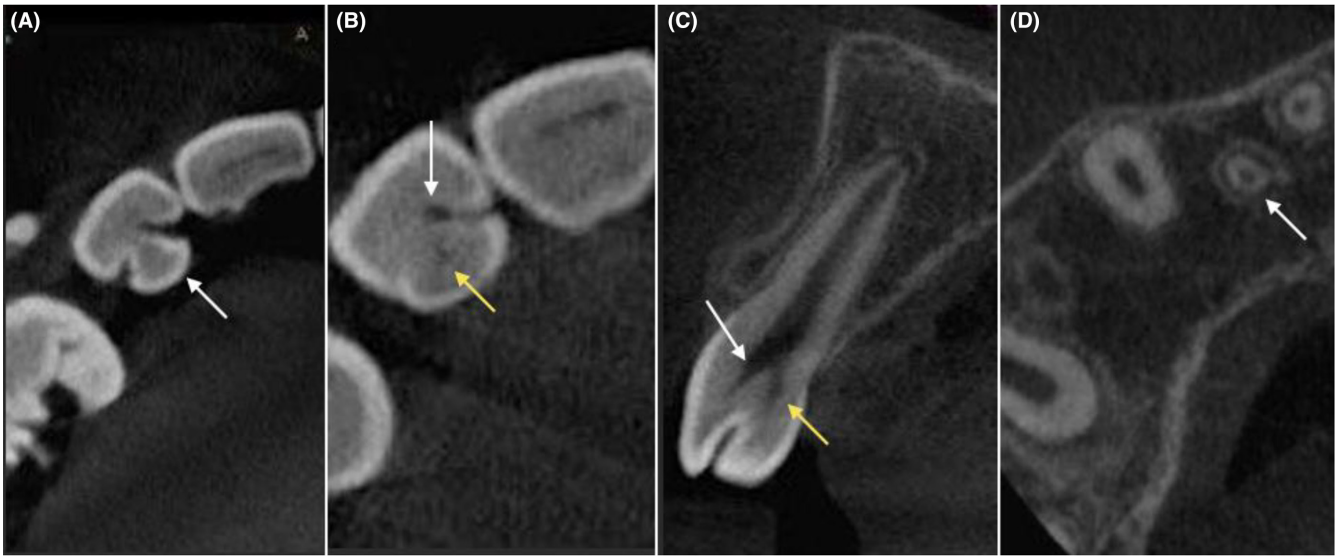

FIGURE 3 CBCT scan showing (A) the presence of a well-defined projection (arrow) of enamel and dentine on the palatal aspect of the maxillary right lateral incisor on an axial view, 5 mm from the incisal tip; (B) axial view; (C) sagittal view at the cervical level of the tooth showed the main root canal system in the center (white arrow) as well as an accessory canal (yellow arrow) on the palatal aspect of the root branching from the main root canal system; and (D) AXIAL view 0.5 mm from the root tip revealed an immature open apex.

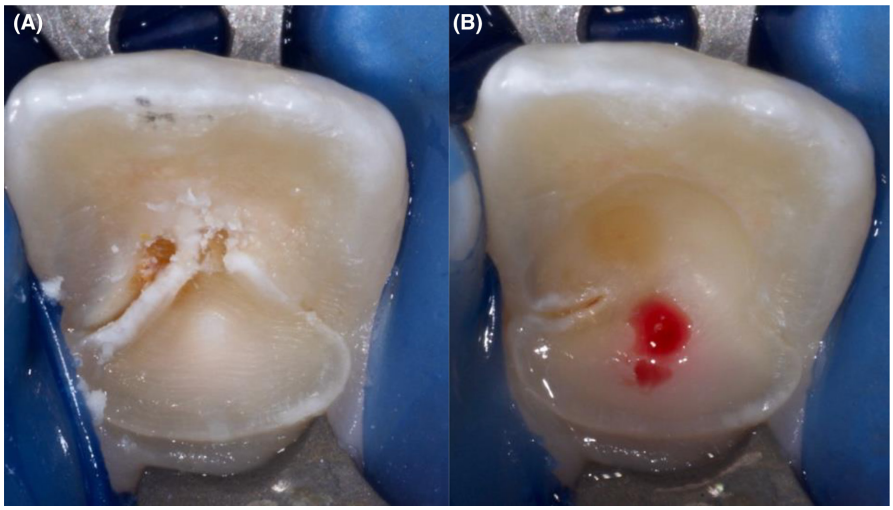

FIGURE 4 (A) Reduction of the talon's cusp using a coarse diamond bur until the correct shape of the palatal aspect of the tooth was achieved leaving some carious tooth structure in the middle; (B) after complete removal of the carious tooth structure the pulp was exposed.

pulp tissue within the talon cusp, and symptoms usually determine the choice of treatment. The presence of a talon cusp is clinically significant as the grooves surrounding the additional enamel projection often accumulate plaque with subsequent caries formation. Furthermore, in instances where the talon cusp is lingually/palatally positioned, it could interfere with occlusion and may even result in fracture of the talon cusp, exposing the pulp or even causing fracture of the opposing tooth. Traumatic occlusion may further result in mobility of the affected or apposing tooth. Early diagnosis is therefore essential to minimize complications and to allow different and less invasive treatment options.

Small talon cusps might not require any treatment,[17] or merely require sealing of the deep surrounding grooves as a preventative measure.[2,27] Carious fissures can be restored or small projections can be masked with composite resin restorations.[2]

For larger talon cusps, the three main treatment approaches include gradual reduction over time, partial reduction or full removal in a single visit.[28] Gradual reduction has also been referred to as step-wise or periodic reduction of the cusp and air abrasion has also been successfully used for this purpose.[29] Minimal reduction is done every 4–6 weeks, with the main aim to stimulate and allow tertiary dentine formation resulting in pulp obliteration within the cusp.[16,29] After each reduction of

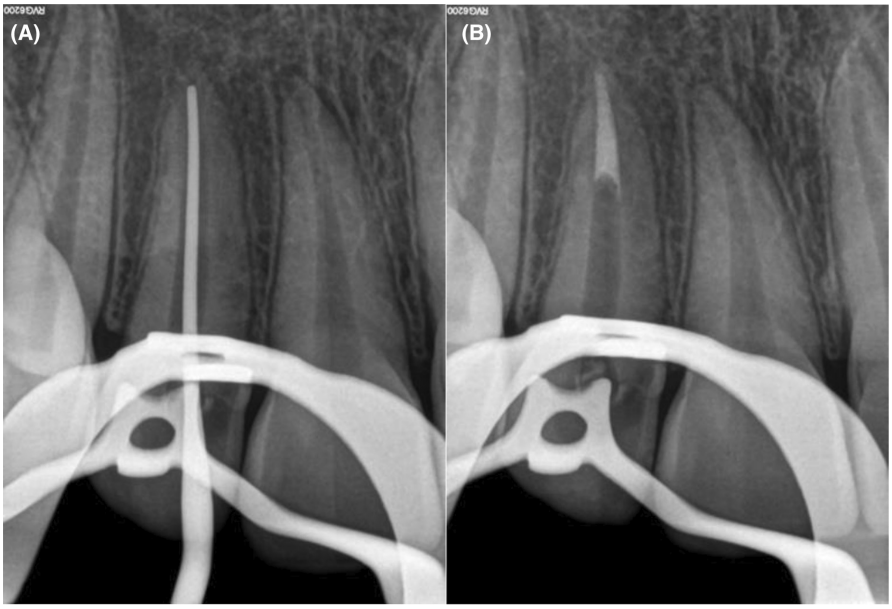

FIGURE 5 (A) Periapical radiograph illustrating a stainless steel endodontic plugger attached to an electronic apex locator to confirm the exact position of the open apex and the apical position where an mineral trioxide aggregate (MTA) plug will be created; (B) periapical radiograph showing a 5 mm apical barrier that was created by packing MTA incrementally.

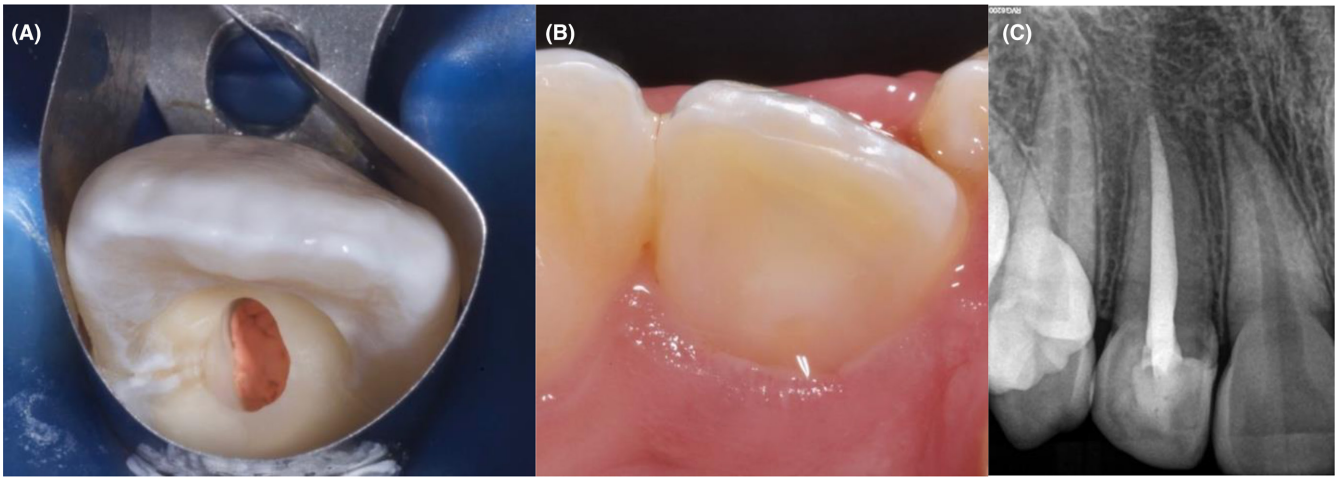

FIGURE 6 (A) Matrix band was placed after access cavity was air-polished using 29 μm aluminum oxide to remove any remnants of bioceramic cement and gutta-percha; (B) Postoperative view of access cavity and palatal surface of the tooth restored with composite resin at a 4-month follow-up visit; (C) Postoperative periapical radiograph showing the apexification, root canal obturation and restoration at a 4-month follow-up visit.

the cusp, application of fluoride or desensitizing agents is recommended to cover exposed dentine.[30] This approach is least invasive and if successful, it may avoid the need for any pulp therapy. The gradual reduction approach is however time consuming, unpredictable, reliant on patient compliance, and will not be suitable for all cases.

Symptoms associated with talon cusps will also guide the practitioner to the right treatment approach. If it is mainly an aesthetic concern, a premature contact or minor occlusal interference then gradual reduction will be an ideal treatment approach, however, if the tooth fractured exposing the pulp or traumatic occlusion is causing tooth mobility, partial or complete removal might be indicated.[31] During partial or complete removal—pulp therapy should be planned and executed in accordance with the pulp status and degree of root formation. Vital pulp therapy in the form of a direct pulp cap or pulpotomy might be necessary depending on the size of the exposure.[32,33] The success of vital pulp therapy will also be higher when accurately planned during reductions, as one can then insure that the pulp is exposed under sterile conditions. It is important to note that teeth with talon cusps often also present with necrotic pulp tissue as a result of untreated caries, trauma or traumatic occlusion which will subsequently require endodontic treatment, and often apexification, as these roots might not be fully formed yet.[34]

In the present study, the anomaly on the maxillary lateral incisor was classified as a talon Type 1 which refers to a morphologically well delineated additional cusp that prominently projects from the palatal surface and extends at least half the distance from the cemento-enamel junction and up to the incisal edge. In addition, the tooth presented with irreversible pulpitis and an open root apex that made the management of the case more complex.

The preoperative CBCT scan helped with planning and execution of the present case. The additional information obtained from CBCT scans may increase or improve the diagnostic accuracy, confidence in decision-making and impact on treatment planning.[35] The scan revealed that the pulp tissue projected into the accessory cusp and that the root of the tooth presented with an immature apex.

MTA was used for the root end closure as a one-step procedure because of its favorable properties. The setting of the MTA is not adversely affected by moisture, it has excellent sealing properties and actively promotes hard tissue formation.[34] Numerous studies associate MTA with significantly better outcomes for apexification compared to calcium hydroxide regarding mean time for apical hard tissue barrier formation[36] and for being less time consuming clinically.[37]

In conclusion, this report documents the successful management of a right maxillary lateral incisor affected by a Type 1 talon cusp that presented with irreversible pulpitis and an open apex. After MTA apexification and root canal treatment, the access cavity was restored with composite resin to manage this developmental anomaly. The information obtained from the preoperative CBCT scan was very valuable for formulating and executing the treatment plan. Preservation of pulpal vitality, preventing and removing caries while taking in to account the occlusal and aesthetic needs of the patient are the main objectives during the treatment of talon cusps. The use of preoperative CBCT images and accurate diagnosis are also highlighted in this case report.

AUTHOR CONTRIBUTIONS

Peet van der Vyver: Conceptualization; data curation; writing – original draft; writing – review and editing. **Nicoline Potgieter:** Conceptualization; data curation; writing – original draft; writing – review and editing. **Martin Vorster:** Conceptualization; data curation; writing – original draft; writing – review and editing.

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CONFLICT OF INTEREST STATEMENT

The authors have no conflict of interest to disclose.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ETHICS STATEMENT

Ethical approval and patient consent will be obtained for this manuscript.

CONSENT

Written informed consent was obtained from the patient to publish this report in accordance with the journal's patient consent policy.

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