THE PATTERN OF PATHOLOGICAL ROOT RESORPTION IN PRIMARY TEETH: RETROSPECTIVE STUDY

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ABSTRACT
Aim of the study: To assess the prevalence of the modified pattern of the root resorption in primary teeth and its causes in a group of Romanian children. Material and methods: The retrospective study was carried out between 2016 and 2017 at the Paediatric Dentistry Department. The patients study sample contained 94 Romanian children (46 girls and 48 boys, aged between 3.5 and 13.58 years, mean age 8.00±0.20 years) and a primary teeth sample of 835. Results: From the total amount of teeth with pathological root resorption pattern, 72.7% were affected by external root resorption, while 36.4% were affected by internal root resorption. Half of the pathological alterations of root resorption pattern were caused by vicinity pressures. Conclusions: The pathological alterations of root resorption pattern were represented especially by external root resorption. An important cause of pathological root resorption pattern was represented by necrosis and apical periodontitis.

Key-words: PATHOLOGICAL ROOT RESORPTION, PATTERN, PRIMARY TEETH

INTRODUCTION

Root resorption represents a physiological or a pathological process that appears as a consequence of the actions performed by the clastic cells (1-6).

Physiological root resorption occurs only at the apex of the primary teeth having a horizontal or slightly oblique pattern (7). It represents the gradual shortening of the roots of primary teeth until their complete disappearance (8).

The root resorption of the primary teeth can also be pathological, while in permanent teeth it is always pathological (9). Pathological root resorption represents the process of modified pattern (localisation) and speed of root consumption.

The pathological root resorption’s classification according to Andreasen uses the location criterion and subdivides root resorption in two main groups: internal and external (8-10).

Internal root resorption is noticed in the inner walls of the root canal (11) and can be subdivided based on the histopathological aspect in three categories: *inflammatory resorption* (2,12,14,15) (it may appear in the apical region after multiple inflammatory periapical pathologies or it may be intraradicular, that can be recognized as a round or oval shaped radiolucency contained in the tooth root) (12,13,14), *replacement resorption* and *transient apical internal resorption* (2,12,13,14,15) (induced by trauma and recognisable by a transient periapical radiolucency which disappears in a few months) (12-14).

External root resorption was classified based on the localisation on the root surface of the tooth in 3 categories: lateral (**Fig.1**), apical (**Fig.2**) or cervical (1,4).

Figure 1. Radiographic appearance of lateral external root resorption in distal root of 7.4

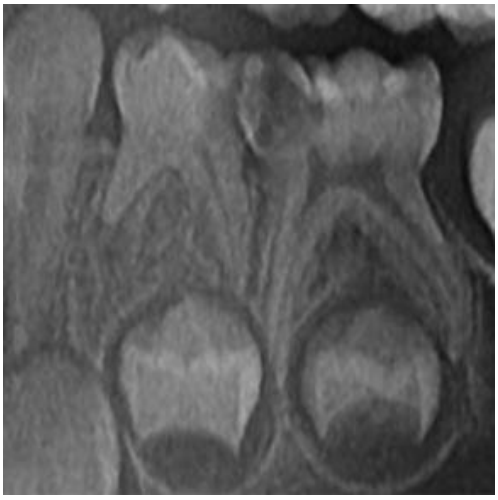

Figure 2. Radiographic appearance of external apical root resorption in mesial root of 7.4

It can be subdivided in three categories, based on the histological aspect: *external surface resorption* (1,2,4,5,13,15), *inflammatory resorption* (1,2,4,5,15,16) (it can be progressive and can be stopped by treatment) (12,13), *replacement resorption (ankylosis)* (1,2,4,5,12,13,15,16,17) (it involves the progressive resorption of cementum and dentin, their place being taken by bone, the latter coming in contact with dentin) (12,13,17), *invasive cervical resorption* (1,2,4,5,12,13,14,16,17,18,19) (characterized by coronal dentin and enamel resorption, that creates clinically a pinkish colour in the tooth crown) (1,12,13,17,18,19).

The present retrospective study investigated the modified pattern of the root resorption in primary teeth and its possible causes in a group of children examined and treated at the Paediatric Dentistry Clinic of “Carol Davila” University of Medicine and Pharmacy, Bucharest, Romania.

MATERIAL AND METHODS

This retrospective study was carried out over a period of 1 year, between 2016 and 2017, at the Paediatric Dentistry Clinic.

The study sample of patients was selected using the following inclusion criteria: healthy children with full medical records and primary or mixed dentition.

The patients study sample contained 94 Romanian children (46 girls and 48 boys, aged between 3.5 and 13.58 years, mean age 8.00±0.20 years) with primary or mixed dentition.

The teeth study sample contained 835 primary teeth (165 incisors, 225 canines and 445 molars) with root resorption, out of a total of 1137 primary teeth (with and without root resorption) which constituted the initial sample of teeth (IST: 618 M, 201 I, 318 C).

Data were collected from the patients’ medical records and from their orthopantomograms (OPG).

The variables extracted from the patients’ medical records were the following: age, gender, type of tooth, pulp diagnosis, presence and type of dental trauma.

The variables obtained from the OPGs were the following: type of root resorption (physiologic or pathologic), the pattern (location) of the external (cervical, lateral, apical, combinations) or internal root resorption (coronal / radicular with or without perforation), the severity of pathological root resorption (PRR), the number of affected roots and the possible causes of PRR (pulpal pathology, dental trauma, dental ankyloses, pressure on the dental root, multiple or idiopathic causes).

The severity of PRR was assessed based on the amount of affected tooth structure reported to the thickness of the dentinal wall: internal root resorption (coronal/radicular root resorption with or without perforation) and external lateral root resorption (1/3, 2/3 or total perforation of the root).

All radiographs were taken in the same radiographic facility according to a standardized technique. The research team consisted of four examiners: a PhD student (AGG) which was previously trained in order to obtain an acceptable inter-examiner reliability score (Fleiss' kappa=0.82), and three experienced researchers.

Data analysis was performed using Stata® 11IC (StataCorp LP, Texas, USA, version 2009) statistical software. A *p*-value of 0.05 was considered statistically significant.

RESULTS AND DISCUSSIONS

Root resorption was registered in 73.43% (n=835) of all studied teeth (IST=1137). An average of 8.8 teeth with root resorption per patient was recorded.

PRR has been observed in 32.81% (n=274) of the study initial sample of teeth (IST). An average of 2.9 teeth with PRR per patient was recorded (**Fig. 3**).

Out of a total of 618 primary molars, PRR was recorded in 25.4% (n=157). PRR was recorded especially in mandibular molars (67.51%, n=106).

PRR pattern was found in 3.9% (n=44) of the initial sample of teeth (n=1137) which represented 5.3% of the teeth with ongoing root resorption (n=835).

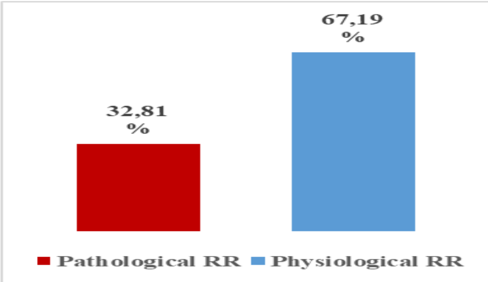

Figure 3. The prevalence of PRR in primary teeth

External root resorption was found in 63.6% (n=28) of the teeth with PRR pattern, while internal root resorption was encountered in 27.3% (n=12) (**Fig. 4**). Both resorption patterns were found in the same teeth in 9.1% (n=4) of cases.

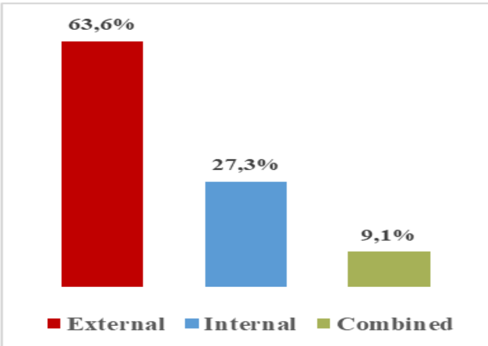

Figure 4. The frequency of the PRR pattern

The pattern of the external root resorption was mostly lateral (65.6%, n=21), followed by lateral and apical combinations (28.1%, n=9) and cervical (6.3%, n=2).

Half of the pathological alterations of the root resorption pattern was caused by vicinity pressures (50%, n=22), followed by pulpal pathology of carious and traumatic cause (45.5%, n=20) and idiopathic or multiple causes (4.6%, n=2).

Vicinity pressure was caused in most cases by the successor (its position or size) (63.64%, n=14), followed by supernumerary teeth (27.27%, n=6) and other causes (9.09%, n=2) (**Fig. 5**).

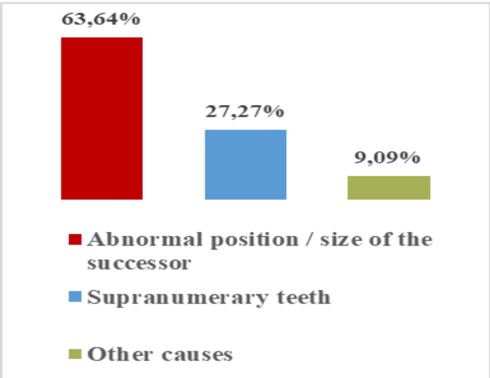

Figure 5. The causes of vicinity pressure induced PRR pattern.

The distribution of the internal root resorption according to the severity was the following: radicular without perforation (56.3%, n=9), radicular with perforation (25%, n=4), coronal without perforation (12.4%, n=2) and coronal with perforation (6.3%, n=1).

The severity of the external lateral root resorption was assessed based on the amount of affected tooth structure reported to the thickness of the dentinal wall, as follows: up to 1/3 of the root's wall - 13.3% (n=4), 1/3 to 2/3 of the root's wall - 26.7% (n=8) and involving dental pulp 60% (n=18).

PRR pattern was observed especially in mesial roots (22.7%, n=10) and in multiple roots (18.2%, n=8).

The pulpal diagnosis of teeth with PRR pattern was as follows: necrosis (25%, n=11), apical periodontitis (22.7%, n=10) and irreversible pulpitis (9.1%, n=4).

There was a statistically significant higher frequency of PRR pattern in patients with pulpal necrosis and apical periodontitis (14.89%, n=21) compared to those without pulpal involvement (2.0%, n=19) ($p<0.001$).

The frequency of PRR pattern was not statistically correlated to the type of tooth ($p=0.815$) or the patient's gender ($p=0.648$).

There are a reduced number of clinical studies in the medical literature, which deal with the pathological root resorption in the primary dentition. These few studies were made especially on molars.

In our study the overall prevalence of the PRR was of 32.8%.

PRR was encountered in 25.4% of the molars, which is lower than the results recorded by Mulia et al. (47.89%), but higher compared to the results of Vieira-Andrade et al. (16.2%) (6,20).

The lower primary molars were predominantly affected by the pathological root resorption (67.51%, n=106).

The frequency of asymmetrical root resorption was 22.7%. This result was higher than the findings of Vieira-Andrade et al. - 3.8% (21).

The frequency of PRR was not statistically correlated to the type of tooth ($p=0.815$) or to the patient's gender ($p=0.648$), which is in disagreement with the findings of Vieira-Andrade et al. (20).

The prevalence of PRR was higher in teeth with pulpal involvement (56.8%), which is similar to the results of Vieira-Andrade (61%) (20).

The distribution of the internal root resorption according to its severity indicated that the radicular resorption without perforation was the most frequently encountered (56.3%, n=9).

CONCLUSIONS

1. PRR in primary teeth represents a challenging pathology for the paediatric dentist.
2. The pathological alterations of root resorption pattern were represented especially by external root resorption.
3. One of the important causes of PRR pattern was represented by necrosis and apical periodontitis. Early diagnosis and treatment of teeth with PRR and pulpal involvement may be helpful to clinicians in order to prevent premature loss of primary teeth and its consequences in the permanent dentition.

REFERENCES

1. De Aguiar Santos BO, De Mendoça DS, De Sousa DL, Morereira Neto JJS, De Araujo BR. Root resorption after dental traumas: classification and clinical, radiographic and histologic aspects. RSBO. 2011;8(4):439–445.
2. Fernandes M, de Ataide I WR. Tooth resorption part I - pathogenesis and case series of internal resorption. J Conserv Dent. 2013;16(1):4–8.
3. Nilsson E, Bonte E, Bayet F, Lasfargues JJ. Management of Internal Root Resorption on Permanent Teeth. Int J Dent [Internet]. 2013; 2013:929486. Available from: https://doi.org/10.1155/2013/929486.
4. Fuss Z, Tsesis I, Lin S. Root resorption-diagnosis, classification and treatment choices based on stimulation factors. Dent Traumatol. 2003;19(4):175–182.
5. Darcey J QA. Resorption: part 2. Diagnosis and management. Br Dent J. 2013;214(10):493–509.
6. Mulia D, Indiarti I, Budiarjo S. Effect of root resorption of primary teeth on the development of its permanent successors: An evaluation of panoramic radiographs in 7–8 year-old boys. J Phys Conf Ser. 2018;1073:032015.
7. Knott VB, O’Meara WF. Serial data on primary incisor root resorption and gingival emergence of permanent successors. Angle Orthod. 1967;37(3):212–222.
8. Andreasen J0. Luxation of permanent teeth due to trauma. A clinical and radiographic follow-up study of 189 injured teeth. Eur J Oral Sci. 1970;78(1-4):273-286.
9. Kanas RJ, Kanas SJ. Dental root resorption: a review of the literature and a proposed new classification. Compend Contin Educ Dent. 2011;32(3):38–52.
10. Thomas P, Krishna Pillai R, Pushparajan Ramakrishnan B, Palani J. An Insight into Internal Resorption. ISRN Dent [Internet]. 2014; 2014:759326. Available from: https://doi.org/10.1155/2014/759326.
11. Mincik J, Urban D, Timkova S. Clinical Management of Two Root Resorption Cases in Endodontic Practice. Case Rep Dent. 2016; 2016:9075363.
12. Heithersay GS. Management of tooth resorption. Aust Dent J. 2007;52(1 Suppl):S105-121.
13. Yigit - Ozer S. Diagnosis and Treatment Modalities of Internal and External Cervical Root Resorptions: Review of the Literature with Case Reports. Int Dent Res. 2011;1:32–7.
14. Bartok RI, Văideanu T, Dimitriu B, Vârlan CM, Suciu I, Podoleanu D. External radicular resorption: selected cases and review of the literature. J Med Life [Internet]. 2012;5(2):145–8. Available from: https:// www.ncbi.nlm.nih.gov/ pmc/ articles/ PMC3391 874/.
15. Swami V, Singh A, Abraham D, Ahuja R. Internal Resorption: A Review. Int J Med Sci Clin Invent [Internet]. 2017;4(4). Available from: https://valley international.net/ index.php/ijmsci/article/view/753.
16. Tronstad L. Root resorption--etiology, terminology and clinical manifestations. Endod Dent Traumatol. 1988;4(6):241–252.

17. Maria R, Mantri V, Koolwal S. Internal resorption: A review and case report. Endodontology. 2010; 100-108.
18. Singh O, Sinha D, Tyagi S, Tyagi N. Root Resorption: Challenge to the Endodontist. Int J Dent Res Oral Sci [Internet]. 2017;2:31–41. Available from: https://actascientific .com/ ASDS/pdf/ASDS-01-0008.pdf.
19. Cvek M, Abbott PV, Bakland LK, Heithersay GS. Management of trauma-related pulp disease and tooth resorpion. In Andreasen JO, Andreasen FM, Andersson L (editors). Textbook and Color Atlas of Traumatic Injuries to the Teeth, 5th edition, Wiley Blackwell. 2019; 700-707.
20. Vieira-Andrade RG, Drumond CL, Alves LP, Marques LS, Ramos-Jorge ML. Inflammatory root resorption in primary molars: prevalence and associated factors. Braz Oral Res [Internet]. 2012;26(4):335–340. Available from: http:// www.ncbi. nlm.nih.gov/ pubmed/22790498.
21. Vieira-Andrade R, Drumond C, Araújo M, Santos G, Fonseca Silva T, Ramos-Jorge M. Asymmetrical root resorption in primary mandibular molars: Prevalence and determinants factors. Int Dent Med J Adv Res. 2016;1:1–5.