

Preventive management of a chronic microtraumatic factor in an adolescent patient using an occlusal splint for mucosal protection; a case report

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Abstract: The development of cancer involves three stages: initiation, promotion, and progression. These consecutive stages are referred to as the process of carcinogenesis. The role of dentists in this process in relation to oral cancer is to intervene in the promotion stage, focusing on prevention by both eliminating and not causing chronic microtraumatic factors. This article is a clinical case report of a 14-year-old male patient seen at Hospital de Odontología Infantil "Don Benito Quinquela Martín", who underwent a clinical functional stomatological examination. He was observed to have geographic and fissured tongue, with severe indentations on the edges, resulting from a chronic microtraumatic factor, due to the presence of an unfavorable dental arch. If this factor is not controlled or eliminated, it could cause ulceration due to chronic trauma, which is a potentially precancerous lesion. **Objective:** to describe the clinical condition of a 14-year-old male patient who is fitted with an occlusal splint for mucosal protection in order to prevent potentially precancerous diseases, such as ulceration due to chronic trauma, caused by the chronic microtraumatic factor present. **Conclusion:** by using an occlusal splint for mucosal protection as part of the treatment plan, future lesions that would compromise the patient's general health may be prevented.

Key words: carcinogenesis, chronic microtraumatic factor, occlusal splint for mucosal protection, geographic tongue, fissured tongue.

Manejo preventivo del factor microtraumatizante crónico en un paciente adolescente mediante el uso de mucoprotector; reporte de caso clínico

Resumen: En el desarrollo del cáncer se reconocen tres etapas: iniciación, promoción y progresión. A estas etapas consecutivas se las denomina proceso de carcinogénesis. La función que el odontólogo cumple en este proceso en cuanto al cáncer bucal es intervenir en la etapa de promoción haciendo foco en la prevención, ya sea eliminando y a su vez no instalando factores microtraumatizantes crónicos. Este trabajo es un reporte del caso clínico de un paciente de sexo masculino de 14 años de edad atendido en el Hospital de Odontología Infantil "Don Benito Quinquela Martín", al cual se le realiza el examen clínico estomatológico funcional detectando que presenta una lengua geográfica y escrotal, con severas indentaciones en los bordes, producto del factor microtraumatizante crónico por la presencia de un arco dentario desfavorable. Si este factor no es controlado o eliminado, podría provocar ulceración por trauma crónico que es una de las enfermedades potencialmente cancerizables. **Objetivo:** describir la situación clínica de un paciente de sexo masculino de 14 años de edad, al cual se le instala un mucoprotector con el fin de prevenir enfermedades potencialmente cancerizables, como la ulceración por trauma crónico debida al factor microtraumatizante crónico presente. **Conclusión:** mediante la instalación del mucoprotector dentro del plan de tratamiento, se previenen lesiones a futuro que puedan llegar a comprometer el estado de salud general del paciente.

Palabras clave: carcinogénesis, factor microtraumatizante crónico, mucoprotector, lengua geográfica, lengua escrotal.

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Manejo preventivo do fator microtraumatizante crônico em um paciente adolescente mediante o uso de mucoprotetor; relato de caso clínico

Resumo: No desenvolvimento do câncer são reconhecidos três estágios: iniciação, promoção e progressão. Esses estágios consecutivos são chamados de processo de carcinogênese. O papel do dentista nesse processo no câncer bucal é intervir no estágio de promoção com foco na prevenção, eliminando e não instalando fatores microtraumáticos crônicos. Este trabalho é um relato de caso clínico de um paciente do sexo masculino, com 14 anos de idade, atendido no Hospital de Odontologia Infantil “Don Benito Quinquela Martín”, que foi submetido a um exame clínico estomatológico funcional e foi constatado que apresentava língua geográfica e escrotal, com indentações severas nas bordas, como resultado de fatores microtraumáticos crônicos, devido à presença de uma arcada dentária desfavorável. Se esse fator não for controlado ou eliminado, pode levar à ulceração por trauma crônico, que é uma das doenças potencialmente cancerígenas. **Objetivo:** descrever a situação clínica de um paciente do sexo masculino, de 14 anos de idade, que recebeu um mucoprotetor para prevenir doenças potencialmente cancerígenas, como ulceração por trauma crônico, devido ao fator microtraumático crônico presente. **Conclusão:** com a instalação do mucoprotetor no plano de tratamento, evitam-se lesões futuras que poderiam comprometer a saúde geral do paciente.

Palavras-chave: carcinogênese, fator microtraumático crônico, mucoprotetor, língua geográfica, língua escrotal.

Introduction

In the dentist office, it is of fundamental importance that pediatric dentists perform a clinical functional and stomatological examination in addition to the clinical inspection of the dental and periodontal tissues, because it plays an important role in the early detection of oral diseases at an early age. This procedure, for which professionals should be trained, has to be orderly and systematized. It starts with first observing the patient's lip area with their mouth closed. Then the patient is asked to slowly open their mouth until reaching the maximum opening, where the different regions and subregions that comprise the oral cavity should be observed.¹

This examination consists of examining the usual functions of the stomatognathic system, since the oral cavity involves both hard and soft tissues in intimate contact and functioning permanently. Sometimes a lesion is not apparently consistent with an injuring element, but during swallowing,

phonation or parafunctions, contacts occur which go unnoticed while the mouth is at rest.

In this way, it will be possible to identify variants of normality and recognize the main alterations of the mucosa, such as changes in color and integrity, as well as changes in texture, consistency and volume, detectable by palpation and other diagnostic elements.

These alterations of the oral mucosa are called *elementary lesions*, and it is important to recognize them in order to make a correct pathological diagnosis.

Therefore, one of the objectives of performing a clinical functional and stomatological examination is to detect such elementary lesions and thus focus on the prevention of *potentially precancerous diseases* of the oral mucosa. These are clinical conditions with a higher probability of developing into a malignant neoplasm, due to exposure to risk factors or genetic alterations.²

One of these conditions is *ulceration due to chronic trauma* (UCT), which is a loss of substance starting from the outside in, of variable depth and size, which tends to heal spontaneously, caused by any agent acting continuously. This is called **chronic microtraumatic factor (CMF)** and refers to any minimal trauma imperceptible to the patient that persists over time. Some examples of CMF include:

- **MECHANICAL:** The most common type of CMF, caused by teeth and prostheses, such as misalignment, missing teeth, sharp edges due to carious lesions, overflowing fillings and overextended, broken or poorly designed prostheses.
- **CHRONIC INFLAMMATION:** Microbial plaque is the most common type.
- **CHRONIC DRYNESS:** In the labial semimucosa, this is the main cause of carcinogenesis leading to lip cancer.
- **CHRONIC TRANSIENT ISCHEMIA:** The most common type includes inflammation due to overcompression associated with poorly designed removable prostheses, orthodontics and dentofacial orthopedics appliances and scars, especially in the posterior part of the mouth.

These chronic microtraumatic factors may result in painful or non-painful ulcerations. As long as the cause is identified and eliminated, the lesion will repair within a few days. The most frequent locations of ulceration due to chronic trauma are the edges of the tongue, the ventral side of the tongue, the floor of the mouth, and the buccal mucosa.³

If the injuring element persists, the lesion may develop a more noticeable border and the

depth of the loss of substance may increase, becoming an ulcer, a lesion that does not tend to heal spontaneously, so it is necessary to identify and eliminate its cause and, subsequently, control its course. If remission is not observed, it will be necessary to perform a biopsy for a pathology study.

The objective of this article is to describe the clinical condition of a 14-year-old male patient diagnosed with geographic and fissured tongue with severe indentations caused by the size of his tongue and unfavorable dental arches, who is fitted with an occlusal splint for mucosal protection in order to prevent potentially precancerous diseases, such as ulceration due to chronic trauma, caused by the chronic microtraumatic factor present.

Case report

This was a 14-year-old male patient with no personal or family medical history of interest, who attended Hospital of Pediatric Dentistry "Don Benito Quinquela Martín" seeking care; the reason for consultation was cavities. He was admitted for care at the Department of Preventive Dentistry.

The clinical functional and stomatological examination of the patient first with his mouth closed showed scaling and atrophy of the labial semimucosa (Figure 1).

When asked to open his mouth, the patient shows, both on the dorsal and ventral sides of the tongue, a pattern of altered desquamation of the lingual papilla, with no pain, compatible with *geographic tongue*. Grooves and an increased size of the tongue are also observed, typical of *fissured tongue*. At the same time, indentations on the edges of the tongue are already visible (Figures 2 - 7).



Figure 1. Closed-mouth clinical functional and stomatological examination.



Figure 4. Dorsum of the tongue.



Figure 2. Open-mouth clinical functional and stomatological examination.



Figure 5. Severe indentations on the right edge of the tongue.



Figure 3. Clinical functional and stomatological examination showing indentations on the edges of the tongue.



Figure 6. Indentations on the left edge of the tongue.



Figure 7. Ventral side of the tongue.



Figure 9. Indentations on the right edge of the tongue.

These multiple indentations are present on the right and left edges of the tongue and correspond to the imprints caused by the lower teeth, since it exceeds the size of the dental arch. Likewise, the dental arches are observed to have diastemas in the anterior area and a lingualized position in the posterior area, which favors this picture (Figures 8-11).



Figure 10. Indentations on the left edge of the tongue.



Figure 8. Dorsum of the tongue in an unfavorable dental arch.



Figure 11. Dental arches in occlusion.

A comprehensive, individualized treatment plan with a strong preventive component was implemented, including preventive and therapeutic actions based on individual risk to make an adequate diagnosis.⁴ The comprehensive assessment should include general condition and growth, extraoral and intraoral soft tissue, gingival and periodontal health and hygiene, occlusion development, and patient behavior. Based on the assessment of occlusion, the patient is referred for consultation and orthodontic treatment.

Once the corresponding explanations were provided to the patient's parents, they signed the informed consent form established by the Government of the Autonomous City of Buenos Aires - Ministry of Health (Resolution 0356/MSGC/09 - Law 153 - Decrees 208/01 and 2316/03) for the performance of the proposed treatment and for the registration, documentation, and potential publication of the case report.

As the first therapeutic measure, the regular use of lip balm is indicated to moisturize the labial semimucosa.

Following this basic therapy, with the mouth in good health and the patient duly motivated in terms of oral hygiene and dietary advice, it was decided to make a **thermoformed soft tissue mouthguard or occlusal splint for mucosal protection** to prevent potential ulcerations due to chronic trauma caused by the usual functions of the tongue and due to its characteristics, as described above.

An occlusal splint for mucosal protection is a flexible, thermoformed mouthguard that protects the soft tissues from the chronic microtraumatic factor that occurs with usual functions. It will be made for the lower jaw as this is where the tongue mainly impacts

and where dental misalignments cause tongue indentations.

The pertinent explanations are given to the patient and his family, with emphasis on the preventive purpose of the occlusal splint for mucosal protection, in order to motivate the patient to use it and also to encourage collaboration and the success of the treatment.

Making an occlusal splint for mucosal protection

A dental impression of the lower jaw is taken, with the corresponding muscle portions and trying to obtain a good definition of the gingival sulcus. The impression is sent to the hospital's prosthodontics laboratory to make the cast of the impression in stone plaster. It is indicated that this model should be made without a base (Figure 12).



Figure 12. Case study model.

Once the model of the lower jaw is obtained, it is remodeled according to the clinical examination and the patient's occlusal status. Such remodeling is done on the model by wetting a brush in a different color plaster—in this case, white—in order to be able to distinguish what is being added. The purpose of this is to use the white plaster to remodel the places where the shape of the dental arch is irregular or causes steps due to teeth misalignments, always taking the occlusion into consideration (Figure 13).



Figure 13. Remodeling of the case study model.

The model is then sent back to the prosthodontics laboratory for thermoforming. The indication is to use 0.6" thick, flexible thermoformed plate and to

leave it untrimmed. Once the prosthodontist obtains the thermoformed plate, they should proceed to trim it following the mucogingival line as a reference (Figure 14).



Figure 14. Model stamping and trimming of the thermoformed plate.

After making the corresponding tests on the patient's dental arch, silicone rubber is used to bevel the edges so that they are properly rounded (Figure 15).

The occlusal splint for mucosal protection is placed and instructions for use and care are given to the patient and the accompanying family member. It must be used 24 hours a day, except for eating and drinking hot beverages, and must be rinsed with cold water (Figure 16).

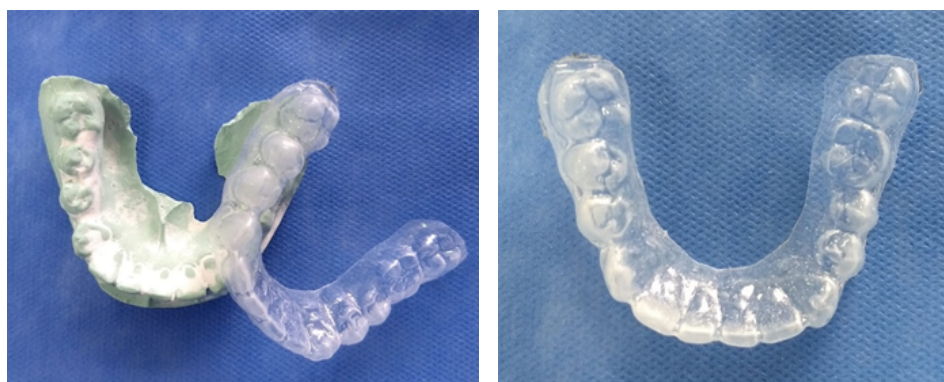


Figure 15. Occlusal splint for mucosal protection.



Figure 16. Placement of occlusal splint for mucosal protection.

Course and follow-up

A control is scheduled in one month for assessment of adaptation and state of the occlusal splint for mucosal protection, as well as for determination of any lesion in the patient's tongue. Patients and their parents and/or companions should always be instructed about the fundamental importance of controls and long-term follow-up, not only for the maintenance of dental oral health, but also in this case, given that this patient presents risk factors in soft tissues.

The labial semimucosa show a significant improvement, since the patient has been using lip balm on a regular basis (Figure 17).



Figure 17. Labial semimucosa.

The indentations on the edges of the tongue are no longer as marked as they were before the use of the occlusal splint

for mucosal protection. Likewise, at this moment, the desquamation pattern of the lingual papilla on the dorsal and ventral sides of the tongue appears less altered (Figures 18 – 20).

The patient reports that he has adapted correctly to the device and that he uses it continuously. The indications are repeated and the patient goes on with the corresponding controls and follow-up.



Figure 18. Progress of tongue with the use of the occlusal splint for mucosal protection.



Figure 19. Right edge of the tongue.



Figure 20. Left edge of the tongue.

Discussion

The term cancer encompasses a broad group of diseases characterized by uncontrolled cell proliferation. Three stages are identified in its development: initiation, promotion and progression, known as the carcinogenesis process. The role of dentists becomes very relevant in the promotion stage, where the identification and elimination of risk factors, such as a chronic microtraumatic factor, allows the implementation of effective preventive strategies.

Numerous studies have established the relationship between chronic microtrauma and the development of potentially malignant lesions in the oral cavity. In particular, ulceration due to chronic trauma has been recognized as an entity with potential for neoplastic transformation when the harmful agent persists over time. As explicitly pointed out by the Program of Oral Pathology and Clinical Practice II of Universidad de Buenos Aires, ulceration due to chronic trauma is a precancerous lesion, emphasizing that its persistence may result in dysplastic changes or facilitate the action of other carcinogens, such as tobacco or alcohol.⁵

Piemonte et al. (2010) have described how persistent mechanical trauma, although initially asymptomatic, may cause tissue modifications that alter cellular homeostasis and favor oral epithelial dysplasia. These lesions, if not adequately treated, may evolve into malignant processes, especially in areas such as the edges of the tongue, the floor of the mouth and the buccal mucosa, which are considered high risk due to their thin mucosa and proximity to muscle tissue.⁶

Along the same lines, González Roma (2020), in their clinical and bibliographic analysis of ulcerations due to trauma, highlights the importance of a differential diagnosis between an ulceration due to chronic trauma and an incipient carcinoma, since poorly controlled chronic lesions may develop a morphology compatible with the initial stages of malignant transformation. The author emphasizes that many patients with oral carcinoma report a history of recurrent ulcerations in the same locations, suggesting a progressive evolution from chronic trauma to neoplasia.³

In the face of this problem, several therapeutic strategies have been proposed. Traditionally, priority has been given to eliminating the causative agent: adjustment or replacement of prostheses, orthodontic treatment, correction of defective restorations, among others. However, some authors have suggested the use of devices for mucosal protection as an intermediate or supplementary measure.

Authors such as Ingrassia Tonelli and Rivarola (2022) have pointed out that flexible thermoformed devices may significantly reduce tongue friction and prevent the onset of ulcerations, especially

in patients with anatomical alterations that could facilitate the development of lesions when they coexist with chronic irritant factors.⁷

The use of an occlusal splint for mucosal protection in this clinical case eliminates the constant mechanical stimulation, reduces subclinical inflammation, prevents ulcerations, and ultimately protects the integrity of the oral epithelium. This is in line with the current recommendations made by authors such as Miloglu et al. (2009) to adopt a comprehensive preventive approach that prioritizes not only restorative treatment, but also the elimination of predisposing factors in order to maintain soft tissue health and prevent progression to more serious lesions.⁸

Compared to other more invasive approaches, such as surgical resection of redundant tissues or immediate corrective orthodontics, the use of a flexible occlusal splint for mucosal protection represents a low-risk alternative, well-tolerated by pediatric patients, with the potential to slow down chronic inflammation and prevent progression to severe lesions.

Furthermore, this strategy is framed within a comprehensive preventive approach that prioritizes education, oral hygiene and regular follow-up, all aspects recommended by the current bibliography for the management of potentially malignant mucosal lesions (Blanco Carrión et al., 2013).⁹

Conclusions

It is of fundamental importance that pediatric dentists are trained to perform

a clinical functional and stomatological examination, that is, not only to observe the anatomical structures at rest, but also the oral dynamics in order to be able to diagnose and adequately treat future lesions that may compromise the patient's general health.

In this case, special focus is placed on prevention, within a comprehensive, individualized treatment plan with a strong preventive component, by making an occlusal splint for mucosal protection for an adolescent patient with risk factors in the soft tissues, in order to prevent the severity of trauma to the buccal mucosa at an early stage.

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Conflicts of interest

The authors stated that they did not have any conflict of interest or receive funds for the development of this article.

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