TAURODONTISM – A CHALLENGE FOR PEDIATRIC DENTISTS

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ABSTRACT

Aim of the study The purpose of this paper is to review existent literature regarding taurodontism and to highlight the clinical challenges of this pathology in paediatric dentistry. **Material and methods** Literature was searched for clinical studies and descriptive papers with titles containing the words "taurodontism", "enlarged pulp chamber", "bull teeth" "Hertwig epithelial rooth sheath". **Results** Taurodontism is a dental developmental disturbanc in which the body is enlarged at the expense of the roots. An enlarged pulp chamber, apical displacement of the pulpal floor and lack of constriction at the cement-enamel junction are the characteristic features. It appears most frequently as an isolated anomaly, but its association with several syndromes and abnormalities has also been reported. Endodontic treatment of taurodontic teeth is stated to be complicated and difficult due to the complexity of the tooth morphology. **Conclusions** Taurodontic teeth bring a series of challenges to the dental practitioner, from a morphological standpoint, endodontic treatment, periodontal and surgical implications. Literature is scarce regarding protocols for managing teeth with taurodontism, therefore it is in the hand of the clinician to review the best treatment options for those teeth, considering that they are aware of the specific characteristics of the pathology.

Key words: Bull teeth, karyotype, taurodontism, Hertwig epithelial root sheath (HERS), enlarged pulp chamber

INTRODUCTION

Dental anomalies are formative defects caused by genetic disturbances during teeth morphogenesis. Taurodontism is a dental anomaly characterized by morpho-anatomical changes in the tooth shape, with roots reduced in size and an enlarged body of the tooth. It is recognized as a clinical variant for almost a century, having been found in the dentition of modern day races. It is characterized by pulp chamber enlargement, with an enlarged body of the tooth, at the expense of the roots and apically displaced furcation areas. The bifurcation may be only a few millimeters above the root apices (1).

Taurodontism was first described by Gorjanovic-Kramberger in 1908. However the term "taurodontism" was first proposed by Sir Arthur Keith in 1913. He coined the term that is derived from Greek "tauros" meaning "bull" and "odontos" which means "tooth", because of the morphological resemblance of affected teeth with hooved animal's teeth, especially bulls (2).

Witkop defined taurodontism as "teeth

with large pulp chambers in which the bifurcation or trifurcation is displaced apically and hence the chamber has greater apico-occlusal height than in normal teeth and lacks the constriction at the level of cemento-enamel junction (CEJ). The distance from the trifurcation or bifurcation of the root to the CEJ is greater than the occluso-cervical distance" (3).

The diagnosis of taurodontism is mainly based on features that are particularly best visualized on the radiography (4). Literature is scarce regarding taurodontism, mostly represented by case reports, and only a few number of reviews being present.

MATERIAL AND METHODS

Literature was evaluated for clinical studies and review articles regarding taurodontism, searching printed and electronic papers in PubMed and MedLine databases, for terms like: taurodontism, bull teeth, enlarged pulp chamber, Hertwig epithelial root sheath .

RESULTS AND DISCUSSIONS

Theories concerning the etiology of taurodontism have been diverse and the pathology is commonly attributed to the failure of invagination of the epithelial root sheath sufficiently early to form the cynodont (3). This alteration in the Hertwig epithelial root sheath involves failure of the epithelial diaphragm to form a bridge prior to dentin deposition resulting in a large pulp chamber (5). Some authors indicated that the anomaly expresses a primitive pattern, a specialized or retrograde character, a mutation, an X-linked trait, an atavistic feature, an autosomal dominant trait or familial transmission. Although it has been reported that taurodontism can be associated with genetic syndromes, certain defects and its true origin are still obscure (6).

Taurodontism most often appears as an isolated anomaly, but it has been also affiliated with several developmental anomalies and syndromes including amelogenesis imperfecta, Down syndrome, ectodermal dysplasia, Klinefelter syndrome, tricho-dento-osseous syndrome, Mohr syndrome, Wolf-Hirschhorn syndrome and Lowe syndrome (7). Taurodontism has also been reported to be present in other rare syndromes such as Smith-Magenis syndrome (8), Williams syndrome (9), McCune-Albright syndrome (10) and Van der Woude syndrome (11).

Theories regarding the pathogenesis of taurodontic root formation are also varied: an unusual developmental pattern, a delay in the calcification of pulpal chamber, an odontoblastic deficiency, an alteration of the Hertwig epithelial root sheath (12). According to some authors, taurodontism is most likely the result of disrupted developmental homeostasis (13).

Identification of taurodontism can only be done by radiographic examination, as the external teeth morphology is within normal configurations. Taurodontism was initially detected through periapical X-rays and in panoramic radiographies. The radiographic examination is the best method for visualizing the pulp chamber in a rectangular configuration and Taurodont tooth appearance has a very characteristic morphology. Affected teeth take a rectangular shape with a relative tapering towards the roots. The pulp chamber is exceedingly large, with a greater than normal apex-occlusal height, lacking the usual constriction at the cervical region of the teeth, and with extremely short roots. The trifurcation or bifurcation may be situated a few millimeters above the apices of the roots (14).

In 1928, Shaw classified this condition as hypotaurodontism, mesotaurodontism and hypertaurodontism, based on the relative

displacement of the floor of the pulp chamber (15). This subjective, arbitrary classification led normal teeth to be misdiagnosed as Taurodont teeth. In 1977, Feichfnger and Rossiwall stated that the distance from the bifurcation or trifurcation of the root to the cemento-enamel junction should be greater than the occluso-cervical distance for a taurodontic tooth (16). Though there are many classification systems to determine the severity of taurodontism, Shifman and Chanannel proposed a new classification in 1978, which still remains a widely used system (17).

Differential diagnosis is a challenge for the clinician. In certain metabolic conditions, including pseudo-hypoparthyroidism, hypophosphatasia, and hypophosphatemic vitamin D-resistant and dependent rickets, the pulp chamber may be enlarged but the teeth are of relatively normal form (2). Another differential diagnosis is in the early stages of dentinogenesis imperfecta, where the appearance may resemble to the large pulp chambers found in taurodontism. Moreover, the developing molars may appear similar to taurodonts; however, an identification of wide apical foramina and incompletely formed roots could be of help in the differential diagnosis.

Literature reveals a wide discrepancy in the prevalence of taurodontism in different populations. Taurodontism prevalence has been reported to range between 5.67% and 60% of subjects (18,19). In a recent study, it has been accounted for 18% of all of the dental anomalies (20). The prevalence of taurodontism in children was found to be 0.3% (19). This diversity basically results from a lack of uniformity, either in methodology or classification performed in different studies (21).

Clinical implications of taurodontism include a potentially increased risk of pulp exposure, due to dental decay or dental procedures. Taurodontism may complicate orthodontic and/or prosthetic treatment planning. Taurodontism, although not very common, has to be emphasized due to its influence on various dental treatments.

For instance, pulp therapy for taurodonts is a challenging treatment, with an increased incidence of haemorrhage during the access opening, which may be mistaken for a perforation. Since the roots are short and the pulpal floor is placed apically, care should be taken to prevent perforations. Conventional filling materials like bulk Zinc oxide eugenol may take a longer time to resorb, which may delay the natural exfoliation of the tooth. In such cases, combinations of calcium hydroxide can act as a great material due to its resorption rate. Studies have reported Endoflas as a proper filling material, which is a combination of zinc oxide eugenol, iodoform, calcium hydroxide and barium sulphate. This material seems to add the advantage of a faster resorption rate, due to the presence of calcium hydroxide and iodoform (6, 22, 23).

A taurodontic tooth shows wide variations of pulp chamber sizes and shapes, different degrees of obliteration and canal configurations, apically positioned canal orifices, and a higher potential for additional root canal systems. Therefore, root canal treatment becomes a particularly complex challenge. Moreover, whilst the radiographic features of a taurodontic tooth are characteristic, pre-treatment radiographs offer little information about the root canal system (24).

There are different views regarding access cavity design and preparation: Shifman et al. stated that access to the root canal orifices can be easily obtained, as the floor of the pulp chamber cannot be affected by the formation of reactional dentine, like in normal teeth (17). In contrast, Durr et al.

suggested that tooth morphology could hamper the location of the orifices, thus creating difficulty in endodontic instrumentation and filling (24).

Each taurodontic tooth may have particular root canals in terms of shape and number. A case study has reported complicated root canal treatment for a mandibular taurodontic tooth with five canals, only three of which could be instrumented to the apex (25). Authors seem to agree that careful exploration, especially with magnification, of the grooves and between all canal orifices (26), is recommended to reveal additional orifices and canals (27).

Because the pulp of a taurodontic tooth is usually voluminous, in order to ensure complete removal of the necrotic pulp, 2.5% sodium hypochlorite has been initially suggested as an irrigant to digest pulp tissue (27). Moreover, as adequate instrumentation of the irregular root canal system cannot be anticipated, some authors suggested that additional efforts should be made by irrigating the canals with 2.5% sodium hypochlorite in order to dissolve as much necrotic material as possible, while others suggest that the application of a final ultrasonic irrigation may ensure that no pulp tissue remains (27).

Due to the complexity of the root canal anatomy and the proximity of the buccal orifices, complete filling of the root canal system in taurodontism is challenging. A modified filling technique has been proposed, which consists of combined lateral compaction in the apical region with vertical compaction of the elongated pulp chamber (26).

Another endodontic challenge related to taurodontic teeth is intentional replantation. The extraction of a taurodontic tooth is usually complicated because of a dilated apical third (27). In contrast, it has also been hypothesized that because of its large body, there is a little surface area of the tooth embedded in the alveola. This feature would make the extraction less difficult, as long as the roots are not widely divergent. Some authors noted that in cases of hypertaurodontism (where the pulp chamber nearly reaches the apex and then breaks up into two or four channels), vital pulpotomy instead of routine pulpectomy may be considered as the treatment of choice (27).

From a periodontal standpoint, taurodontic teeth may offer favorable prognosis in specific cases. If periodontal pockets or gingival recession occurs, the chances of furcation involvement are considerably less than those in normal teeth, because taurodontic teeth have to demonstrate significant periodontal destruction before furcation involvement occurs (25).

Extraction of a taurodontic tooth is usually complicated because of the apical third divergence of the furcation. In contrast, it has also been hypothesized that the large body with a small surface area embedded in the alveola (2,3) could make the extraction less difficult. Some authors reported that the extraction of such teeth should not be a problem unless the roots are not widely divergent. However, other studies suggest that hypertaurodonts may pose some problem during extraction, because of the apical shift of furcation and also due to the difficulty in placement of forceps. This problem can be resolved by proper usage of surgical tooth elevators (12).

For the prosthodontic treatment of a taurodontic tooth, it has been advocated that post placement should be avoided in tooth reconstruction. Because less surface area of the tooth is embedded in the alveola, a taurodontic tooth may not have as much strength as a cynodont, when used as an abutment for either prosthetic or orthodontic

purposes. Stainless steel crowns are considered the ultimate extra-coronal restoration in pediatric dentistry, as the lack of a cervical constriction tends to prevent the tooth of the excessive loading of the crown (20). It is very important for a general dental practitioner to be familiar with taurodontism, not only in respect to clinical complications, but also to its management. Taurodontism also provides a valuable clue in detecting its association with many syndromes, such as amelogenesis imperfecta, or systemic conditions (28).

CONCLUSIONS

Taurodontic teeth have a wide range of anatomic variations including the size and shape of pulp chambers, varying degrees of obliteration and canal complexity, apical displacement of canal orifices, and the potential for additional root canal systems. The dental practitioners should be well aware about these significant changes. In the endodontic management of such teeth, careful exploration of the grooves, especially with magnification, ultrasonic irrigation and a modified filling technique are recommended.

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