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Case Report

Improvement on OHRQoL after endodontic treatment associated with aPDT in traumatized primary teeth: a 12-month follow-up case report

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Abstract: Dental trauma is often associated with a negative impact on the oral health-related quality of life (OHRQoL). The management of traumatized teeth is a challenge in the daily pediatric dentistry clinic, due to the sequels generated over time. Pulp necrosis is a frequent sequel that requires a pulpectomy. Antimicrobial photodynamic therapy (aPDT) is an adjuvant technique, effective in eradicating microorganisms from the root canals. This case report aimed to describe OHRQoL after endodontic treatment associated with aPDT in traumatized primary teeth of a 4-year-old female patient attended at a Dental Trauma Care Program considering a period of 12-month follow-up. The Brazilian version of the Oral Health Early Childhood Impact Scale (B-ECOHIS) was used to evaluate the OHRQoL. The dental trauma and its sequels had a negative impact on the child's OHRQoL. The proposed treatments (endodontic and restorative procedures) improved the patient's OHRQoL. The association of aPDT with conventional endodontic treatment was effective in this case. It allowed the sinus tract regression and new bone formation. Besides that, this case report emphasizes the need and importance to follow-up dental trauma cases in the pediatric dentistry clinic.

Keywords: Primary teeth, photodynamic therapy, pulpectomy, dental trauma, quality of life

Introduction

Trauma in primary teeth may have serious consequences, such as medical, aesthetic, and psychological problems [1]. Some epidemiological studies reported the frequency of approximately 30% of traumatic injuries to primary teeth [2-4]. The highest prevalence can be observed in children under 2 years and the primary upper incisors are the teeth most often involved [5, 6] with a prevalence ranging from 11.0% to 47.0% [7, 8].

Due to the high prevalence of dental trauma, there is an increasing interest in its effect on quality of life. Oral health-related quality of life (OHRQoL) is a multidimensional construct that reflects, among other things, the comfort of the individual when feeding and during sleep, social interactions, self-esteem and satisfaction with their oral health [9]. Instruments measuring OHRQoL have become essential for considering the population's perception about the impact of oral disorders on well-being [10]. Measurements on OHRQoL are essential strategies of oral health surveys, clinical trials, and studies evaluating therapeutics outcomes [11]. Among the instruments found in literature to assess OHRQoL of children and adolescents there is not a specific one for dental trauma and quality of life [12]. The Early Childhood Oral Health Impact Scale (ECOHIS) was developed in English language [13] and cross-culturally adapted to Brazilian Portuguese (B-ECOHIS). It is a proxy measure of children's OHRQoL that presents satisfactory psychometric properties and it is designed to assess the negative impact of oral disorders on the quality of life of preschool chil-

Figure 1. Initial clinical aspect: discoloration of the tooth 51 and coronal fracture of the tooth 61.

dren (2 to 5 years old) answered under parental perception [14, 15].

The International Association of Dental Traumatology (IADT) has developed an updated set of guidelines to treat dental trauma. According to them, a detailed radiographic examination is essential to establish the extent of the injury to the supporting tissues, the stage of root development, and the relation to the permanent successors [16]. When an infection exists, endodontic treatment is indicated [17]. One of the main goals of this treatment is an effective disinfection of the canal systems, becoming a fundamental component for a successful treatment outcome [18]. Advances in endodontic decontamination focus on methods to assist the disinfection of the root canal system. Antimicrobial photodynamic therapy (aPDT) has been proposed as an adjuvant during endodontic treatment due to its low toxicity and antimicrobial action [19].

This case report aimed to describe OHRQoL after endodontic treatment associated with aPDT in traumatized primary teeth of a 4-year-old female patient attended at a Dental Trauma Care Program considering a period of 12-month follow-up.

Case report

A 4 years old female child was referred to the Dental Trauma Care Program in a Brazilian Public University. During the anamnesis, the child's mother reported that her daughter had teeth with color alteration, since she had fallen from her own height. The mother did not know exactly when the accident had occurred and did not seek immediate care. She only sought a Public Health Clinic a while later the fact. Clinical examination showed involvement of teeth 51, 52, 61 and 62, with coronal fracture of the element 61, discoloration of the element 51 and temporary restorations on 52 and 62 (**Figure 1**). Radiographic exam revealed periapical lesions in the teeth 51 and 61 and both had more than 2/3 of the root (**Figure 2**). The B-ECOHIS was administered to assess the OHRQoL and it was detected that the dental trauma had a high impact on the child and her family daily live (**Table 1**, appointment 1). The Brazilian version for the Oral Health Early Childhood Impact Scale (ECOHIS) for preschool children (2-5 years old) and their families is the B-ECOHIS. This questionnaire is applied to assess the impact of oral health conditions on the child's quality of life [14]. The ECOHIS presents 13 questions divided in subscales: child (9 questions) and family (4 questions). Each answer receives a score ranging from 0 to 4 according to Likert scale: "Never", equivalent to 0; "Almost never", equivalent to 1; "Sometimes/from time to time", equivalent to 2; "Often", equivalent to 3;

Figure 2. Clinical radiographic aspect: teeth 51 and 61 with periapical lesions.

Table 1. ECOHIS scores for each item, domains, subscales and total scale in different points of time

ECOHIS	Appt. 1 (clinical exam)	Appt. 2 (after endodontic treatment)	Appt. 3 (after restorative treatment)	Appt. 4 (12-month follow-up)
Child Impacts				
A-How often has your child had pain in the teeth, mouth or jaws?	3	2	0	0
B-How often has your child had difficulty drinking hot or cold beverages?	3	0	0	0
C-How often has your child had difficulty eating some foods?	2	2	0	0
D-How often has your child had difficulty pronouncing any words?	3	0	0	0
E-How often has your child missed preschool, daycare or school?	0	0	0	0
F-How often has your child had trouble sleeping?	2	0	0	0
G-How often has your child .... because of dental problems or dental treatments been irritable or frustrated?	1	0	0	0
H-How often has your child .... because of dental problems or dental treatments avoided smiling or laughing?	2	0	0	0
I-How often has your child .... because of dental problems or dental treatments avoided talking?	2	0	0	0
Family Impacts				
J-How often have you or another family member ..... because of your child's dental problems or treatments been upset?	2	0	0	0
K-How often have you or another family member ..... because of your child's dental problems or treatments felt guilty?	2	0	0	0
L-How often have you or another family member ..... because of your child's dental problems or treatments taken time off from work?	2	0	0	0
M-How often has your child had dental problems or dental treatments that had a financial impact on your family?	0	0	0	0
ECOHIS domains (variation)				
Symptoms domains (0-4)	3	2	0	0
Function domain (0-16)	8	2	0	0
Psychological (0-8)	3	0	0	0
Self-image/social interaction (0-8)	4	0	0	0
Parental distress (0-8)	4	0	0	0
Family Function (0-8)	2	0	0	0
ECOHIS Subscales				
Child Subscale (0-36)	18	4	0	0
Family Subscale (0-16)	6	0	0	0
Total ECOHIS Score	24	4	0	0

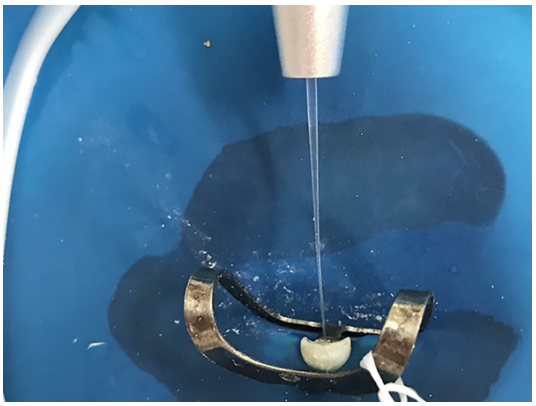

Figure 3. Use of the aPDT as adjuvant during endodontic treatment of the tooth 61.

and "Very often", equivalent to 4. The scores of each question are summed to obtain a total score that ranges from 0 to 52. The higher the value, the greater the impact on the child's oral health quality of life. This questionnaire is applied to assess the impact of oral health conditions on the child's quality of life [13, 14].

After planning the patient's treatment, a signed written informed consent form was obtained from the mother to start the child's treatment and further publication of the case. This Project was approved by The Ethics Committee by the number CAAE nº 70872117.8.0000.5626/protocol nº 2.320.329.

Initially, the pulpectomy of the element 51 was performed. Following administration of local anesthesia with 2% lidocaine, isolation was executed with a rubber dam (Madeitex, São José dos Campos, SP) and a clamp number 212 (SS White Duflex, Rio de Janeiro, RJ). Upon removal of the pulp chamber roof, a compatible diamond spherical bur was used to gain access to the root canal. The patency length was 14 mm and it was obtained through the initial radiography. The working length was set at approximately 1 mm short of the apical foramen. The root endodontic treatment was performed using a conventional technique with mechanical hand file in a step-back technique with K-files up to size nº 80. The irrigation was performed with 10 ml 2.5% sodium hypochlorite (NaOCl) after each instrument. The root canal received a final irrigation with 10 ml 0.9% saline solution to neutralize the effect of NaOCl, and it was dried with sterile paper points (Maillefer, Switzerland). The canal was filled with Zinc Oxide Eugenol (ZOE) paste using a lentulo spiral. The canal orifice was sealed with a temporary filling (Coltene) and the tooth was restored with glass ionomer cement (Riva light cure capsule, SDI).

When the patient returned for a second visit, a sinus tract in the element 61 was observed. Pulpectomy of this tooth was performed in the same way as the element 51, but after completion of the chemo-mechanical root canal preparation the application of aPDT was carried out. The canal was fulfilled with dye 0.01% methylene blue (Chimiolux, DMC) as a photosensitizer for 5 minutes. Afterwards, a laser fiber, with wavelength of 660 nm, 100 mW, 120 J/cm^2 4 J, was introduced into the apical portion of the root canal, with apical to cervical movement to ensure equal diffusion of light into the lumen of the canal, for 90 seconds (**Figure 3**). After aPDT, a final irrigation with 0.9% saline solution was done. The canal was dried with sterile paper points (Maillefer, Switzerland) and then it was filled with ZOE paste using a lentulo spiral. The canal orifice was sealed with a temporary filling (Coltene) and the tooth restored with glass ionomer cement (Riva light cure capsule, SDI). A final periapical radiograph was taken to verify the obturation quality of the teeth 51 and 61 (**Figure 4**). After completion of the endodontic treatments, a second evaluation of the OHRQoL was performed using the B-ECOHIS. **Table 1**, appointment 2 shows an improvement on the quality of life, but there were still two questions that presented impact on the child's OHRQoL (pain and discomfort when eating).

A final visit was set to execute the restorative procedures. The elements 51, 52 and 61 were restored with composite resin (Filtek Z250 XT, 3M ESPE) and adhesive (Adper Single Bond, 3M, ESPE) with the aid of a properly adapted celluloid crown. The tooth 62 was restored with the same composite resin and adhesive (**Figure 5**).

After restorative treatment, a third evaluation of the ECOHIS was administered (**Table 1**-appointment 3). The child was very satisfied with the result (**Figure 6**). Clinical and radiographic findings over the 12-month evaluation period (**Figures 7** and **8**) showed absence of radiolucent area in the periapical region with new bone formation and the restorations were perfectly adapted. One last evaluation of the

Figure 4. Final radiographic aspect: endodontic treatments.

Figure 5. Final clinical aspect: restorative procedures.

B-ECOHIS was administered showing an improvement on the OHRQoL (**Table 1**-appointment 4).

Discussion

Dental trauma is a frequent problem, especially among preschool children [20]. During this period, the young child is learning to crawl, stand, walk and run. The rudimentary reflexes and the lack of motor coordination may lead to falls. These falls, often in combination with play are the main etiological factors, and traumas in the primary dentition are difficult to prevent [2, 21, 22]. Traumatic dental injury is a distressing experience with aesthetic, physical, and psychological repercussions. It can cause a negative impact on OHRQoL of young children, ado-

Figure 6. Child satisfaction after endodontic and restorative treatments.

Figure 7. Clinical exam: 12-month follow-up.

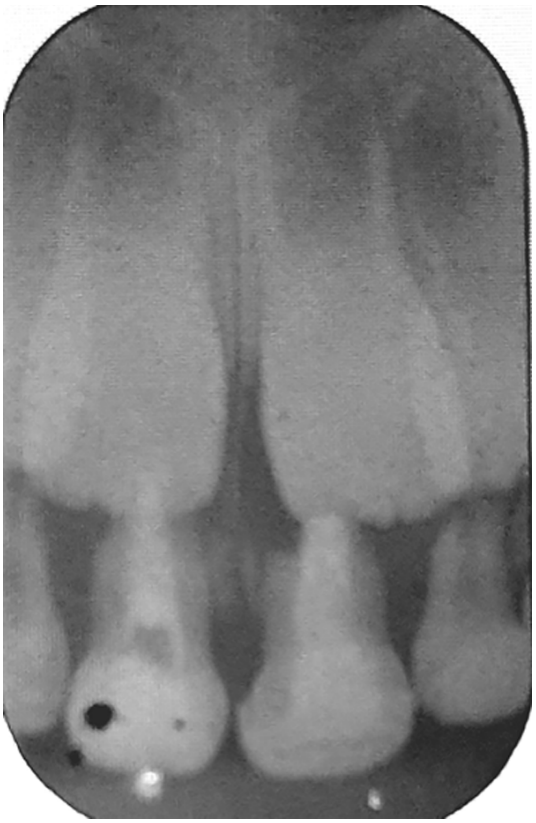

Figure 8. Radiographic exam: 12-month follow-up.

lescents and their parents affecting their oral health and well-being [23-26]. For that reason, it is important to have a holistic view of the patient, especially regarding treatment. In this case report, it was possible to observe the impact of dental trauma on patient's OHRQoL and how much the treatment managed to improve the patient's quality of life overtime [27-29] (**Table 2**).

The high prevalence of dental trauma in children at early ages may result in serious damage not only to the primary dentition, but also to the permanent dentition [6]. It is possible to treat the patient holistically based on the negative impact that dental trauma causes on the OHRQoL. Therefore, the follow-up of patients who suffered a dental trauma is paramount important, once it enable an effective treatment avoiding major damage. In this case report, tooth discoloration and pulp necrosis were the sequels observed. Crown discoloration should be considered, as it is a frequent question by the parents or caregivers, mainly due to aesthetic reasons [16]. Teeth with persisting dark discoloration may remain asymptomatic clinically and radiographically or develop apical periodontitis [30, 31]. There is an association between crown discoloration and pulp necrosis in traumatized primary teeth [32, 33].

According to the International Association of Dental Traumatology (IADT), the treatment selection for traumatized tooth should be aimed to minimize any additional risks of damage to the permanent successors [16]. After a trauma, if the dental pulp is affected, endodontic treatment becomes necessary. Effective root canal disinfection is one of the main goals and extremely important for a successful endodontic treatment [18]. Several microorganisms are resistant and considered to be difficult to eliminate from infected root canals. *Enterococci* are most often implicated in persistent root canal infections [34]. Some studies reported that complete eradication of microorganisms from the root canals cannot be effectively achieved [35, 36]. Canal root disinfection can be enhanced by using some protocols, such as chemical substances and other approaches for complementing the effect of conventional disinfection. Dental use of aPDT is increasing rapidly and several studies have shown that oral bacteria are susceptible to it [37, 38]. Photodynamic therapy has been recently used to eradicate microorganisms from root canal systems, which suggests that it might be useful as adjunctive therapy to current endodontic disinfection techniques [39]. In this case report, conventional endodontic treatment of teeth 51 and 61 was performed. Both teeth presented periapical lesions. Due to the arising of a sinus tract in the element 61, aPDT was associated in order to potentiate root canal decontamination and to favor periapical repair. The same was performed in other case reports [18, 19, 40]. Due to the broad spectrum of action, aPDT is a useful microbial reduction tool, providing a higher quality treatment [40]. It is an extreme ly important adjuvant treatment, especially in deciduous teeth due to technical difficulties. The literature shows that teeth with apical periodontitis demonstrated better bone healing and reduction of microorganisms after conventional treatment associated with aPDT [41, 42].

Instruments to measure the impact caused by dental trauma on OHRQoL is paramount important, since they help us to evaluate the disease, to choose the best treatment and its outcome, and also to manage resources [12]. In the pr-

Table 2. Studies evaluating TDI and its treatment on OHRQoL of children, adolescents and family

Author, year	Type of study	Sample	Conclusion
Aldrigui et al., 2011 [23]	Crossectional	Children and parents	Complicated TDI have a negative impact on the OHRQoL of preschool children and their parentes.
Antunes et al., 2013 [24]	Case-control	Children and adolescents	Children and adolescents who suffered TDI showed negative experiences and greater functional and emotional impact.
Abanto et al., 2015 [25]	Crossectional	Children	Complicated TDI were associated with worse OHRQoL of Brazilian preschool children.
Antunes et al., 2020 [26]	Systematic Review and Metanalisis	Children, adolescents and family	Impact of TDI on OHRQoL in children under age 10 was only significant in the symptom domain. The impact of TDI on OHRQoL in early adolescents aged 11 to 14 was significant in every assessed domain.
Berger et al., 2009 [27]	Non-randomized clinical trial (before and after study)	Children, adolescents and family	Severe TDI produce initial and ongoing pain. Detrimental effects on the OHRQoL of both children and parents are still present at one-year and these long-term effects are different for children and parents.
Bendo et al., 2010 [28]	Case-control	Children	Children with a TDI in the anterior teeth experienced a negative impact on social wellbeing, mainly with regard to avoiding smiling or laughing and being concerned about what other people may think or say.
Antunes et al., 2013 [29]	Non-randomized clinical trial (before and after study)	Family	It was observed positive decrease in the impact on OHRQoL after TDI treatment.

esent case report, all these principles were observed, thus emphasizing how much dental trauma and its sequel were affecting the quality of life of this child and her family. The use of B-ECOHIS was important for treatment decision making and it was possible to observe an improvement on the patient's quality of life throughout the treatment. The same was reported in a previous systematic review which concluded that the conventional endodontic treatment enhanced the oral health-related quality of life [43].

The endodontic and aesthetic treatments proposed in this case report had a good clinical and radiographic prognosis and helped to evaluate its outcome. In addition, they made possible to include again this child into society improving her OHRQoL.

Conclusion

Dental trauma and its sequels had a negative impact on the child's OHRQoL. The proposed treatments (endodontic and restorative procedures) improved the patient's OHRQoL. The association of aPDT with conventional endodontic treatment was effective in this case. It allowed the sinus tract regression and new bone formation. Besides that, this case report emphasizes the need and importance to follow-up dental trauma cases in the pediatric dentistry clinic.

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Disclosure of conflict of interest

None.

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