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Microfiltration of composite resins in marginal areas of Class II cavities in Latin America: Bibliographic review

Microfiltração de resinas compostas em zonas marginais de cavidades Classe II na América Latina: Revisão bibliográfica

Microfiltración de resinas compuestas en zonas marginales de cavidades Clase II en Latinoamérica: Revisión bibliográfica

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Abstract
Using composite resin in modern dentistry in Class II posterior restorations allows us to recover morphology and functionality in an affected tooth structure. Microleakage in the marginal sector of a tooth may be due to several factors, one of the main ones being the low polymerization shrinkage and stress to which the material is subjected. In addition, a good restoration prevents the infiltration of bacteria into the tooth. The objective was to determine the degree of marginal microleakage in Class II cavities restored with resin in the Latin American population employing a literature review. Materials and methods. In the present descriptive, cross-sectional, and retrospective study, articles referring to the subject in a maximum study time of 5 years were chosen, in addition to the search in literature sources such as PubMed, SciELO, Google Scholar, and Elsevier. Results. Microleakage is a post-operative complication found in most dental restorations with a 56% margin of failure from lack of polymerization shrinkage and other variables. Conclusion. Microleakage is a common problem during restoration; it is vital to know the product we use and its correct use. In addition, type II cavities are a challenge for any clinician during surgery.
Keywords: Restoration; Class II cavities; Misalignment; Microleakage; Occlusal cases.

Resumo
O uso de resina composta na odontologia moderna em restaurações posteriores Classe II nos permite recuperar a morfologia e funcionalidade na estrutura dental afetada. A microinfiltração no setor marginal de um dente pode ser devida a vários fatores, sendo um dos principais a retração por polimerização deficiente e a tensão à qual o material é submetido. Uma boa restauração evita a infiltração de bactérias no dente. O objetivo deste estudo foi determinar o grau de microinfiltração marginal em cavidades Classe II restauradas com resina na população latino-americana, por meio de uma revisão da literatura. Materiais e métodos. O presente estudo descritivo, transversal e retrospectivo, no qual foram escolhidos artigos referentes ao assunto dentro de um período máximo de estudo de 5 anos, além da pesquisa em fontes bibliográficas como: Pubmed, Scielo, Google Scholar, Elsevier. Resultados. A microinfiltração é uma complicação pós-operatória encontrada na maioria das restaurações dentárias com uma margem de 56% de falha, devido à ausência de retração por polimerização e outras variáveis. Conclusão. A microinfiltração é um problema comum quando se realiza uma restauração. É de vital importância conhecer o produto que estamos utilizando e sua

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correta utilização, e as cavidades tipo II são um desafio para qualquer clínico quando se realiza a operação.
Palavras-chave: Restauração; Cavidades classe II; Desalinhamento; Microinfiltração; Caixas oclusais.

Resumen
El uso de resina compuesta en la odontología moderna en restauraciones del sector posterior clase II, nos proporciona recuperar morfología y funcionalidad en la estructura dentaria afectada, la microfiltración en el sector marginal de una pieza dentaria se puede deber a diversos factores, uno de los principales es la deficiente contracción de polimerización y estrés al que se encuentra sujeto dicho material. Una buena restauración evita la filtración de bacterias al interior de la pieza dental. El objetivo fue determinar el grado de microfiltración marginal existente en cavidades clase II restauradas con resina, en la población latinoamericana mediante una revisión bibliográfica. Materiales y métodos. El presente estudio descriptivo, transversal y retrospectivo, en el cual se escogieron artículos referentes al tema en un tiempo de estudio máximo de 5 años, además de la búsqueda en fuentes bibliográficas tales como: Pubmed, Scielo, Google académico, Elsevier. Resultados. La microfiltración es una complicación post operatoria, se encuentra en la mayoría de las restauraciones dentales con un 56% de margen de fracaso, a partir de la faltade contracción de polimerización y otras variables. Conclusión. La microfiltración constituye un problema común al momento de realizar la restauración, es de vital importancia conocer el producto que utilizamos y el correcto uso, las cavidades tipo II suponen un reto para cualquier clínico al momento de realizar la operatoria.
Palabras clave: Restauración; Cavidades clase II; Desajuste; Microfiltración; Cajas oclusales.

1. Introduction

Composite resins are a type of restorative material, composed of an organic matrix and an inorganic filler, the fixation of the matrix is created through the bonding of vinyl silane (inorganic filler) and bisphenol glycidyl methacrylate or BisGMA (organic matrix) that together with the help of ultraviolet light produces photopolymerization. This is used for the shaping of tooth morphology, cementation of orthodontic appliances, cementation of bridges and crowns, etc. The resin must provide the optimum consistency, in addition to matching the color of the tooth structure, and above all minimum water absorption, solubility and shrinkage.

In the case of direct restorations in class II cavities based on composite resin has been increasing, this is due to the physical, chemical and mechanical characteristics offered1, this biomaterial presents an organic load and an inorganic filler which facilitates the adaptation to deep cavities, but there is always the risk of lack of polymerization shrinkage within the cavity, in the polymerization process there is an interface that produces an incomplete seal, resulting in a small adjacent leakage, hence "the higher the proportion of inorganic filler, the higher the hardness and the smaller the particle size, the lower the modulus of elasticity" (Alzraik at. 2017)

One of the main problems of marginal microleakage is the passage of bacteria and liquids through a tiny space in the walls of the cavity giving rise to demineralization of the hard tissues of the dental structure and contamination of the same, also problems can be found in the dental structure such as abnormal marginal staining, deterioration of the dental margins, caries and hypersensitivity, lesions at the pulp level 4-5

2. Methodology

This is a descriptive, cross-sectional and retrospective study, which was carried out by examining the digital scientific literature, focusing on the websites of dental literature that contain important information on microleakage, such as: Scielo, Google Scholar, Redalyc, PubMed, in addition to keywords such as: Restoration, class II cavities, misalignment, microleakage, occlusal boxes, Ryge criteria for simplifying the search. Inclusion criteria included cross-sectional, longitudinal, cohort, prospective studies, case-control series, clinical cases and randomized controlled trials, where information related to marginal resin microleakage in type II cavities in Latin American countries was reported, of which about 35 articles were collected, undifferentiated by language. As for the scientific information research process, two terms were taken into consideration; the first one is the year the article was published and the other one is the design of the study; the search was restricted to original articles, bibliographic review articles, clinical cases and theses related to the topic. The exclusion criteria were those studies

such as monographs, and information from web pages without scientific contribution or articles without sender or year of publication. After the collection of relevant articles regarding the topic, the synthesis of important information was developed. Next, the relevant information was digitized in Microsoft Word to structure and establish the content of the study topic.

3. Results and Discussion

Results

Of all the articles reviewed, the majority of the authors report that microleakage is a postoperative problem, which is found in most dental restorations with a margin of 56%, this arising from the lack of polymerization shrinkage with 10.3 % in conventional resins and 10% in nanohybrid resins, on the other hand the restorations with composite resin in posterior teeth in which an ionomeric base is not used tend to have a higher degree of microleakage in the marginal part with 25%, being the slightest, in addition it is determined that approximately 80% of marginal caries develop in the gingivo-cervical margin in class II restorations, being these the most prevalent and also the most difficult to treat.As far as restorative treatment is concerned, it is considered that beveling reduces up to 50% of the stress present in the dental cavity, besides improving the marginal adaptation of the resins, thus avoiding their microfiltration, but at the same time it was also found that a bad beveling technique increases filtration by 24%, besides producing occlusal misalignment. Based on the different types of resin, microscopic marginal microleakage of less than 50% was observed in bull-filk resins, in composite resin in the Opallis brand, there was 40% more marginal microleakage and as for the use of fluid resin, 60% of microleakage was maintained. Bulk-fill resins tend to have greater fluidity, better marginal sealing with a success margin of 95%, in relation to the conventional one which is a margin of 90%. In addition, it was demonstrated that the oblique incremental technique consists of failures since it is more prone to conduct marginal microleakage with 47% in restorations near the pulp cavity and 42% in medium dentin.

Discussion

Restorations with composite resin are procedures that are widely used in the dental area, as well as class II restorations that involve the proximal surfaces of each dental piece, for which reason this literature review was intended to determine if the microleakage of resins in marginal areas in type II cavities is caused by different factors, such as the choice of resin, the polymerization or the technique used. In the year 2022 in the study of Calizaya in Peru, he mentions that class II composite resin restorations with ionomeric base present a lower degree of marginal microleakage. Gil Minaya in his study in 2013, shows that depending on the technique, microleakage is evidenced as in the oblique incremental technique since 47% of the restorations presented marginal microleakage in the pulp cavity, 42% in the middle dentin and 12% in the deep dentin. While in the cavities restored using the resin bead technique, 62% presented marginal microleakage in the pulp cavity, 30% in the enamel and middle dentin, and 8% in the deep dentin. In the year 2021 Cargua X, in his study, found no significant differences in marginal integrity for both the incremental layering technique and the block technique. While Mendoza in 2020 demonstrates in his study that marginal microleakage is recorded to a lesser degree in Spectra Smart nanohybrid composite resins of the renowned brand Dentsply Sirona, with a significance level of 0.05 when compared with Tetric N-Ceram composite resins that obtained a mean of 1.4 and Opallis resin a mean of 2.5 presenting a high risk of marginal microleakage. In the studies of articles from Brazil, they found agreement that microleakage was mainly due to the C factor, as is the case of Signor L. et al. in 2017, conducted in Brazil it is considered that the incremental technique for deep restorations by oblique increments per portion decreases the C factor by 5% , with increments no larger than 2 mm, since thicker increments minimize the light-curing capacity, therefore, by reducing the volume of the composite resin the polymerization is uniform and reduces the marginal stress. The study by Pedrosa L. et al. (2021), evaluated two types of resins; a flowable universal composite, and a conventional resin, in different types of cavity, it was demonstrated that the filling technique and the type of resin go together,

besides having a great impact on the adhesion of the resin, especially in cavities with a high C factor. The flowable resin provided good bond strength regardless of filling technique and cavity depth in more than 35% of the success; however, when conventional resins were used in the single filling technique, the adhesion was not satisfactory.

According to Silva et al., (2017), after composite resin polymerization, there can be a loss of material volume of up to 3%, which can cause detrimental changes, reducing the life of the restoration.

4. Conclusion

In conclusion, marginal microleakage of resin is a problem for any dentist, in the study we have been able to confirm that this problem is found in 56% of the restorations made with composite resin, compromising the restoration and causing failure in the restorative treatment. Microleakage is produced by several factors, the most important one is the lack of polymerization contraction and the stress produced inside the dental cavity, there are also other factors such as the lack of marginal sealing, a bad restorative technique, a bad choice of restorative materials and even a failure to understand the resin replacement criteria, and to a lesser extent, dental beveling. Microleakage causes bacteria, saliva and other oral cavity materials to be introduced into the interior of the tooth, producing post-operative sensitivity. In the case of class II cavities, this problem is usually located in the interproximal areas of posterior teeth, more specifically between premolars and molars, although some authors have proposed that the most microleakage restoration is located in the cervical area of the tooth, since it is a site that is difficult to access and there is even the possibility that the material we use is not suitable for restoring or isolating the tooth due to its proximity to the gingival margin, In these cases the literature shows us that a technique of increments is the best technique to use, in this case we can use wedges, use an ionomer base and start the restoration with fluid resin up to where we can make the restoration either with composite resin or with bulk-fill resin, this last one being the most used but in single block restorations. It has been demonstrated that bulk-fill resin reduces polymerization stress above conventional resin with a gradient of 10% difference, although in the studies reviewed there are no significant differences in the degree of marginal filtration and polymerization shrinkage in class II cavities restored with bulk-fill resin and conventional resin. Therefore, and in order to try to reduce this type of problem in this type of cavity, we should choose the best protocol to carry out a restoration that has the equivalent of 8 years of prevalence in the dental cavity, but not an interval of 2 years or less that is usually assumed to last the restoration, thanks to the ravages of microfiltration.

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