

Técnica restauradora atraumática modificada con plata (SMART) en caries temprana de la infancia

Silver-modified atraumatic restorative technique (SMART) in early childhood caries

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NC 407**Silver-modified atraumatic restorative technique (SMART) in early childhood caries**

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ABSTRACT

Background: rehabilitation of patients with early childhood caries often involves complex and expensive treatments. Techniques based on minimally invasive odontology have been developed to restore function and esthetics with simple and accessible procedures.

Case report: the objective of this study is to present a treatment used in a 3-year and 3-month-old child using silver diamine fluoride with rehabilitation using an atraumatic restoration technique that does not

require anesthesia or rotating tools to remove caries known as the silver-modified atraumatic restorative technique.

Discussion: this intervention could be added to the routine clinical practice in primary care.

Keywords: Early childhood caries. Silver diamine fluoride. Silver-modified atraumatic restorative technique. Celluloid crowns.

RESUMEN

Introducción: la rehabilitación en pacientes con caries temprana de la infancia generalmente involucra tratamientos complejos de alto costo. Se han desarrollado técnicas basadas en odontología mínimamente invasiva que permiten devolver función y estética con procedimientos sencillos y accesibles.

Caso clínico: el objetivo de este trabajo es presentar un tratamiento realizado en un paciente de sexo masculino, de 3 años y 3 meses de edad, utilizando fluoruro diamino de plata con posterior rehabilitación mediante una técnica de restauración atraumática sin necesidad de utilizar anestesia ni instrumental rotatorio para remover caries, conocida como técnica restauradora atraumática modificada con plata.

Discusión: esta intervención podría ser incorporada en la práctica clínica en los servicios de atención primaria.

Palabras clave: Caries temprana de la infancia. Fluoruro diamino de plata. Técnica restauradora atraumática modificada con plata. Coronas de celuloide.

INTRODUCTION

Early childhood caries (ECC) is the most prevalent oral condition in pediatric populations. It is defined as “the presence of one or more dental cavities (non-cavitated or cavitated lesions) or closed surfaces in any primary tooth,” in children under 6 years old (1).

The etiology of ECC is complex, multifactorial and of rapid progression; it is influenced by psychosocial, cultural, socioeconomic behaviors as well as the health practices that are common to the children and their families

mainly those of their tutors (2). On the other hand, it is associated with high consumption of sugary drinks or foods, poor oral hygiene and/or no breastfeeding (3).

ECC negatively impacts the development of the children's basic activities such as talking, eating, playing and performing in school. On the other hand, ECC is associated with the onset of acute dental manifestations characterized by pain and infection requiring emergency treatment (1,4). For this reason, ECC determines the onset of a set of alterations that can affect the child's physical and psychological development, thus compromising his own quality of life and that of his family (2,5).

Oral rehabilitation in these cases often involves complex, lengthy, and expensive treatments, which is why treatment under sedation or general anesthesia is usually preferred. The approach depends on the availability of the therapeutic resources involved, the caregiver's interest, the patient's behavior, cooperation, and age, which translates into significant cost for both the family and society. All this sets ECC as a significant problem of public health (2).

Techniques and procedures based on the principles of minimally invasive dentistry (MID) have been developed. They consist of controlling dental caries through training, prevention, and the use of non-surgical measures, thus preventing the wear and tear of viable tissue and preserving the dental structure at a lower biological cost (6). These techniques facilitate restoring function and esthetics, and optimize biological and economic resources. An example of this is the atraumatic restorative technique (ART) or the recently described silver-modified atraumatic restorative technique (SMART) that incorporates use of silver diamine fluoride (SDF). This technique consists of using SDF to stop the carious lesion without having to eliminate the infected dentine to subsequently seal using restoration (7). Evidence shows that the use of SDF should be taken into consideration for the management of ECC, above all, in difficult to treat patients due to their young age, behavior or other associated conditions or diseases (7-9).

Among the recommendations established for the use of SDF, it is indicated as non-invasive treatment to manage ECC with a high level of evidence to even stop cavitated dental lesions without any signs and symptoms of

pulp inflammation. It is contraindicated in cases of allergy to some of its components or for the lack of approved consent for its use by the child's tutors (6,7). The ART is also indicated for the management of dental caries in patients with ECC. However, there is a higher risk of restoration failure compared to conventional restorative approaches with low quality evidence level to stop carious lesions, mainly regarding multiple-surface cavities. Therefore, in lesions with more than one surface compromised it would be contraindicated (6). On the other hand, the SMART technique is a combination of both techniques where inactivation is performed chemically with SDF. Also, with the ART the tooth repair is sealed through mechanical restoration, which improves the prognosis of the longevity of restoration and the tooth itself. This technique is indicated in cases where there is esthetic and functional compromise, dental caries without pulp inflammation, lesions that do not allow self-cleaning, patients with ECC or high cariogenic risk, lesions with multiple surfaces compromised, patients with special needs or difficulties cooperating during treatment, and cases where access to dental care is difficult (7).

The objective of this case report is to present a treatment based on MID using the silver-modified atraumatic restorative technique (SMART).

CASE REPORT

This is the case of a 3-year and 3-month-old patient with positive behavior according to Frankl behavior scale, migrant, in social risk, without a relevant past medical history. He was admitted to a teaching hospital Pediatric Dentistry program.

Main reason for consultation

His mother speaks of "teeth problems." While explaining the patient's medical history, she says that he did not brush his teeth until he was 2 years and 6-month old. It was then that she saw that his upper front teeth were badly damaged. She also says that, in the past, they have visited several dental clinics where they were said that the treatment required general anesthesia that the family could not afford.

Past medical history

Night-time bottle until the patient was 2 year and 6-month-old, onychophagia and dermatophagia. Cariogenic diet with high intake of natural fruit juices with added refined sugar.

Intraoral examination

Complete deciduous dentition, generalized gingival inflammation, misaligned dental midline, 1.5 mm overbite, 1 mm overjet, bilateral canine neutroocclusion, mesial groove mola relation. ECC, carious lesions codes ICDAS 5 in teeth no. 5.4, 6.4, 7.4, and 8.4, and ICDAS 6 in teeth no. 5.2, 5.1, 6.1, and 6.2, occlusion lesion ICDAS 2 and 3 in teeth no. 5.5, 6.5, 7.5, and 8.5. All the carious lesions showed signs of activity. The patient did not show pulp inflammation or periapical symptoms or a history of pain (Fig. 1).

X-ray examination

The complementary X-ray examinations (periapical x-rays) of teeth 5.4, 5.1, 6.1, 6.4, 7.4, and 8.4, reveal great crown damage in upper front teeth, proximal to the pulp chamber with an underlying dentine band, chamber, and ducts. Presence of deep dentinal caries on the rear teeth proximal to the pulp chamber with dentine band (Fig. 2).



Fig. 1. Intraoral pictures.

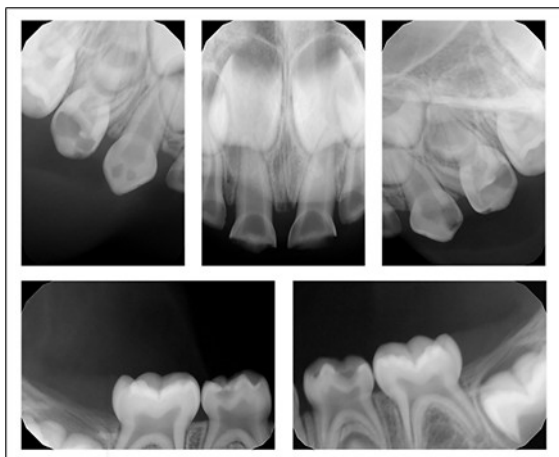


Fig. 2. X-rays.

Preventive stage

Training was given on caries etiology, poor oral habits, and instructions on oral hygiene, dietary pieces of advice, and therapeutic alternatives including information to the child's mother through teledentistry on the advantages and disadvantages of applying and using of SDF prior to the first clinical session. Regarding the patient's past medical history and cariogenic risk, weekly clinical sessions were planned continuously until rehabilitation was completed.

First clinical session (1st week): on the week following the first dental visit we performed adaptation to dental care, prophylaxis, and application of 5 % cherry-flavored fluoride varnish (Clinpro™ White Varnish, 3M ESPE Dental Products, St. Paul, MN, United States).

Second clinical session (2nd week): ART was performed in teeth 5.4, 6.4, 7.4, and 8.4, and sealants in teeth 5.5, 6.5, 7.5, and 8.5 with self-curing glass ionomer cement (Ketac Molar, 3M ESPE Dental Products, St. Paul, MN, United States).

Third clinical session (3rd week): 38 % SDF (Advantage Arrest. Elevate Oral Care, West Palm Beach, FL, United States) was applied to teeth 5.2, 5.1, 6.1, and 6.2 to stop carious lesions (Figs. 3 and 4).

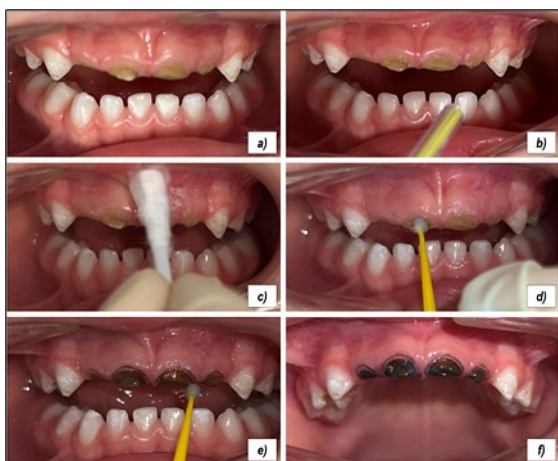


Fig. 3. Sequence of application of silver diamine fluoride. A. Early picture. B. Cleaning and drying of dentary preparation. C. Application of solid vaseline in soft tissues and areas prone to coming in contact with SDF. D. Application of SDF with microbrush. E. New application. F. Picture taken right after application.

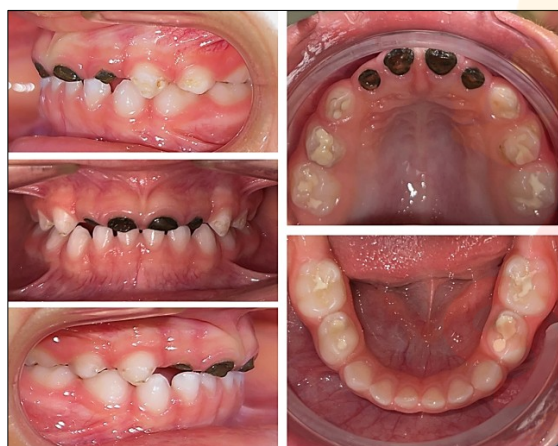


Fig. 4. End of preventive stage (control 2 weeks).

Rehabilitation stage

Fourth clinical session (5th week): the texture and color of the dental preparations were controlled and evaluated in teeth 5.2-5.1-6.1-6.2 to continue with the SMART technique that, basically, consists of performing a more esthetic restoration with composite resin or glass ionomer to mask the black coloration present after the application of SDF, thus providing better esthetics and protection to dental remnants. Once texture has been confirmed, which should be harder and the presence of a dark color confirmed (caries inactivation), the following step was to prepare dental tissue to be rehabilitated, which in this case consisted of using celluloid

crowns filled with composite resin. First, prophylaxis was used. After using relative isolation with cotton rolls, light-cured glass ionomer cement was applied as base refill (Vitrebond 3M ESPE Dental Products, St. Paul, MN, United States) to teeth 5.1-6.1, as protector of the dentin-pulp complex and to conceal the black coloration resulting from the SDF. Afterwards, restorations of composite resins were performed using the celluloid crown technique (transparent crowns TDV, Pomerode, Santa Catarina, Brazil). Only teeth 5.1 and 6.1 were repaired to avoid losing the patient's degree of cooperation since that some time is required even though it is a simple technique.

Fifth clinical session (6th week): under relative isolation with cotton rolls Vitrebond was applied to teeth 5.2-6.2 to overshadow the black coloration. In this case, due to loss of dental remnants, dental size and anchoring difficulty, composite resin restorations were performed freehand with conventional adhesive technique to mask dental coloration. Finally, the patient's teeth were polished with topical anesthesia, then checked and the occlusion adjusted (Fig. 5).



Fig. 5. Sequence of oral rehabilitation with celluloid crowns. A. Early picture. B. Application of base glass ionomer cement (Vitrebond). C. Occlusion polishing, adjustment, and checking. D. Rehabilitation of the front upper sector finished.

Periodic controls

Sixth clinical session (8th week): the first clinical and photographic control was conducted 2 weeks after finishing rehabilitation (Fig. 6). Afterwards, follow-up was conducted every month. This was a clinical session where the instructions on oral hygiene were reinforced, gingival health was checked, and the state of the restoration and polishing work performed

was assessed. After making sure that the treatment administered was in good condition, the patient was scheduled another appointment 3-months after rehabilitation was done (Fig. 7). Currently, the patient is under periodic controls every 6 months.



Fig. 6. Pictures taken after the rehabilitative phase was over (2-week follow-up).



Fig. 7. Clinical and photographic follow-up pictures (3-month follow-up).

DISCUSSION

The prevalence of ECC continues to be high worldwide, as it was revealed in the Conference of the Bangkok International Association of Pediatric Dentistry on ECC back in November 2018. To reach this conclusion, they reviewed a total of 72 studies conducted all across the world from 1998 through 2018 measuring the prevalence of ECC. The result was that the prevalence of caries in children under 4 years went from 12 % in a 2009 study conducted in France to 98 % back in a 2014 Australian study. In addition, it was found that the prevalence of caries in children < 1 year

was a mean 17 % and increasing considerably up to 36 % in two-year-old kids. In addition, the mean prevalence of caries in children aged 3, 4 and 5 years was 43 %, 55 %, and 63 %, respectively (1,2). However, despite maintaining a high prevalence of caries, the number of teeth treated has increased considerably indicative that more treatments are being administered (1,2,6). We should mention that despite the advances made, rehabilitation is not the solution to the problem.

Among the risk factors associated with the etiology of ECC, high sugar consumption in different presentations is mainly mentioned associated with a high frequency of intake between meals throughout the day, which increases the risk of developing caries. Regarding the aforementioned, the American Heart Association (AHA) and the American Academy of Pediatrics (AAP) recommend that adding sugar to food and drink should be avoided in young children between 2 and 3 years (1-3). It is absolutely essential that dietary advice and oral hygiene instruction should be provided from the first visit to the dentist.

Socioeconomic factors at community, ethnic group, and family level and the mother's school level are strongly associated with its prevalence (1,3,4). Similarly, it has been reported that ECC often occurs in children who live in a situation of poverty and deficient environmental scenarios (2,3) being the most affected groups those of underprivileged, indigenous and ethnic minorities. For example, there is an association between low educational levels and family income and the high prevalence of ECC according to a review published by Seow et al. (3) Although it is not possible to modify all the factors associated with the risk, it is possible to undertake educational, preventive and resourceful actions to stop the advancement and development of ECC.

The following are among the consequences of this disease: greater risk of developing new carious lesions both in deciduous and permanent teeth, abscesses, acute and chronic pain, hospitalizations, dental emergency care, growth and physical development retardation, school absenteeism, low levels of concentration and reduced quality of life affecting both children and their families and/or communities, which adds an extra financial burden for society (1-3,5).

Oral rehabilitation of ECC usually requires several clinical sessions and interventions that often involve extraction of deciduous teeth, pulp treatments, spacers, among others. Also, depending on the severity of the disease or the patient's degree of cooperation, treatment under sedation or general anesthesia in the OR should be assessed (2-4,6). Some studies mention that quality of life improves after dental treatment under general anesthesia in children with significant favorable changes, at least, in the short term (2). Management under dental general anesthesia (DGA) is usually performed in young children or patients who are difficult to manage. However, this procedure is no stranger to biological risks and is associated with a high economic burden (10,11). Therefore, not every child or their tutors can have access to this type of procedure. Therefore, many cases remain unsolved.

Over the past few years, the term MID has been added with a patient-focus approach based on the evidence available and supporting the development of new treatment options for carious lesions. This includes both delayed interventions and smaller preparations limited to conservative elimination of only the decayed tissue, thus avoiding possible dental fractures, pain and pulp exposure while increasing the chances of success (2,12-14).

Current evidence suggests that to treat carious lesions, especially in children, minimally invasive therapeutic approaches should be used for selective removal of caries while considering that it is important to achieve good sealing with the restoring material. In addition, it has been confirmed that less clinical time is required, which is associated with less anxiety and discomfort during treatment (7,14). Therefore, it is essential to choose non-invasive and/or minimally invasive treatments preserving more dental tissue, and reducing the levels of anxiety or stress in children during the dental treatment.

Currently, the use of SDF as a cariostatic agent has become very popular because of how effective it is stopping cavitated lesions and ECC progression. It is a painless, simple and affordable procedure that stands as an alternative to the conventional management of caries (1-3,13).

Thirty-eight percent SDF is a solution containing ionic silver, fluoride, and ammonia solution that is applied locally. It has a high concentration of

fluoride ions (expected means 44 800 ppm). When applied on decayed tissue, it produces a series of chemical reactions that promote tooth desensitization resulting from dentinal tubule blockade, stopping of the carious lesion, bactericidal action, remineralization of demineralized tissue, and inhibition of dentinal collagen degradation. Therefore, it is used to treat dental hypersensitivity and stop cavitated carious lesions without pulp inflammation (6,9,13).

A side effect of SDF is that it dyes the decayed dentin black. Despite the unesthetic results, its use is preferred to the discomfort associated with conventional dental treatment (6,8). Some studies on the parents' perception of the application of SDF show that most agreed that application is an easy, painless procedure with acceptable coloration and taste. Most parents are willing to sacrifice esthetics in favor of using a minimally invasive approach with their children (8,15,16). However, before it is applied it is important to obtain authorization through an informed consent signed by the parents or tutors explaining the side effects associated with it with explanatory images.

On the other hand, ART has a MID approach to eliminate decayed tissue in a non-traumatic way by using manual tools and without local anesthesia by sealing the tooth with glass ionomer cement for dentine cavitated lesions and stopping the advancement of the carious lesion since bacteria are left without substrate. This technique is supported by strong evidence as concluded by a literature review of 56 articles of controlled randomized assays or systematic reviews of strategies to treat cavitated or uncavitated carious lesions both in adults and children (2,17). On the other hand, this technique allows us to eliminate sensory triggers, thus reducing dental anxiety and allowing us to treat young children (2,7,10,11). Another advantage is that the use of glass ionomer cement allows us to work with basic dental isolation. However, it is ill-advised for occlusal-proximal restorations or restorations of incisal edges (2).

Currently, silver-modified ART or SMART have been described, which is a variation of ART. It consists of stopping the carious lesion with the use of SDF to later restore the lesion with some adhesive material like glass ionomer cement without having to eliminate the decayed soft tissue. Also, it can be used after selective removal of the caries. This type of procedure

can potentially reduce the possibility of caries relapse. If the decayed tissue is not cleared out, it is advisable to wait until the carious lesion has stopped and there are no pulp symptoms after the use of SDF to be restored (7,13). SMART works by stopping the carious lesion with SDF and then sealing it with an adhesive material, thus improving tooth prognosis. On the other hand, restoration would help prevent possible fractures of the dental remnants (7). Finally, the use of SDF is a complement to ART where caries is stopped both chemically and mechanically. In addition, we should mention that it improves the esthetic perception for both the children and tutors significantly.

In this case celluloid crowns were used for the rehabilitation of the anterosuperior sector after the use of SDF since composite resins have greater binding strength and compression resistance compared to glass ionomer cement. In addition, the use of composite resins shows better clinical evidence compared with the use of glass ionomer cement in carious lesions with multiple damaged surfaces. However, the operative field should be isolated to prevent contamination with saliva (2). On the other hand, the literature recommends the use of celluloid crowns over direct restorations in temporary anterosuperior teeth (6). Nevertheless, it is important to consider that it can be done when there is a minimal degree of patient cooperation.

CONCLUSIONS

The therapeutics proposed by using the SMART technique should be considered the therapeutic option for ECC, and added to the routine clinical practice in primary care services since it is a simple, painless procedure.

It is presented as an excellent accessible alternative that allows us to solve the problem of uncooperative patients in a timely manner, providing greater comfort, reducing treatment times and complications that can result in emergency treatments and/or premature extractions, especially in contexts of social risk with difficult access to general anesthesia and other complex forms of treatment.

It is essential for tutors to accept the dark coloration following its application since patients will remain like this until they are rehabilitated. Also, we should mention that in some cases it will not be possible to mask it completely. It should also be understood that there is also the possibility that the patient won't allow rehabilitation as it was achieved in this case, and then he/she will remain like this until it is possible to conduct a new evaluation.

It is important to admit that timely diagnosis and intervention are essential to prevent and control the advancement of ECC allowing us to take less invasive, more conservative actions. Treatment should focus on prevention, education, and motivation while making family-oriented personalized recommendations involving tutors. It is important to keep timely follow-ups with periodic controls to keep the patient's dental health.

Clinical significance

This intervention could be added to the clinical practice in primary care particularly providing a solution to all patients who cannot be treated in the conventional way.

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