Treatment of pre-eruptive intracoronal resorption: A scoping review

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Abstract

Aim Pre-eruptive intra-coronal resorption (PEIR) is a rare condition that can affect children's dentition. Showing the same aspect of dental caries, these lesions are diagnosed in non-erupted teeth. The aetiology is not yet defined and no consensus on their treatment is available. Thus, the aim of the present scoping review of the literature was to try to establish a protocol for treatment and management of PEIR defects.

Methods The search was performed on Medline via PubMed, Science Direct and EBSCOhost' databases using the appropriate Medical Subject Headings (MESH) terms. Studies that described the PEIR were considered eligible and the data from the selected papers were extracted and analysed independently by two authors.

Results Out of 172 articles identified in initial research, 15 articles were selected for reviewing. Interventions varied from preventive treatment to extraction, depending on the lesion severity and its proximity to the pulp.

Conclusion Non-operative procedures, conservative approaches and extractions were recommended for the management of PEIR, depending on the extent of the lesions. Overall, further researches should be conducted to explore the effectiveness of the approaches of PEIR management.

KEYWORDS Pre-eruptive; Intra-coronal resorption; Intra -coronal radiolucency; Occult caries; Children.

Introduction

Pre-eruptive intracoronary resorption (PEIR) or pre-eruptive intracoronary lesion was firstly described as intra-follicular decay. However, this illustration has changed because dental caries cannot affect an unerupted tooth [Kronfeld, 1955]. Then the lesion was defined as a radiographic radioclarity, in the dentin of the crown of an unerupted tooth just below the enamel-dentin junction [Counihan et al., 2012].

Several studies had focused on its prevalence. Seow et al. [1999b] reported a percentage between 3 and 6% in the Australian patients and 0.5 to 2% of the examined teeth.

No statistically significant difference was reported between genders or ethnicities [Al-Batayneh et al., 2014; Manmontri et al., 2018].

The aetiology of PEIR is not yet defined. However, the most sustained explication was the implication of resorption cells that passed into the tooth through the reduced enamel epithelium [McNamara et al., 1997]. Predisposing factors have also been suggested, such as the ectopic position of the tooth which can generate local pressure stimulating the resorption process [Seow et al., 1999a].

Only a few studies have illustrated the histological aspect of PEIR. Some authors reported signs of resorption by the scalloped appearance of the contours and the presence of giant osteoclastic cells and multinucleated cells [Counihan et al., 2012; Wong et al., 2014]. Yamada et al. [2001] found multinucleated cells which had cathepsin-k immunoreactivity as an indicator of the resorptive activity of giant cells, in the cytoplasm. These findings suggested that the resorption process can progress if there are no appropriate treatments.

McNamara et al. [1997] also reported areas repaired with a spongy bone that was reshaped in places into lamellar bone. O'Neal [1997] and Şahin et al. [2015] described the presence of inflammatory cells including lymphocytic cells, an edematous matrix and some vascular ducts surrounded by hyalinotic connective tissue.

The diagnosis of PEIR's lesions is most of time fortuitous and determined through radiographs due to the absence of clinical signs [Ilha et al., 2018], but some cases of associated pain have been reported in the literature [Brunet-Llobet et al., 2014; Yang et al., 2017].

For the clinical aspect, most cases reported in the literature were without any apparent lesion [Counihan et al., 2012; Czarnecki et al., 2014; Yamana et al., 2010], but in some cases the lesion was clinically obvious [De Souza et al., 2017; Manan et al., 2012; Omar et al., 2015] and the surrounding tissues were generally of normal appearance [Fiorentin et al., 2016; Yamana et al., 2010].

Several treatments have been proposed for these lesions but no consensus on a rigorous therapeutic strategy has been yet established.

The main objective of this scoping review was to provide dentists with a clinical guide for the management of teeth with pre-eruptive intracoronary resorption.

Methods

Research question

This scoping review was developed following the recommendations of Arksey and O'Malley and aimed to answer the following question: What are the treatment modalities of PEIR lesion?

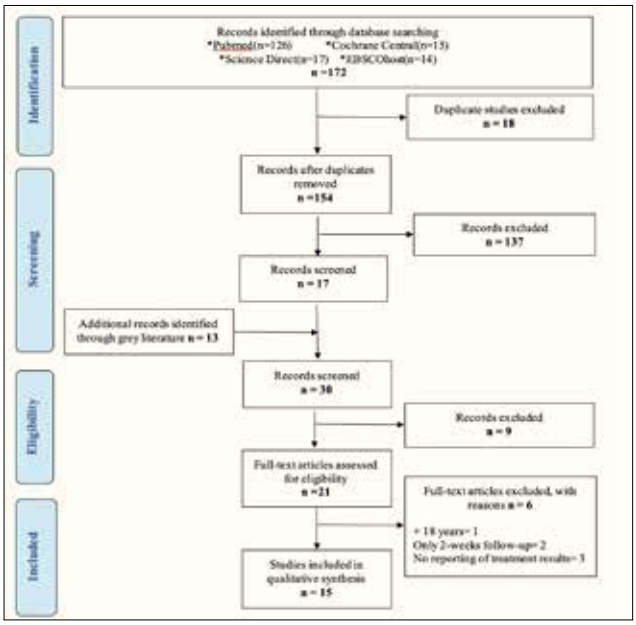

FIG. 1 Flow diagram of the literature search.

Identifying the relevant studies and information

Search strategy

Databases search was conducted from June 15, 2008 to June 12, 2018 and updated on December 11, 2019 to identify all published studies discussing therapeutic modalities of pre-eruptive intra-coronal resorption in a paediatric population (patients under 18 years of age). The research has covered Medline via PubMed, Cochrane Central, ScienceDirect and EBSCOhost. Pre-eruptive intra-coronal resorption was not indexed as MeSH terms; hence the following set of keywords was used during the search through different user combinations: "Tooth unerupted", "Tooth resorption", "Tooth crown", "Intracoronal", "Radiolucency", "Dental radiography", "Tooth Diseases".

Inclusion/exclusion criteria

The studies were initially screened based on title and abstract according to the following inclusion criteria: Case report related to PEIR with clear description and diagnosis of PEIR and its management details: tooth number, clinical and radiographic exam, surgical and/or restorative treatment, treatment's results and follow-up of at least 3 months; in patients aged less than 18 years; published in English.

The exclusion criteria included: publications before 2008, retrospective studies, duplicates, editorials, irrelevant papers, articles not in English, and those with unavailable data.

Data charting

The titles of all studies were reviewed by two authors independently. Duplicate studies were excluded. After titles selection, the abstracts were reviewed. Studies were excluded when they did not discuss any therapeutic modalities of PEIR. Cohen's κ statistic was done with value of 0.92 and 96.29% of agreement. Disagreement was solved by a third evaluator.

A data extraction sheet for the included articles was developed by the reviewers and the following items were collected: Identification of the article (author and year); number and age of children; type of teeth with pre-eruptive intracoronary resorption; intervention (timing, modalities, procedures); treatment's results.

Results

Study selection

The search strategy yielded a total of 172 articles from four search engines, PubMed via MEDLINE (127), Cochrane central (15), ScienceDirect (17), EBSCOhost (14) which were imported into Mendeley. Of the 172 references initially identified, 18 were duplicates, and 137 records were excluded by screening for title and abstract. Thirteen articles were added from grey literature and 9 articles were excluded. The remaining 21 articles were selected for full text review, after which, 6 studies were eliminated based on the exclusion criteria and 15 articles were chosen for assessment (Fig. 1) (Table 1).

Reference		Authors	Type of article	Year
1	Radiolucent lesion identified in unerupted mandibular left first permanent molar: Case report and literature review.	Yamana et al.	Case report	2010
2	Pre-eruptive coronal resorption of a maxillary canine: A case report	Yaqoob et al.	Case report	2011
3	Case report: pre-eruptive intra-coronal radiolucencies revisited	Counihan, O'Connell	Case report	2012
4	Case report: idiopathic pre-eruptive coronal resorption of a maxillary permanent canine	Manan et al.	Case report	2012
5	Oral pain due to severe pre-eruptive intracoronal resorption in permanent tooth	Brunet-Llobet et al.	Case report	2014
6	Pre-eruptive intracoronal Resorption of a permanent first molar	Czarnecki et al.	Case report	2014
7	Occult caries or pre-eruptive intracoronal resorption? A chance finding on a radiograph	Wong, Khan	Case report	2014
8	Pre-Eruptive Intracoronal Resorption (PEIR): literature review and case report	Omar et al.	Case report	2015
9	Non-cavitated dental radiolucent lesions: A challenge for the dental healthcare provider	Ahn et al.	Case report	2016
10	Diagnosis and clinical management of pre-eruptive intracoronal resorption – a case report	Fiorentin Moura et al.	Case report	2016
11	Pre-interruptive intracoronal resorption: clinical and radiographic follow-up	Barra SG, et al	Case report	2017
12	Case Report Preeruptive Intracoronal Radiolucencies: Detection and Nine Years Monitoring with a Series of Dental Radiographs	Manmontri et al.	Case report	2017
13	Intracoronal radiolucency in an unerupted premolar: A rare occurrence	De Souza et al.	Case report	2017
14	Management of infected immature permanent tooth with pre-eruptive intracoronal resorption: two case reports	Yang et al.	Case report	2017
15	Pre-eruptive intracoronal radiolucency in first permanent molar	Ilha et al.	Case report	2018

TABLE 1 Articles considered for reviewing.

Study characteristics

The retained studies described the clinical management of teeth with PEIR lesions in children aged between 4 and 14 years treated and with a follow-up ranged from 3 to 104 months.

The included articles were published between 2010 and 2018.

The main characteristics of the included studies are shown in Tables 2, 3 and 4. All cases of pre-eruptive intracoronary resorption were discovered prior to the eruption except for the case reported by Manan et al. [2012] where the diagnosis was established just at the eruption time. For all the included cases, the diagnosis was fortuitous. Panoramic radiographs were used for diagnosis in 11 cases and in 2 cases only bite-wing radiographs were used. All patients had only one tooth with pre-eruptive intracoronary resorption except one case where the patient had 2 affected teeth.

The degree of alteration according to The Seow classification [Seow et al., 1999b] was as follows: degree I for 5 teeth, degree II for 5 teeth and degree III for 9 teeth. The localisation of lesions was: mesial, distal and occlusal respectively for 5 teeth, mesio-occlusal or occluso-distal for three teeth, all the crown for 3 teeth and all dentinal thickness for other four ones. The clinical management of PEIR defects depends mainly on the lesion size and degree of progression at the time of detection but other factors may influence the treatment plan such as the stage of root development and the proximity of the successor germ.

In this scoping review, treatments described by the authors were diverse and varied from a preventive approach to extraction.

Main outcomes

In order to have a clear vision when interpreting the results of the included articles, we tried to group the findings according to the lesion degree.

Lesion degree I

For degree 1 lesion, a follow-up approach was always

Author/ year	Age/ gender	Dent.	Tooth	Localisation	Eruption status	Diagnostic method	Time of intervention	Intervention	Follow-up (months)	Clinical outcomes
Counihan, O'Connell (2012)	6y Female	Mixed	46	Distal	Partially erupted	Bitewing	After eruption	Sealant + monitoring	62	No caries Vital tooth
Czarnecki et al. (2014)	4y 3m Female	Primary	46	Central	Unerupted	Periapical radiograph	Before eruption	Surgical exposure + sealant	44 (33 months after treatment)	No caries The lesion was stabilised
Ahn et al. (2016)	11y Female	Mixed	47	Median	Partially erupted	Panoramic radiograph	Before eruption	Preventive obturation with bulk-fill + sealant	12	No clinical signs of complication
			37	Distal	Unerupted		After eruption	Abstention Wait and see? / Follow-up + indirect pulp capping		No clinical signs of complication
Barra et al. (2017)	9y Female	Mixed	45	Mesial	Unerupted	Panoramic radiograph	After eruption	Abstention Wait and see?	48	No progression of the lesion

TABLE 2 Data extraction of lesion degree I of Seow.

Author/year	Age/ Gender	Dent.	Tooth	Localisation	Eruption status	Diagnostic method	Time of intervention	Intervention	Follow-up	Clinical outcomes
Counihan, O'Connell (2012)	10 y Female	Mixed	45	Mesial	Unerupted	Panoramic radiograph	After eruption	Indirect cupping + resin modified glass ionomer + composite resin + sealant	72 months	Root edification is purchased and tooth is asymptomatic
Moura et al.(2016)	14y Female	Mixed	37	Median	Partially erupted	Panoramic radiograph	Before eruption and purchased after	Before eruption Elimination of affected tissue + glass ionomer cement. After the eruption: glass ionomer cement+ resin composite	9 months	Vital tooth, no clinical or radiological signs of complication
Manmontri et al. (2017)	8y 8 male	Mixed	37	Distal	Unerupted	Panoramic radiograph	After eruption	Sealant + Monitoring	104 months	Lesion is stabilized and tooth is asymptomatic
DeSouza et al. (2017)	10y Male	Mixed	35	Mesial	Erupted	Panoramic radiograph	After eruption (after 3 months)	Restoration with Bulk-fill composite	12 months	No progression of the lesion
Ilha et al. (2018)	8y Female	Mixed	36	Mesial	Unerupted	Panoramic radiograph	After eruption (after 6 months)	Surgical exposure + Restoration with glass ionomer cement+ resin composite	18 months	No clinical or radiological signs of complication

TABLE 3 Data extraction of lesion degree II of Seow.

Author/year	Age/ gender	Dentition	Tooth	Localisation	Eruption status	Diagnostic method	Time of intervention	Intervention	Follow-up	Clinical outcomes
Yamana et al. (1010)	5y 10 m Female	Mixed	36	Distal	Unerupted	Panoramic radiograph	After eruption (at 6 y and 4 months)	Indirect cupping (with calcium hydroxide) Coronal obturation with glass ionomer cement + resin composite	9 months	No clinical or radiological signs of complication
Yaqoob et al. (2011)	14 y Male	Permanent	23	All the crown	Unerupted	Panoramic radiograph	After eruption After orthodontic treatment	Extraction	26 months	Fast progression of the lesion
Counihan, O'Connell (2012)	12y Female	Permanent	37	All dentin + polyp	Partially erupted	Panoramic radiograph	After eruption	Extraction	9 months	Fast progression of the lesion
Manan et al. (2012)	13y 17 Male	Permanent	13	All the crown	Unerupted	Panoramic radiograph	After eruption	Extraction	18 months	Clinical and radiological signs of complication (periapical complication)
Brunet-Llobet et al. (2014)	12 y Male	Mixed	37	All dentin	Unerupted	Periapical radiograph	Before eruption	Extraction	5 months	Fast progression of the lesion. (38 replaced the 37)
Wong et al. (2014)	12y Male	Mixed	37	All dentin	Unerupted	Panoramic radiograph	Before eruption	Extraction	18 months	Clinical and radiological signs of complication
Omar et al. (2015)	11y Nm	Mixed	37	Mesio-occlusal	Unerupted	Bitewing	Before eruption	Surgical exposure+ Partial pulpotomy (MTA) Obturation + Resin composite	36 months	Vital tooth + Root edification
Yang et al. (2017)	8y Female	Mixed	33	Occluso-distal	Partially erupted	Panoramic radiograph	After eruption	Revascularization/ Dental Composite	14 months	Vital tooth + Root edification + No clinical signs
	8y Male	Mixed	34	Mesial	Partially erupted	Panoramic radiograph	After eruption (1 year)		3 months	No clinical signs Apical resorption

TABLE 4 Data extraction of lesion degree II of Seow.

recommended. A conservative approach with periodic clinical and radiographic follow-up is recommended in non-progressive lesions and intervention can be postponed until after tooth eruption when treatment does not require immediate surgical intervention. The prognosis of these lesions is often favourable, with generally no complications.

Sealant

In the second clinical case reported by Counihan and O'Connell [2012], intra-coronal radiolucency in a partially erupted lower right first permanent molar was noted on baseline bite-wing radiographs of a 6-year-old girl. Due to the non-progressive aspect of the lesion, a resin sealant was applicated after the eruption. The lesion was monitored annually and the tooth remained vital and asymptomatic, but at the age of 11 years the disto-lingual cusp overlying the PEIR lesion fractured and the tooth was restored using a preformed metal crown.

In the case report of Czarnecki et al. [2014], a non-progressive

PEIR lesion was detected early in non-erupted lower right first permanent molar of a 4-year-old girl. Treated with a preventive glass ionomer sealant before eruption in order to avoid bacterial invasion and monitored for 44 months, the tooth remained asymptomatic and vital. The glass ionomer sealant was used because it resists to humidity, releases fluoride, hardens quickly and requires little or no preparation.

Preventive filling

Ahn et al. [2014] reported a case of female patient aged 11 years with two affected teeth. The panoramic radiograph revealed that teeth 47 and 37 had PEIR lesion. Tooth 47 was palpable while tooth 37 was not, for which reason the treatment of tooth 47 was planned before the eruption and the 37 after it. After the tooth underwent gingival incision, bulk-fill composite resin and a glass ionomer cement-based sealant were placed. The patient was then lost of sight for more than a year before re-consultation and lesion on the 37 had evolved into a Grade II lesion, requiring indirect pulp capping which was done using TheraCal LC® and Biodentine®.

Lesion degree II

In order to stop the progression of the resorptive process and prevent its penetration into the dental pulp, immediate treatment by conservative approaches is generally recommended in degree 2 lesions, where the tooth is not close to eruption within a short time. The prognosis of all the included degree 2 lesions described in the present review was favourable.

Sealant

Manmontri et al. [2018] reported a case of a non-progressive PEIR lesion on a mandibular left second permanent molar of a 17-year-old boy. The lesion was initially detected at the age of 8 years, 8 months and was clinically and radiographically assessed yearly. Cone beam computed tomography was used to evaluate the lesion's size and location. Due to the non-evolving nature of the detected PEIR during the nine-year follow-up, the patient's low caries-risk status, and high patient and parental cooperation, it was decided to place resin sealant on the affected tooth and monitor the lesion without any operative treatment.In this case report, resin material was chosen as sealant to avoid the development of cavities added to pre-eruptive intracoronary resorption, causing significant destruction of the dental structure.

Coronary filling

Ilha et al. [2018] reported a case of degree II PEIR lesion in a left mandibular first permanent molar of an 8-year-old girl. After a 6-month follow-up, the lesion was removed and a restoration was made with glass ionomer cement (GIC). Six months later, the restoration was made with resin-based composite and the GIC was kept as a lining for the restoration. After a follow-up period of 18 months, there were no reports of pain.

Moura et al. [2016], described the clinical management of a permanent second molar presenting a PEIR lesion of a 14-year-old girl. Because of its pulp proximity, the lesion was treated immediately. The treatment decision involved surgical access for removal of the lesion followed by restoration of the coronal cavity. GIC was placed as a liner material and the restoration was made with resin composite.

De Souza et al. [2017] performed a coronary filling by posterior resin after the removal of PEIR defect detected in a mandibular second premolar of a 10-year-old boy.

Ilha et al. [2018] and De Souza et al. [2017], decided to wait for the tooth to erupt for the following reasons.

- Difficulty in controlling humidity and bleeding at surgery.
- The absence of pain or discomfort in addition to a nearly eruption of the tooth.

Indirect cupping

In the first case described by Counihan and O'Connell [2012], an intra-coronal radiolucency in an unerupted lower right second premolar was an incidental finding on orthopantomograph, of a 10-year-old girl. The lesion was monitored radiographically prior to and during eruption. The PEIR lesion did not increase in size and there was continued root development. Despite the fact that the tooth erupted without incident and was clinically sound an indirect pulp capping was performed.

Lesion degree III

If the lesion is very extensive or causing symptoms such as pain, pus discharge or swelling, the removal of the affected tooth may be the treatment of choice.

Indirect cupping

Yamana et al. [2010] described a severe PEIR lesion on an unerupted mandibular left first permanent molar of a 5-year-old girl. The radiographic findings demonstrated a wide radiolucent area in the coronal part of the affected molar, which extended close to the pulp. After a 12 month-follow-up, the affected tooth had emerged into the oral cavity. A surgical removal of the gingival tissue showed that the affected tooth was intact. However, when the enamel of the corresponding tooth was removed, a hollow portion of approximately 2 mm into the tooth with no exposure was revealed. Calcium hydroxide was applied and restoration with cement was performed. Three months after treatment, the patient had no abnormal sign or symptoms.

Pulpotomy

In the reported case of Omar et al. [2015] of a PEIR lesion diagnosed on a permanent second molar in a 11-year-old-patient, a surgical exposure to the tooth before the eruption was done, then a partial pulpotomy with MTA at the pulp exposure site was performed. For restoration a Para Core material® and composite resin were placed after 8 weeks. The choice of the treatment was based on: The importance of the lesion (avoiding more dental destruction); The agenesis of the 4 wisdom teeth; The age of the patient that did not authorise the placement of an implant.

Revascularisation

Yang et al. [2017] described two cases of immature permanent teeth necrotised as a result of deterioration by degree III PEIR lesion. In the first case, the author reported a PEIR lesion on an unerupted left mandibular permanent canine of an 8-year-old girl. According to the clinical and radiological findings, the tooth was diagnosed with pulp necrosis and apical periodontitis. The treatment of choice was regenerative pulp treatment of the immature root. Mineral trioxide aggregate (MTA) was used as coronal seal, and a composite resin restoration was performed using resin-modified glass ionomer cement as a base. After a 6-month follow-up, no particular clinical symptoms and a normal appearance of the root apex were observed. At the 14-month follow-up examination, the patient did not exhibit any particular clinical signs. Furthermore, continued root development, in terms of length and thickness, was evident on the radiograph.

In the second case, a PEIR lesion on an unerupted left mandibular first premolar of an 8-year-old boy was diagnosed.

The tooth was impacted below the preceding primary molar, which make it difficult to intervene. Thus, the plan was made to wait for the tooth to erupt. At the 12-month follow-up, pulp necrosis of the immature tooth was diagnosed after clinical and radiographic examinations. After a tight coronal seal formed by MTA was placed, a composite resin restoration of the left mandibular first premolar was performed. At the 3-month follow-up, no particular clinical symptoms were observed.

Extraction

Five teeth presented with PEIR lesions were extracted [Counihan et al., 2012; Llobet et al,2014; Manan et al., 2012; Wong et al., 2014; Yaqoob et al., 2011] including tooth 37 that caused left mandibular pain. Based on the extent of the lesion and the unfavourable prognosis of the teeth, extraction was performed.

Manan et al. [2012] described a case of PEIR lesion on an erupted right maxillary permanent canine in a 13-year-old boy. Following excisional biopsy, they decided to retain the right maxillary canine and monitor its progress. The patient was reviewed at frequent appointments over 18-months since the time there was radiographic evidence of resorption. And the author decided finally to keep the affected tooth in order to retain the alveolar bone height and width to allow for the option of planning for an implant.

Treatment outcomes

No clinical or radiological signs of complications have been reported after treatment of teeth affected by pre-eruptive intracoronary resorption. Recurrence of the resorption after curettage and restoration of the cavity has not been reported. The root development of the permanent immature teeth continued normally.

Czarnecki et al. [2014] described an increase in radiopacity at the base of the lesion compared to previous X-rays.

Yang et al. [2017] noted, for his second case, a decreasing of the apical image and a normal appearance of the apex.

Discussion

Pre-eruptive intracoronal resorption is considered as a challenge for the dentist, especially when the early diagnosis and timing of intervention are difficult to establish. Indeed, the unexpected evolution sometimes of such lesion [Czarnecki et al., 2014; Fiorentin et al., 2016] or even its unnoticed appearance in intact crown [Yaqoob et al., 2011] constitute the major challenge.

The age of the patients varied between 4 years (and 3 months) and 14 years which is the age of both formation and eruption of permanent teeth (except for the wisdom tooth) which explain the high frequency of mixed dentition (72.22%).

The diagnosis of intracoronary resorption occurred before the eruption or shortly after it, and this may help to confirm the diagnosis of PEIR lesions since the tooth is not yet invaded by bacterial agents and that a carious process cannot be the cause of the lesion.

The absence of associated clinical symptoms in most of the cases makes the clinical diagnosis difficult.

Five cases among eighteen were discovered by orthodontists. And the most used X-ray in the diagnosis was panoramic radiographs. Therefore, pediatric dentists and orthodontists should be aware about the occurrence of these pre-eruptive lesions and should examine carefully dental radiographs involving non-erupted teeth, especially since the early diagnosis is of utmost importance for determination of the treatment plan and prognosis.

Treatment condition

In the developing dentition, the clinical management of these lesions is always considered as complex. Several factors should be considered by practitioners such as respect to root development, need for pulp therapy, possible loss of pulp vitality, longevity of a non-vital tooth and the real value of retaining a tooth; its early loss, may be critical in overall arch-form and occlusal function in some cases. Moreover, clinical management of PEIR defects depends mainly on lesion size and its rate of progression at the time of detection.

Clinical treatment can also be dicted by other factors: patient's behaviour, age, cooperation for routine exams and oral environmental condition such as skeletal relation, spacing/crowding, hypodontia, and supernumerary teeth. The timing for intervention should be defined based on periodic radiographs in order to recognize the progressive and static defects. The rate of progression of PEIR defects varied even within the same patient. For this reason, it has been advised that the initial abnormality should prompt annual follow-up of the affected tooth and the other unerupted teeth.

Two type of classifications were used in the literature to classify these lesions, the classification of Seow et al. [1999a] was used for 2-dimensional radiographs and the classification of Demirtas et al. [2016a] for three-dimensional radiographs.

Treatment options described in the literature include restoration before eruption, restoration after eruption and extraction of the affected tooth. In the present scoping review, in order to suggest a protocol for treatment and management of PEIR defects, the lesions were classified according to the lesion's degree.

Treatment of lesion degree I of Seow

For degree I lesions, a preventative and non-invasive approach was always recommended.

For the unerupted teeth, the lesion was often considered as non-evolving due to absence of bacterial invasion, for this reason, sealant was in most cases preferred after eruption. Preventive filling was also considered as an alternative approach and has the advantage of eliminating the entire lesion.

The timing of the intervention for these defects, was determined subjectively according to the personal judgment of the practitioners in most cases.

Czarnecki et al. [2014] chose to surgically expose the tooth before eruption to examine the integrity of the enamel surface and to perform a histological and microbiological examination, Despite the fact that this attitude was not considered as advantageous for the patient.

The application of the sealant after the eruption could have been carried out in Counihan et al. [2012], especially since the lesion did not show any radiological signs of evolution.

For evolving lesions that require preventive filling, immediate treatment is recommended in order to avoid further tissue destruction and the need for more invasive filling, as did Ahn et al. [Ahn et al., 2014].

Despite a non-progression aspect, complications may occur in some cases. Indeed, Counihan [2012] reported a fracture in the disto-lingual cusp of the tooth, 5 years after the initial diagnosis, requiring the placement of performed stainless-steel crown. This complication was considered as a treatment failure.

The use of glass ionomer cement was recommended as

restorative material, especially after surgical exposure due to its documented benefits, including adhesive proprieties, less moisture sensitivity, fast setting, high viscosity, easy handling, and fluoride release into the cavity.

Treatment lesion degree II of Seow

In PEIR lesion degree II, the literature generally recommends immediate treatment; when the tooth is not close to eruption within a short time, in order to arrest the progression of the resorptive process and prevent its penetration into the dental pulp immediate treatment should be done. In some cases, the treatment decision involving surgical access and removal of the lesion followed by restoration of the coronal cavity were chosen [Moura et al., 2016]. The time of the intervention depends of the stage of tooth development, the lesion proximity to the pulp, its evolving appearance and the occurrence of clinical symptoms. If the tooth is close to eruption within a short time, and does not show any sign of complication, a wait and see approach is recommended in order to avoid a surgical phase considered sometimes as an invasive intervention in young patients.

For lesion degree II, when a decision was taken to preserve the tooth before its eruption, a mucosal flap was raised and the intact enamel on the occlusal side and the tissue filling the defect was removed by gentle curettage. The use of a handpiece in removing the resorptive tissues was contraindicated and hand instrumentation was recommended [Moura et al., 2016].

Depending on the lesion proximity to the pulp, indirect pulp capping can be performed. This technique has the advantage of being efficient in terms of waterproofing and adherence to dentin [Montagne et al., 2007]. And the material of choice would be the GIC for its rapid adjustment and biocompatibility.

Pulp exposures, with inflammation-free tissue, were successfully treated by direct pulp capping with calcium hydroxide, and eruption of the tooth proceeded uneventfully. Recent studies have indicated superior characteristics of MTA and Biodentine in vital pulp therapy compared to calcium hydroxide and can also be suggested for direct pulp capping of these teeth [Moura et al., 2016].

Subsequent coronal seal was important to limit the extent of resorption and prevent contamination and degradation of tissues and the underlying dentine following tooth eruption.

Treatment lesion degree III of Seow

For reported cases of degree III lesions, clinical treatment ranged from indirect pulp capping, to tooth extraction depending on the degree of tissue destruction and pulp vitality.

Indirect pulp capping in the reported case of Yamana et al. [2010] was justified by the fact that there was no pulp exposure and no clinical symptoms of pulp involvement. In this case, the lesion remained stable during the 6-month follow-up. However, waiting for tooth eruption, in progressive defects, to start a clinical treatment may compromise pulp vitality.

After a pulp exposure during the curettage of the lesion Omar et al. [2015] performed a partial pulpotomy. In this case, direct capping could not be performed correctly due to the similarity between the defect tissue and the pulpal tissue. Thus, extending the curettage by a few millimeters to ensure complete elimination of the lesion has been recommended.

The regenerative endodontic therapy allowing the infected pulp tissues to regenerate and heal was recommended in immature permanent teeth with large PEIR lesions.

In the case of pulp necrosis in an incompletely developed root, such treatment can increase both the length and thickness of the root [Kahler et al., 2014].

Regenerative endodontic therapy using calcium hydroxide and MTA has been shown to be more effective than apexification, and it has the same effect regarding the increase in length and thickness of the root.

In the first case reported by Yang et al. [2017], revascularisation was performed to treat a mandibular permanent canine with PEIR, and follow-up at 14 months revealed increased length and thickness of the root compared with the initial radiographic examination. Additionally, no sign or symptom of inflammation was detected. A positive response also was exhibited in electric pulp testing.

In extensive PEIR lesions, causing symptoms such as pain, swelling, or pus discharge, removal of the affected tooth may be the treatment of choice and orthodontic alignment to upright adjacent teeth may be required later.

The ideal time for extraction should be just prior to or just after eruption of the tooth, so that the procedure can be simple.

Bias risk

All the studies included in the present scoping review were case reports, which make the risk of bias very high with significant variability of age, ethnicity and socio-economic conditions. Moreover, the number of patients was very low: only 18 children were included, which can lead to a high risk of error especially in drawing conclusions. A bias of publication can be also considered because the elimination of a case report published in a language other than english was preceded.

Recommendations

When a PEIR lesion is diagnosed, the timing for intervention should be determined based on periodic radiographs in order to distinguish between a progressive lesion and a non-evolving one. Careful radiographic examination of young patient is always necessary. A follow-up period of 6 to 12 months is recommended to assess the progression rate of PEIR lesions. In degree I lesions, a follow-up approach is recommended.

A conservative approach with periodic clinical and radiographic follow-up could be recommended in non-progressive lesions. Intervention can be postponed until after tooth eruption when the lesion does not seem to endanger the pulp.

For lesions that have been confirmed as non-progressive, the practitioner may choose not to treat the lesion: however application of a sealant is recommended to avoid bacterial invasion and the addition of a carious lesion that may aggravate the pre-existing lesion.

Immediate treatment in degree II and III lesions is recommended. To stop the progression of the resorptive process, the surgical exposure is indicated if the tooth is not close to eruption within a short time. If there is no communication between the lesion and the pulp, indirect capping will be the treatment of choice. For pulp exposures, with inflammation-free tissue, direct pulp capping can be considered as the best treatment choice. Hydroxide calcium, MTA or Biodentine could be used in this case.

Revascularisation can be an interesting choice, in permanent immature teeth with large PEIR lesions.

If the lesion is very extensive and showing clinical or radiological signs of complication (pain, swelling, etc.) removal of the affected tooth may be the treatment of choice.

The material of choice for a coronary filling in the surgical phase is the glass ionomer cement; the use of the resin will be

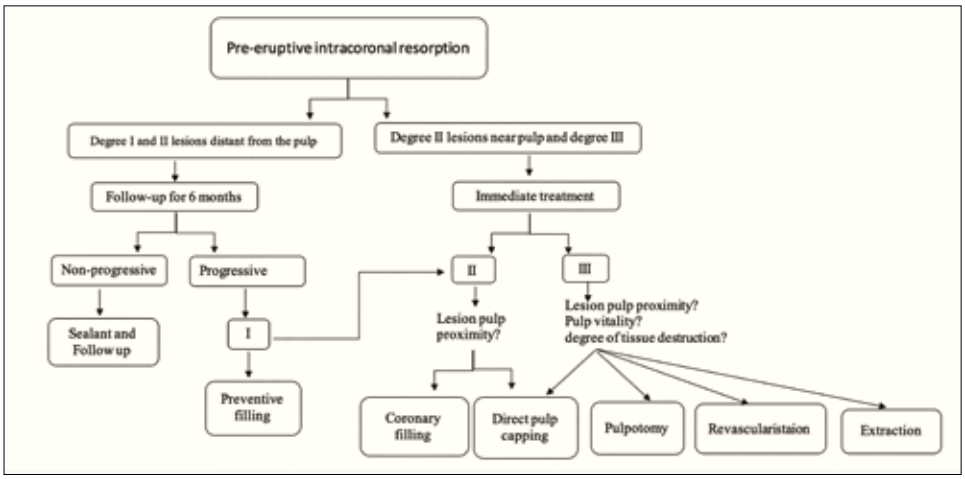

FIG. 2 Therapeutic options for PEIR's lesions.

reserved for erupted teeth.

The therapeutic options for treating pre-eruptive intracoronal resorption are presented in Figure 2.

Conclusion

Early diagnosis of PEIR defects allows early treatment. Panoramic radiographs allow a wide view of mostly unerupted teeth which explains their importance in the management of these lesions.

For therapeutic management, a conservative approach with meticulous clinical and radiographic follow-up are always recommended in non-progressive lesion and intervention can be postponed until after tooth eruption when treatment does not require surgical intervention.

The scoping review revealed gaps in the literature about a clear consensus of PEIR lesion treatment.

We recommend long-term prospective clinical studies and multiple researches in order to establish the aetiology of PEIR lesion and its effects on adjacent teeth.

Conflicts of interest

The authors declare no conflicts of interest.

References

- Ahn SS, Chu PK, Cisneros GJ. Non-cavitated dental radiolucent lesions: A challenge for the dental healthcare provider. SeminOrthod 2016;22(3):185-92.
- Al-Batayneh OB, AlJamal GA, AlTawashi EK. Pre-eruptive intracoronal dentine radiolucencies in the permanent dentition of Jordanian children. Eur Arch Paediatr Dent 2014;15(4):229-36.
- Barra SG, Penido CV, Recchioni AC, Visconti MA. Pre-interruptive intracoronal resorption: clinical and radiographic follow-up. Rev GaúchaOdontol 2017;65(3):282–5.
- Brunet-Llobet L, Lahor-Soler E, Miranda-Rius J. Oral pain due to severe pre-eruptive intracoronal resorption in permanent tooth. Eur J Paediatr Dent, 2014;15(1): 332-4.
- Counihan KP, O'Connell AC. Case report: pre-eruptive intra-coronal radiolucencies revisited. Eur Arch Paediatr Dent 2012; 13(4):221-6.
- Czarnecki G, Morrow M, Peters M, Hu J. Pre-eruptive intracoronal resorption of a permanent first molar. J Dent Child 2014; 81(3):151–5.
- De Souza N, Vaz A, Chalakkal P. Intracoronal radiolucency in an unerupted premolar: A rare occurrence. J Clin Diagnostic Res 2017;11(1):4-5.
- Demirtas O, Dane A, Yildirim E. A comparison of the use of cone-beam computed tomography and panoramic radiography in the assessment of pre-eruptive intracoronal resorption. Acta OdontolScand 2016;74(8):63641.
- Demirtas O, TarimErtas E, Dane A, Kalabalik F, Sozen E. Evaluation of pre-eruptive intracoronal resorption on cone-beam computed tomography: A retrospective study. Scanning 2016;38(5):442–7.
- Fiorentin Moura B, Silveira GR, Rodrigues-Junior SA. Diagnosis and clinical management of pre-eruptive intracoronal resorption– a case report. Rev Sul-BrasileiraOdontol, 2016;13(2):109–15.
- Ilha MC, Kramer PF, Ferreira SH, Ruschel HC. Pre-eruptive Intracoronal Radiolucency in First Permanent Molar. Int J ClinPediatr Dent 2018;11(2):151-4.
- Kahler B, Mistry S, Moule A et al. Revascularization outcomes: A prospective analysis of 16 consecutive cases. J Endod 2014;40(3):333–8.
- Kronfeld R. Resorptive processes associated with embedded teeth. In Kronfeld R, ed. Histopathology of the teeth and their surrounding structures. 4th edition. Philadelphia : Lea Febiger, 1955: 283–4.
- Manan NM, Mallineni SK, King NM. Case report: idiopathic pre-eruptive coronal resorption of a maxillary permanent canine. Eur Arch Paediatr Dent 2012;13(2):98–101.
- Manmontri C, Chompu-inwai P, Mahasantipiya PM, Prapayasatok S. Prevalence of pre-eruptive intracoronal radiolucencies in Thai children and adolescents: A retrospective study. J InvestigClin Dent 2018;9(2):1-7.
- Manmontri C, Mahasantipiya PM, Chompu-inwai P. Preeruptive Intracoronal Radiolucencies : Detection and Nine Years Monitoring with a Series of Dental Radiographs. Case Rep Dent 2017;2017:6261407.
- McNamara CM, Foley T, O'Sullivan VR, Crowley N, McConnell RJ. External resorption presenting as an intracoronal radiolucent lesion in a pre-eruptive tooth. Oral Dis 1997;3(3):199-201.
- Montagne P. Matériaux d'obturation et préparations cavitaires : évolution à travers le temps [Thèse]. NANCY :Faculted'Odontologie, 2007.
- Nik NN, Abdul Rahman R. Pre-eruptive intracoronal dentin defects of permanent teeth. J ClinPediatr Dent 2003;27(4):371-5.
- O'Neal KM, Gound TG, Cohen DM. Preeruptive idiopathic coronal resorption: A case report. J Endod 1997;23(1):58-9.
- Omar S, Choi J, Nelson B, Shin M, Chen JW. Pre-Eruptive Intracoronal Resorption (PEIR): Literature Review and Case Report. J Calif Dent Assoc 2015;43(5):255-60.
- Özden B, Acikgoz A. Prevalence and characteristics of intracoronal resorption in unerupted teeth in the permanent dentition: A retrospective study. Oral Radiol 2009;25(1):6-13.
- Şahin İ, Yildiz E, Özbudak İH. Pre-eruptive Intracoronal Resorption of Dentin in a Permanent Molar: Case Report. TurkiyeKlin J Dent Sci Cases 2015;1(4): 237-41.
- Seow WK, Lu PC, McAllan LH. Prevalence of pre-eruptive intracoronal dentin defects from panoramic radiographs. Pediatr Dent 1999; 21(6):332-9.
- Seow WK, Wan A, McAllan LH. The prevalence of pre-eruptive dentin radiolucencies in the permanent dentition. Pediatr Dent 1999;21(1):26-33.
- Wong L, Khan S. Occult caries or pre-eruptive intracoronal resorption? A chance finding on a radiograph. Pediatr Dent 2014;36(5):429-32.
- Yamada MK, Taguchi Y, Watanabe J, Noda T. Preeruptive intracoronal radiolucency caused by resorption: Report of a case. Eur J Paediatr Dent 2001; 2(2):79-82.
- Yamana A, Nakano K, Sasaki H et al. Radiolucent lesion identified in unerupted mandibular left first permanent molar: Case report and literature review. Pediatr Dent J 2010;20(2):207-11.
- Yang S, Kim J, Choi N, Kim S. Management of Infected Immature Permanent Tooth with Pre-eruptive Intracoronal Resorption : Two Case Reports. J Korean AcadPediatr Dent 2017;44(2):220–7.
- Yaqoob O, DiBiase AT, Kane R, Fleming PS. Pre-eruptive coronal resorption of a maxillary canine: A case report. Orthodontics . 2011;12(2):148-51.