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SYSTEMATIC REVIEW

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Microabrasion in the management of enamel discolorations in paediatric dentistry: a systematic review

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Abstract

Structural abnormalities of the anterior teeth could be aesthetically compromising in young patients. The dentist must provide solutions while preserving dental tissue. Microabrasion approach can be a solution. We conducted a systematic literature review to evaluate whether microbrasion treatment in paediatric dentistry can improve aesthetic in cases of pre- or post-eruptive discolorations on tooth enamel. 741 articles published up to September 2021 were selected from 3 databases using the key word "microabrasion". 11 prospective studies including 6 randomized were relevant to the inclusion criteria. Microabrasion appears to be an effective and reliable technique for the management of pre and post enamel discoloration in paediatric dentistry, especially in fluorosis. More high-powered, well-conducted randomized studies with complete evaluation criteria are needed for other types of spots. Standardization of criteria for assessing treatment success and of the protocol required should be explored.

Keywords

Dental enamel; Microabrasion; Aesthetic; Paediatric dentistry; Minimally invasive dentistry

1. Introduction

Enamel discoloration lesions are defined as surface and subsurface demineralization of enamel without cavitation, altering its chemical composition and, consequently, its optical characteristics [1]. They can occur on a permanent tooth as a consequence of pre-eruptive damage as in fluorosis, traumatic hypocalcification, amelogenesis imperfecta, and molar incisor hypomineralization (MIH) caused by disrupted enamel development or post-eruptive damage [2] following orthodontic treatment. When these discolorations occur in anterior teeth, aesthetic appearance can be compromised with potentially significant consequences for psychosocial development [3]. In accordance with the tissue-sparing approach and the principle of prevention, and to preserve the existing dental tissue of young patients, the least invasive treatment will be more readily selected, to allow further interventions on the tooth if required. Topical application of remineralizing agents (fluoride or Casein Phosphopeptide-Amorphous Calcium Phosphate (CPP-ACP)), microabrasion, bleaching and resin infiltration [1, 4] represent treatments for improving tooth appearance without being invasive. These different techniques can be used alone or in combination. In cases of mild surface hypomineralization, crystal reprecipitation may be sufficient to restore a normal enamel substrate with fluoride or phosphopeptide casein treatment. When the staining is deeper, reprecipitation is not sufficient, the inner part of the lesion remains, with its microporosities. Other techniques should be considered. The microabrasion procedure uses a combination of acidic substances and abrasive agents manufactured commercially or by dental practitioners themselves and reduces the whitish appearance of a lesion through the removal of the outer dysplastic layer of enamel [5, 6]. The success of this aesthetic treatment is based on an objective evaluation of the attenuation or disappearance of the discoloration, as well as on the subjective opinion of the patient and their satisfaction with the result obtained [7].

This systematic review aimed to evaluate the scientific literature available on microabrasion treatment for the purpose of aesthetic improvement in cases of pre- or post-eruptive enamel discolorations in clinical paediatric dentistry.

2. Materials and Methods

2.1 Protocol and registration

A study protocol based on the Preffered Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) was elaborated. In addition, the reporting of the study was based on the PRISMA checklist and registered in PROSPERO under reference CRD42021282023.

TABLE 1. search strategy in different databases.

Database	Search string	Results
PubMed	Search: microabrasion "microabrasion" (All Fields) OR "microabrasive" (All Fields) Translations microabrasion: "microabrasion" (All Fields) OR "microabrasive" (All Fields)	393
Cochrane Library	ID Search Hits #1 (Microabrasion): ti,ab,kw (Word variations have been searched)	47
Web of science	Topic: (Microabrasion) Timespan: All years. Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI, CCR-EXPANDED, IC.	301

2.2 Eligibility criteria

The PICO process was used to develop search strategies. The population (P) component included children and adolescents (World Health Organization (WHO) definition: up to the age of 19) with enamel discoloration of the anterior teeth and good oral hygiene. The intervention (I) component was characterized by clinical utilization of microabrasion for treatment of pre and post eruptive enamel discoloration. The goal was to compare (C) the effect of microabrasion on an area of discoloured enamel before and after treatment. The outcome (O) of interest was the improvement produced in the discoloured enamel by the microabrasion treatment in terms of aesthetic rehabilitation of the smile. Thus, the present study reports the results of a systematic review focusing on the following question: Does the clinical use of microabrasion for the treatment of pre- and post-eruptive enamel discoloration of anterior teeth improve aesthetic rehabilitation of the smile in clinical paediatric dentistry?

We selected original research articles, systematic review and review articles, clinical trials, and meta-analyses. It included the treatment of enamel pre and post eruptive discolorations. We excluded studies in which no evaluation of microabrasion was performed. Studies of extrinsic coloration, dental caries, and proximal tooth surfaces were excluded. We also excluded case reports, qualitative studies, guidelines, letters, editorials, opinions, technical articles, surveys, commentaries, animal studies, and *in vitro* studies.

2.3 Information sources and search strategies

The bibliographic search was carried out in the following research databases: PubMed, Cochrane Library and Web of Science to identify relevant articles in English published up to September 2021. The keys words used (MeSH terms) were "Microabrasion". Both independent raters (IB and AC) reviewed the articles and articles were retained if they met inclusion criteria. Agreement on inclusion and exclusion assignment was unanimous. Table 1 describes the complete search strategy used in each database.

2.4 Study selection

Articles were selected in three phases. Firstly, the two reviewers examined the titles and abstracts of all references independently to eliminate studies that were obviously irrelevant. Secondly, the full texts of the selected studies were reviewed independently by the same reviewers and screened accordingly to check that they matched the PICO search. Finally, the bibliographical references of the selected studies were analysed to check for possible inclusion in our research. The results were then compared in a discussion meeting between the two authors.

2.5 Assessment of risk of bias

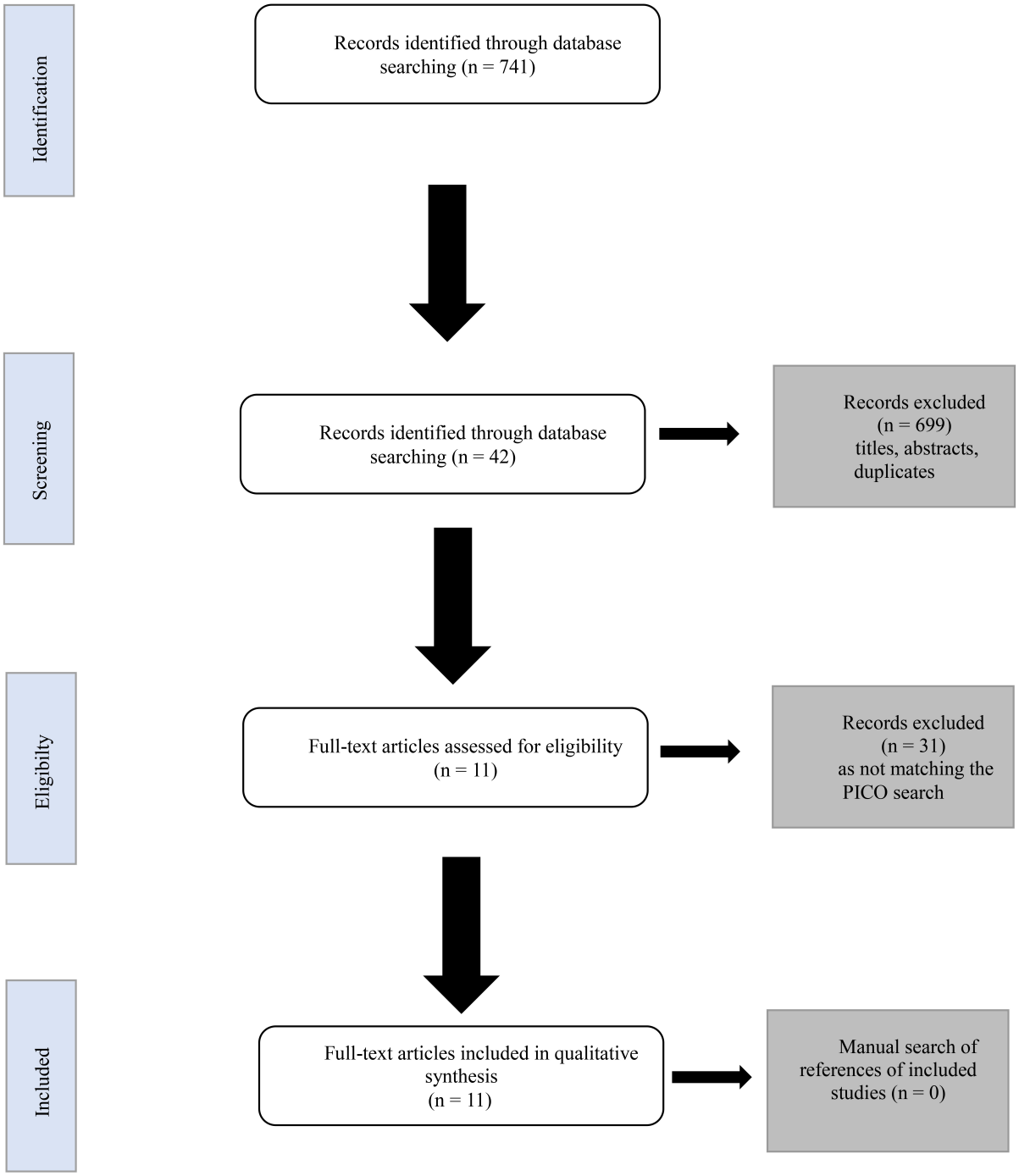
Two authors (IB, AC) independently assessed the risk of bias of the included studies *via* the Cochrane Collaboration's tool for assessing risk of bias [8] with the following parameters: random sequence generation; allocation concealment; blinding participants and personnel; blinding of outcome assessment; the amount, nature, and handling of incomplete outcome data; selective outcome reporting, and other types of bias not covered in the other domains in the tool. Review authors' judgments were categorized as "low risk", "high risk" or "unclear risk of bias". Discrepancies were resolved by discussion with a third author (BJ). The criterion for a high risk of bias was the finding of high risk in one or more key domains, the criterion for a low risk of bias was a finding of low risk in all key domains, while an unclear risk indicated either lack of information or uncertainty regarding the potential for bias.

3. Results

The search identified 741 articles in three electronic databases. We eliminated 699 studies because of duplication, or because of titles or abstracts that did not answer the research question; 42 studies were selected for abstract analysis 31 of which were eliminated because the abstract did not match the PICO search. Thus, a total of 11 studies met all the inclusion criteria. Research was completed by a manual analysis of the bibliography of the selected studies, which did not result in the inclusion of additional articles. 11 articles were included in this study. A summary flowchart of the selection process according to the PRISMA checklist is shown in Fig. 1.

3.1 Characteristics of the studies included in our review

Details of the characteristics of the 11 included studies are listed in Table 2. The studies were five prospective studies [9–13], and six randomized prospective studies [14–19]. The years of publication ranged from 2005 to 2020. Pa-



F I G U R E 1. Flowchart according to the PRISMA checklist showing the flow of publications arising from the main search.

tient ages ranged from 7 to 19 years. All studies analysed the improvement in smile aesthetics produced by microabrasion with the disappearance of discolorations. The origins of the discolorations were different, appearing pre- and post-development. There were two studies which dealt with post eruptive discoloration: post-orthodontic white spots. Pre-eruptive discoloration, specially dental fluorosis was the most common cause evoked (7 studies). The other characteristics studied were the presence of sensitivity (3 studies), surface condition: smoothness (2 studies) or enamel loss (1 study), patient satisfaction (4 studies) and maintenance of results over time (8 studies).

3.2 Risk of bias

The results of the assessment of the methodological quality of the 11 studies are shown in Table 3. The test results showed that only half of the studies were randomized. The most common risk of bias was a lack of follow up. There is difficulty in knowing whether patients and personnel were familiar with the procedure applied. It may still be considered that because of the procedures implemented, it would have been difficult to obtain blinding.

TABLE 2. Summary of the characteristics of the included studies.

Author Year	Study Design	Sample (n)	Subject Age (Years)	Type of Lesion	Treatment	Parameter Analyzed	Follow-Up (Months)	Effectiveness
Akin [9], 2012	Prospective study 3 groups + control group	80	Mean ≃ 14.5	Orthodontic white spots (post-eruptive)	CCP-ACP *vs.* Fluorides *vs.* Microabrasion 18% HCl	Aesthetic	0	Microabrasion most effective
Bezerra [10], 2005	Prospective study 2 groups Split mouth	15	8 to 13	Mild to moderate fluorosis (pre-eruptive)	Microabrasion 18% HCl *vs.* Microabrasion H_3PO_4	Aesthetic Sensitivity Patient satisfaction	1	Aesthetic improvement for 2 materials No sensitivity Patient satisfied
Bhandari [14], 2019	Randomized prospective study 2 groups	43	7 to 16	Mild MIH (pre-eruptive)	Microabrasion 37% H_3PO_4*vs.* Microabrasion 37% H_3PO_4 + Tooth Mousse Plus	Aesthetic	6	Aesthetic improvement for Microabrasion + Tooth Mousse Plus most effective
Bharath [15], 2014	Randomized prospective study. 2 groups Split mouth	30	9 to 14	Mild to moderate fluorosis (pre-eruptive)	Microabrasion 18% HCl *vs.* McInnes solution for discoloration	Aesthetic Sensitivity	6	McInnes technique most effective No sensitivity
Gençer [11], 2019	Prospective study 2 lesion groups redistributed between 3 treatment groups	100	8 to 17	Fluorosis and hypomineralization (pre-eruptive)	Microabrasion Opalustre + Remineralization agent (varnish) *vs.* Microabrasion Opalustre + Tooth Mousse *vs.* Resin infiltration	Aesthetic	6	Resin infiltration most effective
Gu [16], 2019	Randomized prospective study. 2 groups Split mouth	20	12 to 19	Orthodontic white spots (post-eruptive)	Microabrasion Opalustre *vs.* Resin infiltration	Aesthetic	12	Resin infiltration most effective

TABLE 2. Continued.

Author Year	Study Design	Sample (n)	Subject Age (Years)	Type of Lesion	Treatment	Parameter Analyzed	Follow-Up (Months)	Effectiveness
Gupta [17], 2017	Randomized prospective study. 3 groups	90	10 to 17	Moderate fluorosis (pre-eruptive)	Microabrasion PREMA + bleaching with carbamide peroxide *vs.* bleaching with hydrogen peroxide *vs.* bleaching with sodium hypochlorite	Aesthetic Sensitivity Patient satisfaction	3	Aesthetic improvement for all techniques No sensitivity Patient satisfied
Loguercio [18], 2007	Randomized prospective study. 2 groups Split mouth	36	10 to 12	Mild fluorosis (pre-eruptive)	Microabrasion Opalustre *vs.* Microabrasion PREMA	Aesthetic Smoothness Patient satisfaction	0	Aesthetic improvement faster with Opalustre Rougher after treatment (Opalustre > PREMA) Patient satisfied
Nevárez-Rascón [12], 2020	Prospective study 3 groups (small, medium, large stains)	56	12 to 16	Moderate to severe fluorosis (pre-eruptive)	Microabrasion 16% HCl	Aesthetic Enamel loss	0	Aesthetic improvement Enamel loss dependent on procedure time
Sheoran [19], 2014	Randomized prospective study. 2 groups Split mouth	25	11 to 13	Developmental enamel opacity (pre-eruptive)	Microabrasion 18% HCl *vs.* Microabrasion H_3PO_4	Aesthetic Patient satisfaction	1	Aesthetic improvement for 2 materials Patient satisfied
Sinha [13], 2013	Prospective study 3 groups (mild, moderate, severe fluorosis) Split mouth	30	7 to 14	Mild to severe fluorosis (pre-eruptive)	Microabrasion 18% HCl *vs.* Microabrasion H_3PO_4	Aesthetic, Smoothness Sensitivity	1	Aesthetic improvement for 2 materials Smoother after treatment No sensitivity

CPP-ACP: Casein Phosphopeptides-Amorphous Calcium Phosphate; HCl: Hydrochloric Acid; H_3PO_4:Phosphoric Acid; MIH: Molar Incisiv Hypomineralisation.

TABLE 3. Risk of bias in the selected studies.

	Random sequence generation	Allocation concealment	Blinding of participants and personnel	Blinding of outcome assessment	Incomplete outcome data	Selective Outcome Reporting	Other bias: follow up
Akin [9], (2012)	🟡	🟡	🔴	🟢	🔴	🟢	🔴
Bezerra [10], (2005)	🔴	🔴	🔴	🟢	🟢	🟢	🔴
Bhandari [14], (2019)	🟢	🟡	🟢	🟢	🟡	🟢	🟢
Bharath [15], (2014)	🟢	🟡	🟡	🟢	🟡	🟢	🟢
Gençer [11], (2019)	🔴	🟡	🟡	🟢	🟢	🟢	🟢
Gu [16], (2019)	🟢	🟢	🟢	🟢	🔴	🟢	🟢
Gupta [17], (2017)	🟢	🟡	🟡	🟢	🟡	🟢	🔴
Loguercio [18], (2007)	🟢	🟢	🟢	🟢	🟢	🟢	🔴
Nevárez-Rascón [12], (2020)	🔴	🔴	🔴	🟢	🟢	🟢	🔴
Sheoran [19], (2014)	🟢	🟢	🟢	🟢	🟢	🟢	🔴
Sinha [13], (2013)	🔴	🔴	🔴	🟢	🟡	🟢	🔴

high risk of bias: red colour; unclear risk of bias: orange colour; low risk of bias: green colour.

3.3 Summary of outcomes

The main assessment used in the included studies was an improvement in smile aesthetics after microabrasion treatment. The initial description of the discoloration follows a clinical examination allowing comparison with different classifications (TF Index [10, 12], Dean Index [13, 15, 17, 18], TSIF [11], ICDAS [16], MDDEI [11], DDE index [19], MIH EAPD classification [14]) without precise depth assessment. There was considerable variability in the criteria used to assess the success of treatment: decreased numbers of opacities, decreased stain coloration, change in the size of the stain, evaluation according to non-specific visual scales or a complete specific scale [13], by photographic examination or by computerized analysis. There was no consensus on the maintenance of results over time. At the one-month time point, there appeared to be maintenance of this aesthetic result, but the authors did not draw the same conclusions with regard to long-term outcome. Gu *et al.* [16] considered that microabrasion treatment was sufficiently durable over a 12-month period while for Gupta *et al.* [17], there was a very slight reappearance of the defect at 3 months, and Bharath *et al.* [15] considered that, at 6 months, there was a real decrease in aesthetic quality. Gupta explains this reappearance because teeth were dehydrated immediately after bleaching causing an illusionary effect of whitening, which tended to disappear after rehydration.

Some studies detailed secondary assessments: patient satisfaction, hypersensitivity assessed by pulp tests and patient feeling, roughness, and enamel loss after treatment. Patients were satisfied with results in all studies that assessed this parameter, with a positive impact on well-being and social integration [18]. Hypersensitivity was not detected by any assessment method employed. Microabrasion changed the surface condition of the teeth treated and conclusions varied according to the authors who describe increases in roughness or conversely a smooth texture. There was a relationship between procedure time and enamel loss [12]. Loguercio *et al.* [18] considered that treatment with Opalustre further increased the feeling of roughness. This assessment was conducted by questioning the children prior to the polishing procedure. While Sinha *et al.* [13] judged that enamel surfaces acquired a glass-like lustre and an exceptionally smooth texture following complete treatment, this assessment was carried out by means of a scanning electron microscope analysis.

These multiple conclusions were dependent on a lack of standardization regarding the criteria used to define treatment success but also on substantial variability in the protocols and products used (Table 4).

In all studies materials were applied mechanically with a rotating cup at slow speed except for Nevárez-Rascón *et al.* [12] who chose manual application on cotton. The application time for H_3PO_4 ranged from 5 to 30 s, repeated until the stain disappeared for a maximum of 4 to 6 times. HCl application time ranged from 5 to 60 s, repeated until the stain disappeared up to a maximum of 15 times. The procedure was or was not repeated over time with a maximum of 5 sessions. Water rinse times were also very variable; sodium bicarbonate was sometimes used before possibly switching to a polishing procedure

TABLE 4. Microabrasion materials found in the studies.

Erosive Agent						Abrasive Agent				
HCl					H_3PO_4	Silicon Carbide			Fine pumice powder	Diamond Paste
6.6%	1.4%	15%	16%	18%	Medical Custom-made	87.3 µm	63 µm	Medical Custom-made	Medical Custom-made	Medical Custom-made
Opalustre	PREMA	Medical Custom-made	Medical Custom-made	Medical Custom-made		Opalustre	Prema			

HCl: Hydrochloric Acid; H_3PO_4:Phosphoric Acid.

followed by the possible use of a remineralizing agent (GC Tooth Mousse for 4 or 15 minutes, 1.1% or 1.23% fluoride gel for 4 minutes, topical Acidulated Phosphate Fluoride for 4 minutes and GC Tooth Mousse Plus 2–6 minutes at home for 6 months).

In the search for the best possible aesthetic results, microabrasion was combined with other techniques. Gupta *et al.* [17] investigated the combination of microabrasion and bleaching. Microabrasion followed by dental bleaching with 44% carbamide peroxide gel in the dental surgery was as effective as an in-surgery bleaching session with 35% hydrogen peroxide activated by light-emitting diode (LED) and more effective than dental bleaching with 5% sodium hypochlorite in the surgery. According to the author, although much controversy surrounds the success of light sources, the use of high intensity light increased the temperature of hydrogen peroxide (HP) and accelerated the rate of chemical whitening of teeth. Microabrasion combined with varnish or GC Tooth Mousse remained less effective than erosion-infiltration [11]. Microabrasion combined with GC Tooth Mousse Plus with application to the patient at home for 6 months improve the esthetics [14].

The last point investigated was the effectiveness of microabrasion in the improvement of smile aesthetics compared to other noninvasive treatments. Microabrasion appeared more effective than fluoride or CPP-ACP [9] but less effective than McInnes's teeth whitening (bleaching mixture of 36% HCl and 30% H_2O_2 applied over the area of discoloration) [15], and resin infiltration [11, 16].

4. Discussion

The 11 included studies highlight an aesthetic improvement of enamel pre and post eruptive discolorations on the permanent anterior teeth of children and adolescents following microabrasion treatment. These studies were prospective clinical trials, only half of which were randomized.

Patient ages ranged from 7 to 19 years. To our knowledge, no clinical studies exist for children under 7 years of age. So microabrasion appears to be usable for permanent teeth, in paediatric dentistry if the teeth are sufficiently erupted to allow placement of a dental dam.

After microabrasion, enamel presents a lustrous, shiny, and glass-like surface, which may reflect and refract light differently [20]. This is called the "abrosion effect" [21, 22]. These optical properties may be able to camouflage any remaining subsurface enamel stains. Enamel microabrasion was initially performed for the removal of fluorotic white discolorations [5] and today, this remains the most common indication [20, 23]. The included studies explored dental fluorosis and confirmed the effectiveness of microabrasion. Microabrasion also appears in the recommendations for treatment of Molar Incisor Hypomineralisation [24], post-orthodontic demineralization, localized hypoplasia due to infection or trauma and idiopathic hypoplasia where the discoloration is limited to the outer enamel layer [4]. The results of the included studies were positive for these other indications, but more studies that specifically assess each type of stain for this etiology of spots are required. For MIH, only creamy yellow or whitish cream defects that are less porous and of variable depth can sometimes respond to microabrasion followed by CPP-ACP. It is not suitable for opacities deeper than 100 to 200 μm of enamel [24]. For localized hypoplasia, an additional restorative composite resin or laminate veener may be required but microabrasion should be considered the first treatment option. It can reduce the need for enamel wear for a restorative approach, which is mainly important in young patients [25]. For post-orthodontic demineralization, the alternative treatments are fluoride or caseine phosphopeptide treatment for lesions with an ICDAS score of 1–2 and the erosion-infiltration for the score 2 [1]. However, for these treatment options, there is also a lack of reliable evidence [26].

All of these studies evidence an absence of standardization of the criteria used to assess treatment success. A reproducible scale, usable by all evaluators, was necessary. This scale should assess the aesthetic result but also all of the parameters defined by Croll [5] for an ideal microabrasion procedure: insignificant enamel loss, no damage to pulp or periodontal tissues, patient satisfaction, and permanent results achieved in a short clinical period with no patient discomfort. No scale present in the literature meets all these criteria. Many authors used a scale that rates improvement in stain appearance (ranging from 1 to 7) [27]. A complete and accurate scale using photomicrograph analysis has been described [13], but to improve management by the dentist, an aesthetic score that is simple to use could be proposed to standardize the evaluation of the treatment of white discolorations on enamel. This score must consider the extent of the defect, stain appearance, the boundaries of the defect, discoloration opacity, and stain colour. This score should be reproduced over a period of sev-

eral months for a long-term evaluation. It should be combined with a systematic assessment of patient satisfaction and feeling about the procedure immediately after treatment and in the long-term. As aesthetic quality is subjective, self-assessment by the patient should remain the priority; even more so in this paediatric population where aesthetic defects can lead to a negative psychosocial impact, loss of self-esteem and social disability [28].

Microabrasion also requires protocol standardization. In the included studies each author adapted the protocol thus influencing the results. Indeed, many secondary assessments are protocol dependent. The microabrasion method can be used with a very low-speed rotary handpiece with application of pressure to minimize enamel loss [5]. The residual thickness following microabrasion treatment depends on different parameters: procedure time, pressure, number of cycles and stain location. The relationship between enamel loss and procedure time has been demonstrated for some time [29] and appears to be between 200 and 300 μm for a period of 4 minutes [12]. The pressure used during the microabrasion procedure is also crucial [30]: the higher the pressure, the greater the quantity of enamel that is removed. Manual application results in an enamel loss of 152 μm whereas mechanical application results in a loss of 274 μm [31]. The number of cycles also has an impact on enamel loss [32] with an average loss of 12 μm for the initial application and an average loss of 26 μm for subsequent applications. The enamel on the vestibular surface of the maxillary incisors has an average thickness of 1.00 mm on the incisal third, 0.90 mm on the middle third, and 0.3 mm on the cervical third [33]. The loss of enamel does not have an equivalent impact on the surface of the crown. However, Croll [5] considers that quantification of enamel loss is of little importance if tooth function or appearance is not impaired. It is possible to remove the enamel gradually with control over the aesthetic result at each stage and control of each of its parameters so as to remain vigilant with regard to tissue loss.

Microabrasion impacts enamel surface properties. An increase in microhardness has been demonstrated [34]. The chemical features of the procedure also lead to increased roughness [35]. This can be reversed by polishing or by exposure to saliva [25]. This parameter explains the differences in the results noted in our included studies between Loguercio *et al.* [18] and Sinha *et al.* [13]. The simultaneous abrasion and acidic erosion of enamel prisms may compact mineralized tissue within the organic area, replacing the outer layer of prism-rich enamel with a densely compacted, prism-free region [22]. The resulting surface enamel layer is denser than that present physiologically [36]. When the enamel is reorganized, external particles from abrasive products or polishing products are incorporated into the mineral matrix. The exposure of this transformed enamel to saliva causes a precipitation of minerals on its surface. Microabrasion creates a smoother, dense, mineralized enamel layer, less conducive to bacterial colonization, particularly by Streptococcus mutans [37].

The materials used for microabrasion should also be clearly defined and standardized. Only four of the included studies used commercially produced materials, the others used materials custom-made by dental practitioners. In his original description, Croll [38] indicates specific products: hydrochloric acid in an aqueous solution in the concentration range 8% to 16%, and abrasive particulate matter from the group consisting of quartz, silicon carbide and diamond. The use of 35% phosphoric acid instead of hydrochloric acid was proposed by Kamp [39], considered advantageous as it is commonly used in clinical practice for other procedures. The three included studies that compared these two acids did not show differences in effectiveness. Commercial products only should be used to ensure adequate monitoring and traceability. Three products are available commercially. Prema Compound (Premier Dental Company, Philadelphia, PA, United States), which contains 10% hydrochloric acid, was the first to be introduced to the market. Its acid concentration is estimated at 1.4%, pH 3.2/3.5. To date, it is no longer available in the dental market. Opalustre (Ultradent Products Inc., South Jordan, UT, United States) contains approximately 6.6% HCl, pH 0.2 [40] while Whiteness RM (FGM Dental Products, Joinvile, SC, Brazil) contains 6% HCl, the pH is unknown. These products silicon carbide as an abrasive agent with granules of different sizes dispersed in a water-soluble gel for easy removal. Only Prema and Opalustre were evaluated but product superiority was not really established for either formulation [40]. Results were achieved more quickly with Opalustre [18]. This effect may be due to the larger size of the silica granules in Opalustre and its more acid pH [25], leading to excessive substance removal [40, 41]. To our knowledge no other studies have compared the effectiveness of Opalustre and Prema.

Management of enamel pre and post eruptive discoloration by so-called non-invasive treatments may use microabrasion, bleaching and resin infiltration. Two studies tended to show greater effectiveness for erosion infiltration and a concentration-dependent, greater or identical effectiveness for bleaching (2 studies). However, the paediatric dentistry population exhibits some specific features which affect the place of microabrasion in the therapeutic arsenal. Bleaching is prohibited in Europe under the age of 18 [42]. In USA, it is not prohibited but a proper treatment plan with objectives should be drawn up before implementing any bleaching protocol or full-arch cosmetic bleaching for patients in the mixed dentition [43]. Whitening in adolescents is determined on a case-by-case basis and includes an analysis of risk (tooth sensitivity and gingival irritation) versus benefit [12]. Microabrasion could therefore represent an initial solution prior to bleaching. In the same way, the erosion infiltration technique, which requires pre-conditioning of the surface with 15% hydrochloric acid and removes approximately 40 μm of surface enamel to ensure resin penetration, may be used in cases with deeper stains not resolved by microabrasion, the last option before the invasive restorative approach [25]. The precise characterization of a stain, in particular of its depth, is not easy. Clinical examination alone may be insufficient. Transilluminated images may represent a promising imaging method for mapping hypomineralized enamel lesions, especially in MIH cases [44]. Additionally, given its conservative and non-invasive nature, we can recommend microabrasion in all cases in which it could be effective before considering another non-invasive or invasive treatment.

5. Conclusion

Microabrasion appears to be an effective and reliable technique for the management of pre and post eruptive enamel discolorations of permanent teeth in paediatric dentistry, especially for dental fluorosis for which this review shows an efficiency on the mild to severe forms. More high-powered, well-conducted randomized studies with complete evaluation criteria are needed for other types of spots. Due to the heterogeneity of the data, it has not been possible to perform a meta-analysis to date. Standardization of the assessment of treatment success, and of the protocol, which should use only commercial products, is needed. As aesthetic quality is subjective, self-assessment by the patient and their feelings about the procedure should remain the priority.

AUTHOR CONTRIBUTIONS

IB and AC—designed the research study and performed the literature search and data analysis. IB—wrote the manuscripts. BJ and CT—help and advice on the write, drafted and/or critically revised the work. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

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The authors declare no conflict of interest.

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