Shell teeth — management from the mixed to the permanent dentition: case report

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Introduction

Relatively few cases of shell teeth have been reported in the dental literature, and no case has been followed longitudinally. The following case report describes the dental management of a young patient with the diagnosis of shell teeth who was treated from the mixed to the mature permanent dentition. Significant oral features observed in this patient were progressive root resorption, root fractures, and pulpal involvement.

Literature Review

Shell teeth were first described by Rushton[1] in a 21-year-old male as a form of dentinal dysplasia. The shape and color of the teeth were normal, although the teeth darkened with age. Both primary and permanent dentitions were affected, but different teeth within the arch were not affected equally.[1] Radiographically, the enamel was of normal thickness, but the dentin was thin, giving the appearance of a thin shell of hard tissue surrounding a large pulp chamber and large pulp canals. The roots looked short and had closed apices. Histological examination of two extracted teeth revealed normal dentin subjacent to the dentinoenamel junction for 1–2 mm.[1] Then, the dentin abruptly changed with alterations in tubule direction and morphology and an apparent arrest in further dentin deposition. It appeared that the pulp cells suddenly became incapable of forming collagen matrices.

Shell teeth also have been reported in association with other anomalies of dentin. Eight patients in the Brandywine triracial isolate of patients with dentinogenesis imperfecta type III were reported to have primary shell teeth with dentin formation that had ceased after the mantle layer was formed.[2] A condition somewhat similar to shell teeth associated with enamel and dentin aplasia was reported in a 4-year-old child.[3] The child's family subsequently was found to be related to the Brandywine group. A more recent case of shell teeth was reported in an 8-year-old boy who was mentally handicapped and had problems including arachnodactyly, increased laxity of joints, high-archedpalate, and blue sclera, a finding suggestive of osteogenesis imperfecta.[4] In this individual, the crowns of the teeth were shaped normally, but the enamel had a tendency to fracture away from the dentin. The presence of large pulps with a shell of surrounding hard tissue and thin dentin suggested shell teeth. The patient's associated findings, blue sclera and friable enamel, indicated that shell teeth also may have been a variation of dentinogenesis imperfecta.

Case Report

The patient, a 7-year, 6-month-old Caucasian boy, complained of "loose" mandibular front teeth on initial presentation. He was in good health and had no significant past medical history; blood tests were normal. Both parents and an older brother had normal dentitions, and there was no family history of dental anomalies.

Selected radiographs exposed between the ages of 7 and 21 years (Figs 1–4, pages 111–12) demonstrate the characteristics of "shell teeth," as described by Rushton.[1] The clinical appearance of the teeth is seen in Fig 5 (page 113). Four significant dental features were observed over the 14 years of treatment and will be described separately.

Progressive Root Resorption and Shell Roots

The assessment of Figs 1, 2, and 3 shows progressive root resorption that appears to be more rapid in posterior than in anterior teeth, except in those anteriors with root fractures. Most of the teeth have large pulp canals with thin dentin in the roots, but the crowns tend to have an increased deposition of dentin. In some teeth, the crowns almost are obliterated by dentin. The dentin of some teeth has small radiolucent areas which may be globular dentin (Fig 1c, arrow).

Root Fractures

A blow had been sustained to the mandibular anterior area 6 months prior to the films exposed at age 7 years, 6 months which show root fractures of 24 and 25 (Fig 1b). These teeth had approximately 2 mm mobility and were splinted with composite resin and brass wire. The splint was removed in eight weeks; however, the fractures had not healed because of the separation of the segments that had occurred in the 6 months before treatment. The decision was made to maintain the mandibular incisors as long as possible, recognizing that eventually these teeth would be lost. At age 10 years, 7 months, "spontaneous" root fracture of the mandibular right permanent lateral incisor was noted, and three months later the involved incisors were extracted and a partial denture was inserted. When the patient was about 12 years old, the maxillary central incisors showed

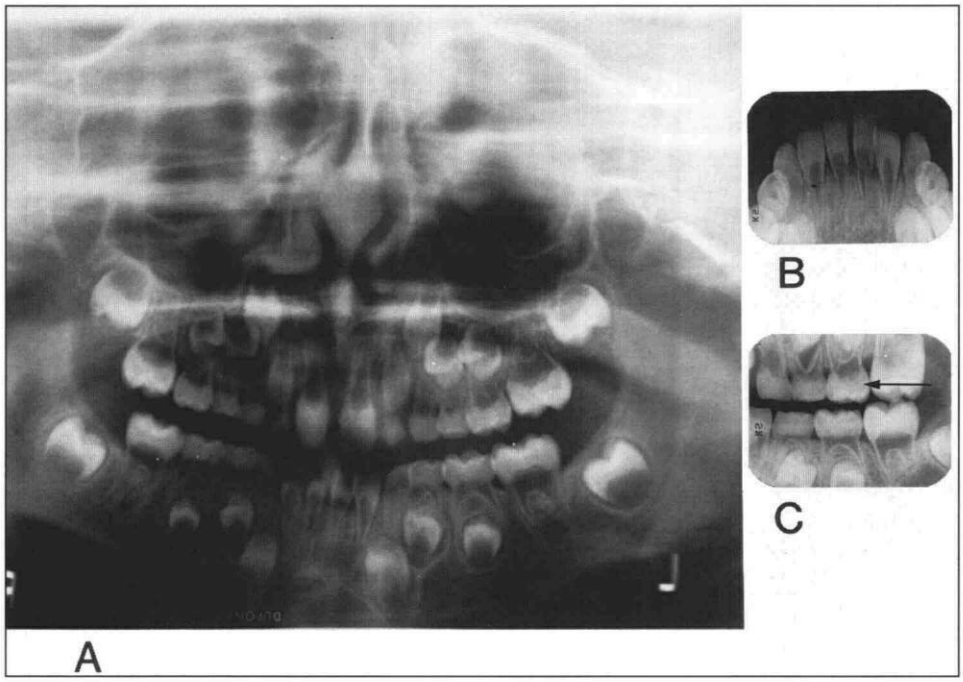

Fig 1a. Mixed dentition, age 7 years 6 months. **Fig 1b.** Root fractures of mandibular central incisors. **Fig 1c.** Spontaneous abscess of maxillary left primary first molar.

radiographic evidence of root fractures (Fig 2). The patient reported a recent blow to this area while he was swimming. Given the previous lack of success with splinting, we decided not to place a splint and to await "exfoliation" of the central incisors.

Pulp Involvement

At the age of 8 years, 10 months a furcation radiolucency was noted on the maxillary left first primary molar (Fig 1c). This tooth had no caries or restoration present and was asymptomatic. All other primary molars had normal furcations and normal physiologic root resorption. The abscessed molar was extracted.

Developmental grooves on the mesiobuccal surface of the mandibular first premolars were restored with amalgam at age 12 years (Fig 2). These noncarious grooves extended close to the pulp because of the minimal amount of dentin, and a pulp cap was required on the mandibular right first premolar. At age 15 years, 5 months, a periapical radiolucency was noted on this tooth and root canal therapy was performed (Fig 4). The endodontically treated right first premolar displayed substantially less root resorption than the adjacent premolar (Figs 3 and 4).

Ectopic Position of Canines

Radiographs exposed at age 13 years, 8 months of age show ectopic mesial eruption of the right maxillary and mandibular permanent canines (Fig 2). Orthodontic treatment was begun using a removable appliance to retract the mandibular right permanent canine; the maxillary right canine was exposed surgically. At the time of surgery, the maxillary right central and lateral incisor were mobile and, within four months, the lateral incisor had exfoliated spontaneously. Eighteen months after beginning appliance therapy, all canines were better placed within the arches and final orthodontic records were taken (Fig 5). A full-mouth series exposed before prosthodontic and implant therapy (Fig 3) shows that the maxillary right canine had assumed the position of the lateral incisor.

Discussion

On initial examination of this patient at the age of 7, odontodysplasia and shell teeth were considered in the differential diagnosis. The thin dentin lining the roots and the enlarged pulp canals of the teeth were somewhat similar to the findings of regional odontodysplasia. However, the defect was not "regionalized" in our patient, but affected all maxillary and mandibular teeth to some degree. The substantial amount of coronal dentin present indicated that regional odontodysplasia was not the correct diagnosis.

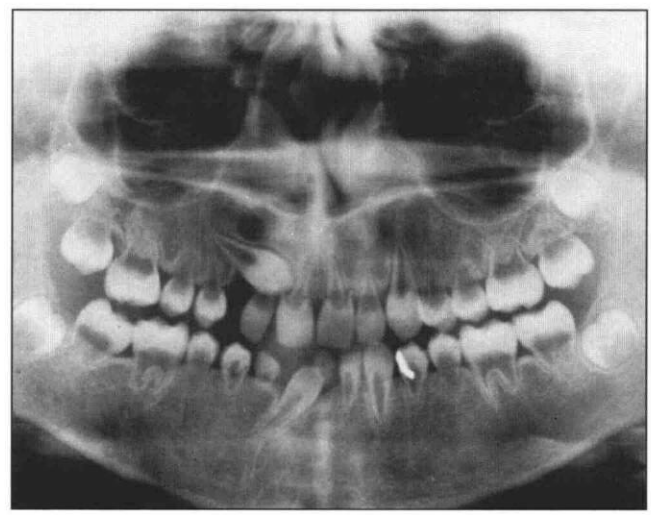

Fig 2. Mesial eruption of right permanent canines and root fractures of maxillary central incisors (age 13 years 7 months).

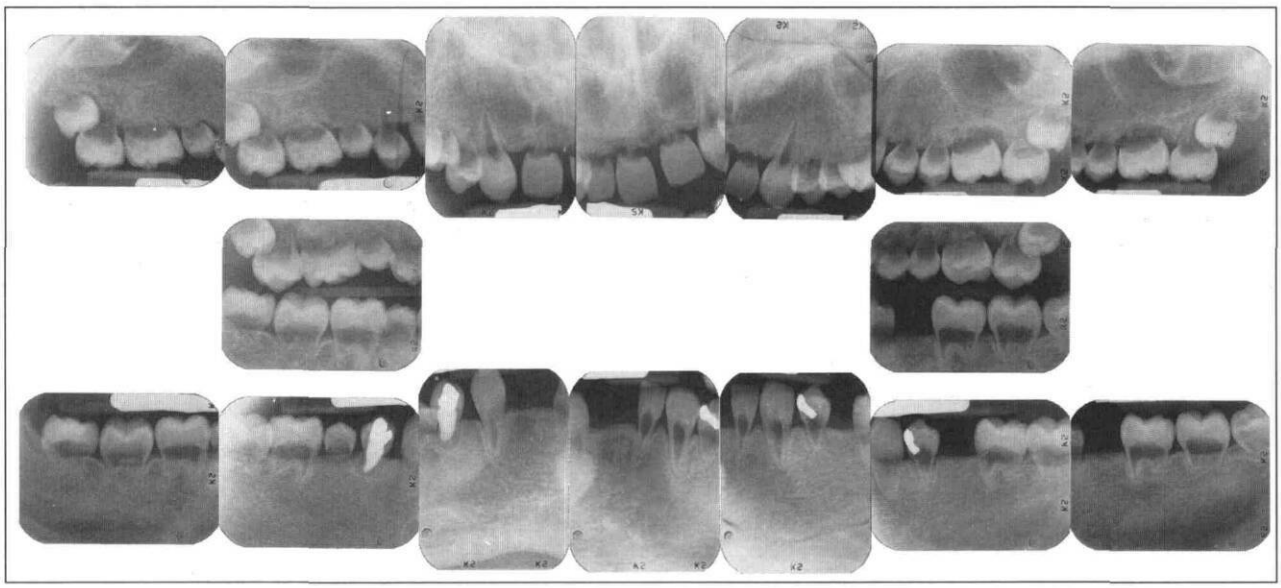

Fig 3. Progressive root resorption (age 21 years 3 months).

Another consideration in the diagnosis was the rare condition of shell teeth. It was difficult to arrive at a diagnosis because of the dearth of documented case reports for comparison. Also, some confusion in the literature is present regarding the clinical presentation of shell teeth. The roentgenographic features of shell teeth are described by Shafer et al.[5] as "all of the teeth appearing as shells of enamel and dentin surrounding extremely large pulp chambers and root canals." The recently documented case by Kinirons[4] says that "in shell teeth the pulp chambers of all the teeth are enormous and are surrounded by a thin layer of dentin." Our patient, however, did not present with this generalized lack of dentin; in the primary molars and in the maxillary permanent incisors, the pulp chambers almost were obliterated by dentin, but the pulp canals were large and surrounded by a thin shell of dentin. This observation is the same as that of Rushton[1], who clearly stated that the teeth are not all affected to the same extent. Because a thin shell of dentin is not present in the crown of the tooth, but often only in the roots, the use of the term "shell teeth" is questionable. Patients such as ours should perhaps be described as having "shell roots," rather than shell teeth.

The eight cases of shell teeth in the Brandywine isolate of dentinogenesis imperfecta, Shields Type III, showed a much more generalized lack of dentin formation than our case, and only the primary teeth had a "shell" appearance.[2, 5, 6] Shell teeth in the Brandywine isolate also had the external appearance seen in dentinogenesis imperfecta — attrition of the crowns of the teeth revealing smooth, amber-colored dentin. The mode of inheritance was autosomal dominant. Our patient had no family history of dentinal defects, had

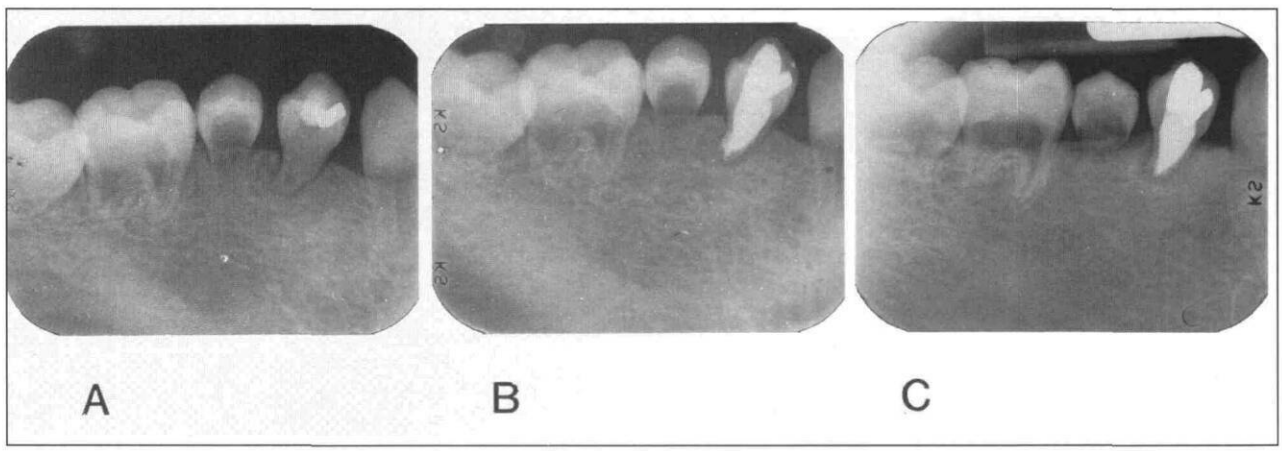

Fig 4. Pretreatment, posttreatment, and 6 year follow-up of endodontically treated lower right first premolar.

teeth that looked normal clinically, and had shell teeth affecting both dentitions. It is, therefore, doubtful that his condition was a variation of dentinogenesis imperfecta, Shields Type III.

Neither our patient nor Rushton's had a family history of shell teeth or dentin abnormalities, but dentinogenesis imperfecta has been described as occurring as a recent mutation, without a family history.[7] It is not possible to say whether sporadic cases of shell teeth such as ours are related genetically to dentinogenesis imperfecta, but the possibility warrants consideration.

Shell teeth have also been reported as part of the trichodental dysplasia syndrome.[8] Again, shell teeth in patients with this syndrome have dentin formation that is much more severely and much more universally compromised than in our patient, or the patient described by Rushton.

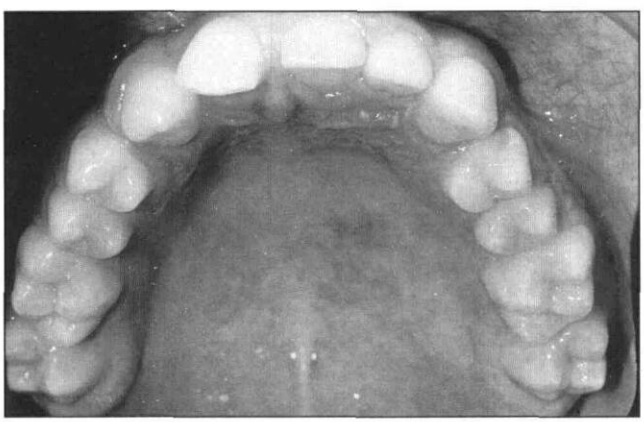

Fig 5. Maxillary and mandibular arches (age 14 years 4 months).

Considering the thin shell of dentin lining the roots of the incisors, it was not surprising that the patient described had two instances of root fractures following minor trauma. He also had what appeared to be spontaneous fracture of the right mandibular lateral incisor. Despite the root fractures, the incisors were maintained in the mouth for many years following trauma, a factor which helped maintain the alveolar bone necessary for later placement of implants.

Spontaneous abscess was not reported in Rushton's case, but multiple pulp exposures do occur in dentinogenesis imperfecta, Type III.[6] In cases of radicular dentin dysplasia (Type I), where spontaneous abscess also is a common finding, the pulp spaces are filled with massive denticles and the dentinal tubules are blocked, which may lead to periapical pathology. A similar situation occurring in the pulp chamber of the primary molars in our patient may have contributed to the spontaneous abscess of the one primary molar. Small radiolucencies which may be areas of irregular, globular dentin are visible in the crowns of the primary molars (Fig 1c).

Several points in managing this and similar cases warrant emphasis. Premature loss of some teeth may contribute to ectopic eruption of other teeth, as was the situation with the mesial displacement of this patient's mandibular right canine following early loss of the incisors. Fortunately, it was possible to tip the canine orthodontically, despite its delicate anatomy, using light, continuous forces. Removable appliances were felt to be the most appropriate because it was uncertain how the enamel might respond to bonding and debonding and how the roots might respond to fixed appliance forces. Surgical exposure of an unerupted tooth also was a successful treatment and can be considered when necessary. Root canal treatment also was successful and did not adversely accelerate root resorption. Because of the thin layer of dentin found in some teeth in a patient with shell teeth, the possibility of pulp exposure during even a conservative restorative procedure is considerable. However, endodontics can prolong the longevity of the tooth and, in one tooth, appeared to retard root resorption. Preserving existing teeth, even those that had suffered root fractures, proved to be a wise choice, as ample alveolus was later available when implants were placed.

Summary

This case report documents the progress of a child whose dentition is similar to that of the case originally described by Rushton as shell teeth. Because dentin in both this case and the original case of Rushton's had actually obliterated the crowns of many of the teeth, the appropriateness of the name, "shell teeth," is questioned. Possibly, the condition should be named "shell roots."

Slow but progressive root resorption is well illustrated in this case. The risk of pulp exposure during restorative procedures and the increased susceptibility to root fractures are evident. However, preserving the teeth as long as possible by orthodontic, restorative, surgical, and endodontic procedures ensured adequate alveolar support for future prosthodontic treatment.

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