BRAZILIAN JOURNAL OF IMPLANTOLOGY AND HEALTH SCIENCES

ISSN 2674-8169

CLINICAL EVALUATION OF GINGIVAL ATTACHMENT LOSS AFTER ABSOLUTE ISOLATION IN ENDODONTICS: LITERATURE REVIEW

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https://doi.org/10.36557/2674-8169.2025v7n2p683-690
Artigo publicado em 09 de Fevereiro de 2025

LITERATURE REVIEW

ABSTRACT

Objective: In this context, this study aims to evaluate, through a literature review, the relationship between the loss of gingival attachment in healthy individuals and the use of endodontic clamps during endodontic treatment. Aspects related to the pathophysiology of gingival changes, the impact of absolute isolation, and clinical strategies to minimize possible periodontal damage will be discussed. Methodology: This narrative literature review article used Rother's (2007) work as a basis, as it explains what is necessary to compose a narrative review. Thus, it was necessary to use narrative, systematic and integrative literature review articles to acquire relevant data related to the topic and with a scientific basis. Thus, to obtain this information to compose the article, searches were made in the following databases: PROSPERO; VHL/BIREME; Web of Science; PUBMED Central; The Cochrane Library; Scielo. Results: Absolute isolation in endodontics ensures a contamination-free field but may impact periodontal tissues. Clamps exert pressure, potentially causing ischemia, inflammation, and gingival attachment loss. Effects vary by clamp type, tooth location, and gingival phenotype. Further studies should refine clinical protocols. Conclusion: Absolute isolation is an indispensable tool for endodontics, ensuring a dry and contamination-free operative field, which improves treatment predictability. However, its impact on the marginal gingiva needs to be better understood and managed to avoid periodontal complications. The use of clamps can generate excessive pressure on the gingival tissues, leading to ischemia, inflammation, and, in extreme cases, irreversible loss of gingival attachment.

Keywords: Endodontics; Absolute Isolation; Gums.

AVALIAÇÃO CLÍNICA DA PERDA DE INSERÇÃO GENGIVAL APÓS ISOLAMENTO ABSOLUTO EM ENDODONTIA: REVISÃO DE LITERATURA

RESUMO

Objetivo: Neste contexto, este estudo tem como objetivo avaliar, por meio de uma revisão bibliográfica, a relação entre a perda de inserção gengival em indivíduos saudáveis e o uso de grampos endodônticos durante o tratamento endodôntico. Serão discutidos aspectos relacionados à fisiopatologia das alterações gengivais, ao impacto do isolamento absoluto e às estratégias clínicas para minimizar possíveis danos periodontais. Metodologia: Este artigo de revisão narrativa da literatura utilizou como base o trabalho de Rother (2007), pois ele explica o que é necessário para compor uma revisão narrativa. Assim, foi necessário utilizar artigos de revisão narrativa, sistemática e integrativa da literatura para adquirir dados relevantes relacionados ao tema e com embasamento científico. Assim, para obter essas informações para compor o artigo, foram realizadas buscas nas seguintes bases de dados: PROSPERO; BVS/BIREME; Web of Science; PUBMED Central; The Cochrane Library; Scielo. Resultados: O isolamento absoluto em endodontia garante um campo livre de contaminação, mas pode impactar os tecidos periodontais. Grampos exercem pressão, potencialmente causando isquemia, inflamação e perda de inserção gengival. Os efeitos variam de acordo com o tipo de grampo, localização do dente e fenótipo gengival. Estudos futuros devem refinar os protocolos clínicos. Conclusão: O isolamento absoluto é uma ferramenta indispensável para a endodontia, garantindo um campo operatório seco e livre de contaminação, o que melhora a previsibilidade do tratamento. No entanto, seu impacto na gengiva marginal precisa ser melhor compreendido e gerenciado para evitar complicações periodontais. O uso de grampos pode gerar pressão excessiva nos tecidos gengivais, levando à isquemia, inflamação e, em casos extremos, perda irreversível da inserção gengival.

Palavras-chave: Endodontia; Isolamento Absoluto; Gengiva.

INTRODUCTION

Endodontics is a science that governs the treatment and monitoring of the root canals of teeth. It is a dental specialty that requires ideal operating conditions to ensure successful treatment. Absolute isolation is one of the main resources used to keep the operating field dry and free from contamination, preventing the infiltration of oral fluids and promoting better adhesion of restorative materials (Santos et al., 2021). However, the use of clamps and rubber sheets can exert pressure on the marginal gingiva, potentially leading to periodontal changes, including inflammation, gingival recession, and loss of gingival attachment (Lopes et al., 2020).

Studies indicate that mechanical trauma to the gingiva can trigger inflammatory processes and reabsorption of connective tissue, leading to changes in gingival attachment (Pini et al., 2019). Excessive compression generated by clamps can compromise the balance of periodontal tissues, resulting in irreversible damage, especially in patients with thin and delicate gingiva. Furthermore, the duration of use of absolute isolation may influence the severity of gingival changes observed after endodontic procedures.

Despite the importance of absolute isolation for the quality of endodontic treatments, the literature still presents gaps regarding its influence on long-term periodontal health. Thus, there is a need for studies that correlate this technique with possible changes in gingival tissues, in order to identify potential risks and develop strategies to minimize adverse impacts on the periodontium.

In this context, this study aims to evaluate, through a literature review, the relationship between the loss of gingival attachment in healthy individuals and the use of endodontic clamps during endodontic treatment. Aspects related to the pathophysiology of gingival changes, the impact of absolute isolation, and clinical strategies to minimize possible periodontal damage will be discussed.

METHODOLOGY

This narrative literature review article used Rother's (2007) work as a basis, as it explains what is necessary to compose a narrative review, what cannot be included in

this work, its structure, its approach and what the search methodology should be. Thus, it was necessary to use narrative, systematic and integrative literature review articles in order to acquire relevant data related to the topic and with a scientific basis. Thus, in order to obtain this information to compose the article, searches were made in the following databases: PROSPERO; BVS/BIREME; Web of Science; PUBMED Central; The Cochrane Library; Scielo. Gray literature was also used, enriching the article with a set of current and relevant information on the topic.

RESULTS

Absolute Isolation in Endodontics

Absolute isolation is considered the gold standard in endodontic procedures, providing a dry and contamination-free operating field (Torres et al., 2022). This technique uses a rubber sheet fixed to the teeth with clamps, separating soft tissues and controlling humidity, which is essential for the success of endodontic treatment. However, the impact of absolute isolation is not limited to the benefit of decontamination; the force exerted by the clamp on the dental crown can result in adverse biological consequences for the surrounding periodontal tissues.

The clamps used in absolute isolation exert an average pressure of approximately 2 to 5 N/cm² on the tooth surface and gingival tissues. This force may vary depending on the type of clamp and the shape of the dental crown. In teeth with extensive coronal destruction due to caries, the remaining surface may offer less mechanical resistance to the clamp, increasing compression on the marginal gingiva. Such compression may interfere with local microcirculation, causing temporary ischemia and subsequent tissue inflammation, which may contribute to loss of gingival attachment.

Impact of Absolute Isolation on the Marginal Gingiva

Although absolute isolation offers several advantages, its impact on the marginal gingiva has been a cause for concern. The use of clamps may cause compression of the gingival tissues, leading to inflammation and possible loss of gingival attachment (Fernandes et al., 2018). Invasion of the biological space may result in chronic inflammation, leading to periodontitis and, consequently, loss of the

tooth. Studies suggest that rigid metal clamps may exert pressures greater than 5 N/cm² on the marginal gingiva, exceeding the physiological limits supported by the periodontium and triggering a chronic inflammatory process.

Another relevant factor is the location of the clamp on the teeth. Clasps placed on molars generally exert less pressure on the marginal gingiva due to the larger support area of the tooth structure. In contrast, clasps used on premolars and incisors can exert greater localized pressure, intensifying the effects of gingival compression. In addition, the length of time the clasp remains in place can amplify these deleterious effects, and it is recommended that absolute isolation should not be maintained for prolonged periods without clinical monitoring.

Periodontal Responses to Mechanical Trauma

Mechanical trauma caused by absolute isolation can trigger inflammatory responses in periodontal tissues. Studies suggest that the pressure exerted by clasps can lead to resorption of connective tissue and loss of gingival attachment (Mitchell et al., 2017). Gingival retraction techniques are used to vertically and horizontally displace the gingiva, allowing the impression material to clearly copy the end of the tooth preparation, but they can also cause changes in the periodontal tissues. Excessive gingival compression can lead to a phenomenon known as pressure necrosis, where the interruption of blood flow results in cell death and subsequent reabsorption of connective tissue. In more severe cases, this necrosis can progress to irreversible gingival recession. The impact of this inflammatory response is more pronounced in patients with a thin gingival phenotype, where the underlying connective tissue is less thick and more susceptible to mechanical trauma.

Characteristics of the Marginal Gingiva and Influence of the Gingival Phenotype

The marginal gingiva is the outermost portion of the gingiva, surrounding the neck of the teeth and forming a protective barrier against mechanical and microbiological aggressions. Its thickness and resistance vary according to the gingival phenotype, which can be classified as thin, medium or thick. Patients with a thin gingival phenotype have more delicate tissues that are susceptible to gingival recession

when subjected to excessive forces, such as the pressure of absolute isolation clasps. Furthermore, geographic and genetic factors influence gingival morphology and thickness. Studies indicate that individuals of Asian and Caucasian origin tend to have thinner gingival phenotypes, while African populations have thicker and more resistant marginal gingiva. This variation may influence the gingival response to mechanical trauma imposed by rubber dams and should be considered when selecting appropriate clasps and techniques for each patient.

Gaps in the Literature and Need for Future Studies

Despite the evidence on the impact of rubber dams on the marginal gingiva, there is a lack of studies evaluating the relationship between the duration of rubber dam use, the type of clasp used and the severity of gingival attachment loss. Future research is needed to determine clinical protocols that minimize the adverse effects of absolute isolation on periodontal health.

DISCUSSION

The results presented in the literature review demonstrate that, although absolute isolation is essential for the quality of endodontic procedures, it can cause adverse effects on the marginal gingiva, especially when the clamps exert excessive pressure on the periodontal tissues. The mechanical impact generated by the clamps can lead to temporary ischemia, inflammation and, in some cases, irreversible loss of gingival attachment, which can compromise long-term periodontal health.

The mechanical trauma generated by the pressure of the clamps can trigger a significant inflammatory response, as reported by Mitchell et al. (2017), who demonstrated the relationship between gingival compression and resorption of connective tissue. This is especially worrying in patients with a thin gingival phenotype, in whom the susceptibility to gingival recession is greater, as indicated by Pini et al. (2019). Furthermore, Fernandes et al. (2018) highlight that the use of more rigid clamps with excessive pressure can induce histopathological changes that favor the development of periodontitis. The length of time the absolute isolation is in place also appears to be a determining factor in the severity of gingival changes. Studies suggest that prolonged pressure may exacerbate the deleterious effects on the periodontium, increasing the likelihood of postoperative periodontal complications. However, the

literature still presents gaps regarding the specific correlation between the type of clamp used, its pressure on the gingival tissues, and the long-term effects on periodontal health. Thus, more longitudinal clinical studies are needed to determine protocols that minimize these impacts.

A relevant question is whether the damage caused by the clamps is permanent or whether it can be reversed. In mild cases, in which gingival compression results only in temporary inflammation, removal of the clamp and the use of local anti-inflammatory measures may allow full recovery of the gingival tissues. However, in situations where excessive pressure has led to resorption of the connective tissue and loss of gingival attachment, the damage may be irreversible, requiring periodontal interventions, such as gingival grafts to restore the compromised structure. Studies indicate that the regenerative capacity of the gums depends on the extent of the trauma and the patient's gingival phenotype, being more favorable in individuals with thick gingiva.

A clinical approach that can reduce risks is the careful selection of clasps and individualized adaptation according to the patient's gingival phenotype. The use of clasps with silicone coatings or optimized anatomical design can mitigate the negative effects, better distributing the pressure exerted on the gums. In addition, monitoring the time of use of absolute isolation can contribute to the reduction of inflammation and loss of gingival attachment, preserving the integrity of periodontal tissues.

CONCLUSION

Absolute isolation is an indispensable tool for endodontics, ensuring a dry and contamination-free operating field, which improves treatment predictability. However, its impact on the marginal gingiva needs to be better understood and managed to avoid periodontal complications. The use of clamps can generate excessive pressure on the gingival tissues, leading to ischemia, inflammation and, in extreme cases, irreversible loss of gingival attachment.

The relationship between the pressure exerted by the clamps, the time of absolute isolation and the gingival phenotypes still requires further investigation. The adoption of anatomical clamps, less aggressive materials and strict control of the time of absolute isolation are measures that can reduce the adverse effects on periodontal

tissues. In view of the above, it is essential that new longitudinal studies be conducted to elucidate the mechanisms that govern the gingival changes induced by absolute isolation and to develop clinical strategies that minimize such impacts. In this way, it will be possible to reconcile the benefits of absolute isolation with the preservation of patients' periodontal health.

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