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An integrative review on adhesive for the restoration of non-carious cervical lesions.

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Dissertação conducente ao **Grau de Mestre em Medicina Dentária (Ciclo Integrado)**

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Trabalho realizado sob a Orientação de
Prof. Doutora Lígia Lopes da Rocha

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Resumo

Introdução: O uso de sistemas adesivos é fundamental para o tratamento de lesões cervicais não cariosas. Atualmente, estão disponíveis diversos tipos de adesivos que podem ser aplicados de diferentes formas: condicionamento total, autocondicionante e condicionamento seletivo ao esmalte.

Objetivo: Verificar se existem diferenças significativas de eficiência entre as três formas de aplicação no tratamento de lesões cervicais não cariosas.

Material e Métodos: Revisão integrativa realizada com base numa pesquisa na base de dados PubMed. Foram utilizadas palavras-chave para encontrar os artigos relacionados ao tema e critérios de inclusão e de exclusão para escolher os artigos úteis para o presente estudo.

Resultados: Os resultados demonstram que pode haver diferenças significativas na eficiência de cada estratégia a depender do adesivo com a qual é utilizada. De modo geral, a maior parte dos sistemas foi considerada aceitável. Por outro lado, fatores como descoloração e microinfiltração apresentaram limitações conforme a combinação de método e sistema adesivo.

Conclusão: Alguns estudos analisados não demonstraram diferenças significativas, entretanto, ao avaliar todos os trabalhos referenciados, a efetividade de sistemas adesivos para tratamento de lesões cervicais não cariosas aparenta depender do conjunto entre modelo de adesivo e método de aplicação utilizado. Sendo assim, o papel do dentista é fundamental para fazer uma avaliação baseada em evidências e adequada para o caso em questão.

Palavras-chave: Adesivos dentários; Lesões cervicais não cariosas; Erosão; Restauração.

Abstract

Introduction: Adhesive systems are essential for treating non-carious cervical lesions. Currently, several models of adhesives are available that can be applied in three strategies: total-etch, self-etching, and selective etching.

Objective: To verify whether there are significant differences in efficiency between the three application strategies in treating non-carious lesions.

Material and Methods: Integrative review based on research in the PubMed database. Keywords to found articles related to the topic and inclusion and exclusion criteria were used to choose useful articles for the present study.

Results: The results demonstrate that there can be significant differences in the efficiency of each strategy depending on the adhesive with which it is used. In general, most systems were considered clinically acceptable. On the other hand, factors such as discoloration and adaptation showed changes according to the combination of method and adhesive.

Conclusion: Some analyzed studies did not show significant differences. However, when evaluating all the referenced works, the effectiveness of adhesive systems for treating non-carious lesions depends on the combination of the adhesive model and application method used. Therefore, the dentist's role is fundamental in making an evidence-based assessment appropriate for the case.

Keywords: Dental adhesives; Non-carious lesions; Erosion; Restoration.

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LIST INDEX OF ACRONYMS AND ABBREVIATIONS

NCCL: Non-cariou cervical lesions

MDP: Monomer methacryloyloxydecyl dihydrogen phosphate

PB: Prime & bond

GI: Glass ionomer

GSL: Gluma universal-selective-etching

1. Introduction

Adhesive systems are critical in treating non-carious cervical lesions often caused by tooth wear, erosion, and abrasion(1). These lesions can lead to functional, aesthetic, and sensitivity problems that significantly affect the patient's quality of life(2). When dental lesions occur near the gingival margin, they are called Non-Carious Cervical Lesions (NCCLs)(3). These lesions can be caused by aggressive tooth brushing, a hard bristle, or abrasive toothpaste but also can be caused by bruxism and maladaptive occlusion, so it's a multifactorial lesion. (3).

Adhesive systems provide a strong bond between the tooth surface and the restorative material, which is crucial for the longevity of the restoration and the prevention of micro-leaks (4).

The three main adhesive systems for restoring NCCLs are self-etch, selective-etch to enamel, and total-etch (etch-and-rinse) systems(5). Self-etch systems are becoming increasingly popular in clinical practice because they simplify the bonding process and reduce the risk of postoperative sensitization(6). They contain acidic and hydrophilic monomers that adhere to the tooth surface without needing a separate acid etching step(6).

On the other hand, total-etch systems require an additional acid etch step to prepare the tooth surface for bonding(7). Phosphoric acid creates microporosities in the enamel and dentin(7). After acid etching, a primer and adhesive are applied, and the composite follows(7). Total-etch systems are still widely used in clinical practice and provide excellent bond strength but are more technically demanding and require additional time and steps(7).

The selective-etch system places phosphoric acid only on the enamel surfaces and can preserve the effects of the adhesive on the dentin(3). However, it is a relatively new technique, and there is no conclusive evidence that the impact of selective-etch is better than total-etch or self-etch(3). Still, some studies(8) find this strategy to have a superior aesthetic outcome(8).

The filler content of the resin composite material is another critical factor to consider when selecting an adhesive system to restore NCCLs (4). Composite materials with a higher filler content have better mechanical properties and higher abrasion resistance,

essential for restorations of NCCLs located on the occlusal surface of the tooth and are subject to heavy wear and tear(9).

In addition to the filler content, the color of the resin composite is also an important aspect of aesthetic restorations(9). Resin composites are available in various shades to match the natural tooth color of the tooth and can be layered to create a seamless and natural-looking restoration(10). The right choice of composite color is crucial for a restoration that blends seamlessly with the surrounding tooth structure(10).

Proper use of adhesive systems is critical to the success of restorations in NCCLs (10). This includes good isolation of the tooth to prevent contamination of the bonding surface and adequate curing of the composite to ensure a strong bond(11). For optimal results, the practitioner must carefully follow the manufacturer's instructions and keep up to date on current techniques and materials(11).

Adhesive systems offer excellent bond strength, improved mechanical properties, and aesthetic results that meet the needs of dentists and patients alike(11). However, one potential limitation of adhesive systems is their susceptibility to degradation over time(12). Degradation can occur due to various factors, including water absorption, hydrolysis, and enzymatic degradation(12). Therefore the dentist must carefully monitor the condition of the restoration over time and be prepared to replace it when necessary to prevent further damage or caries(12).

2. Objectives and Hypothesis

To evaluate the clinical effectiveness of self-etch, selective-etch, and total-etch adhesive systems for restoring NCCLs based on integrative review.

Hypothesis: There is no significant difference between the efficiency of different resin adhesives.

3. Material and Methods

Searches were carried out in the PubMed database using the following terms, which were combined: "non-carious lesions", "adhesives", "self-etch", "selective-etch", "total-etch", and "etch-and-rinse". The research was made from February/2023 to March/2023, and the eligibility criteria for the articles were:

- Articles in English, published from 2013 to 2023 (last ten years);
- Methodology: Clinical trial or *in vitro* using human teeth;
- Article subject: dental adhesives for non-carious lesions treatment.

The following flowchart was elaborated to illustrate the research:

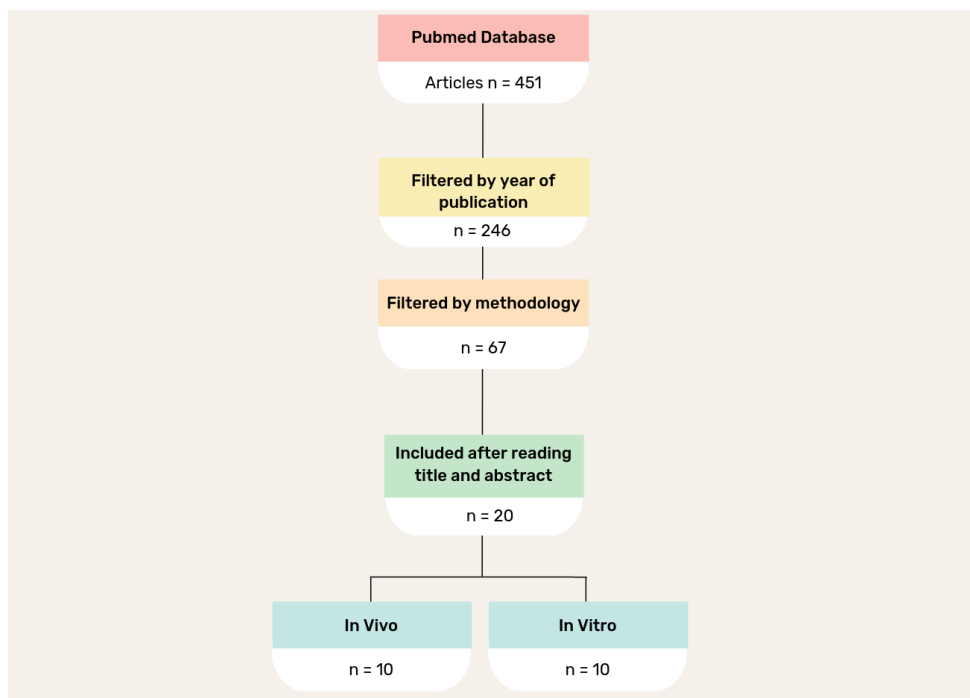


Figure 1: Research flowchart

4. Results

Table 1: *In vivo* results

<i>Title</i>	<i>Authors and year of publication</i>	<i>Materials and methods</i>	<i>Adhesives</i>	<i>Bonding Methods</i>	<i>Results</i>	<i>Conclusion</i>
Bonding Performance of Simplified Adhesive Systems in Noncarious Cervical Lesions at 2-year Follow-up: A Double-blind Randomized Clinical Trial(13)	ZANATTA RF et al. (2019).	Randomized double-blind clinical trial. The research started with 34 participants, and 29 returned after two years.	Scotchbond Universal Adhesive Adper Single Bond 2 Clearfil SE Bond	Self-Etch Etch-and-Rinse	No significant differentiation was found between the systems.	The adhesive systems presented a similar performance in treating non-carious lesions. Both had minimal dental sclerosis after two years.
Clinical behavior of universal adhesives in non-carious cervical lesions: A randomized clinical trial(14)	FOLLAK AC et al. (2021).	Randomized double-blind clinical trial. 54 participants were allocated to four different groups. Both adhesives were analyzed in etch-and-rinse and self-etch.	Scotchbond Universal Adhesive Prime & Bond Elect	Self-Etch Etch-and-Rinse	After six months, a significant difference was encountered only in the PB self-etch group, which showed more failure cases.	The bonding strategy should be appropriate for the adhesive being used. The clinical performance of the PB adhesive was affected by the self-etch procedure.
Clinical evaluation of a universal adhesive in non-carious cervical lesions(15)	ROUSE MA et al. (2020).	A controlled clinical trial with 33 participants. Evaluation through 24 months using Cochran-Mantel-Haenszel tests.	Adhese Universal	Self-Etch Selective-Etch	No significant differentiation was found between self-etch and selective-etch for sensitivity, retention, marginal adaptation, or clinical acceptability.	Both groups presented reduced sensitivity. Selective-etch had worse marginal adaptation, and self-etch had worse marginal discoloration. All groups had acceptable results.

<i>Title</i>	<i>Authors and year of publication</i>	<i>Materials and methods</i>	<i>Adhesives</i>	<i>Bonding Methods</i>	<i>Results</i>	<i>Conclusion</i>
Five-year clinical evaluation of a universal adhesive: A randomized double-blind trial(16)	MATOS et al. (2020).	39 patients were monitored five years after five years.	Scotchbond Universal Adhesive	Self-Etch Etch-and-Rinse Selective-Etch	Etch-and-rinse had better results in marginal discoloration and adaptation.	After 5 years, the etch-and-rinse method presented better results.
Flowable composites for restoration of non-cariou cervical lesions: Results after five years(17)	CIEPLIK et al. (2017).	50 patients received restoration using two flowable composites. They were evaluated after 5 years.	Clearfil Protect Bond	Self-Etch	The majority of patients showed clinically acceptable results after five years.	The flowable composites did not significantly interfere with the performance of the adhesive.
Randomized clinical trial of four adhesion strategies in cervical lesions: 12-month results(18)	DE PAULA et al. (2015).	35 patients with at least 4 NCCLs were evaluated at baseline, 6 months, and 1 year after the restoration.	Optibond FL Optibond Solo Plus Optibond XR Optibond All-in-one	Self-Etch Etch-and-Rinse	Five restorations were lost, and there were minor discrepancies regarding marginal adaptation.	There was similar retention between the strategies.
Thirteen-year randomized controlled clinical trial of a two-step self-etch adhesive in non-cariou cervical lesions(19)	PEUMANS et al. (2015).	100 non-cariou cervical lesions on 29 patients were restored by adhesive and monitored for 13 years.	Clearfil SE Bond	Self-Etch Selective-Etch	There was no significant difference between the bonding methods. After 13 years, the adhesive presented acceptable results.	Clearfil SE Bond presented good results in both strategies. The selective etching had better results but without statistical significance.
Three-year evaluation of different adhesion strategies in non-cariou cervical lesion restorations: a randomized clinical trial	GONÇALVES DFM et al. (2021). (20)	Three year follow up of 42 patients with non-cariou cervical lesions were treated by different methods.	Single Bond Universal	Selective-Etch	Compared to previous results, selective etching affected the retention of Single Bond Universal Adhesive.	The lesion degree and selective etch influenced the retention of the adhesive.



<i>Title</i>	<i>Authors and year of publication</i>	<i>Materials and methods</i>	<i>Adhesives</i>	<i>Bonding Methods</i>	<i>Results</i>	<i>Conclusion</i>
Twenty-four-month clinical performance of different universal adhesives in etch-and-rinse, selective etching, and self-etch application modes in NCCL – a randomized controlled clinical trial(21)	OZ FD et al. (2019).	A randomized controlled clinical trial with 20 participants. They were evaluated at baseline, 6, 12, and 24 months after the procedure.	All-Bond Universal GLUMA Universal	Self-Etch Etch-and-Rinse Selective-Etch	After 24 months, there was no significant difference except for GLUMA and All-Bond retention rates when used in the self-etch application.	The results showed that GLUMA Universal and All-Bond Universal adhesives used in the self-etch mode were less retainable after 6, 12, and 24 months but had acceptable clinical outcomes when used in etch-and-rinse and selective-etch. The universal adhesives and Single Bond2 used in etch-and-rinse had minor marginal adaptation and discoloration differences after 2 years.
Two-year clinical trial of a universal adhesive in total-etch and self-etch mode in non-carious cervical lesions(22)	LAWSON et al. (2015).	37 patients with NCCLs were evaluated at baseline, 6, 12, and 24 months after.	Scotchbond Universal Adhesive Scotchbond Multi-purpose	Self-Etch Etch-and-Rinse	There was no significant difference between retention rates. However, Scotchbond Universal performed better at both strategies after 24 months.	Scotchbond Universal had equal or better results than Multi-Purpose, especially when used in etch-and-rinse.

Table 2: *In vitro* results

<i>Title</i>	<i>Authors and year of publication</i>	<i>Objective</i>	<i>Materials and methods</i>	<i>Adhesives</i>	<i>Bonding Methods</i>	<i>Results</i>	<i>Conclusion</i>
Comparative Evaluation of Microleakage Around Class V Cavities Restored with Alkaside Restorative Material with and without Bonding Agent and Flowable Composite Resin: An <i>In Vitro</i> Study(23)	MESHARAM et al. (2019).	To assess the degree of microleakage at the interface of enamel and dentin restorations in Class V cavities.	Fifteen permanent molars that were recently extracted were chosen for the study. Teeth had no evidence of caries, restorations, or cracks and absence of white spots on the buccal and lingual surfaces.	Cention-N without adhesive Single Bond Universal Tetric-N-Flow	Single Bond and Tetric-N-Flow were applied and cured by light. Cention-N is Self-Etch, and the light was not necessary.	The microleakage values were higher at the dentin restoration junction than at the enamel restoration interface for all groups. However, the difference was not statistically significant.	Although the difference was not statistically significant, the microleakage observed at the enamel restoration was lower. Among the materials, Cention-N with adhesive demonstrated the least amount of leakage.
Comparative Evaluation of Microleakage of Flowable Composite Resin Using Etch and Rinse, Self-Etch Adhesive Systems, and Self-Adhesive Flowable Composite Resin in Class V Cavities: Confocal Laser Microscopic Study(24)	SENGAR et al. (2022).	To investigate microleakage in self-etch, selective-etch, and etch-and-rinse systems.	27 caries-free extracted teeth with V cavities. The evaluation was made using a microscope after 48 hours of dye.	G-aenial Universal Flo Single Bond G-aenial Universal Flo G-Bond Constic	Self-Etch Etch-and-Rinse	The study found a significant increase in microleaking when using the self-etch method comparing to etch-and-rinse.	All adhesive systems presented micro-leaking. However, etch-and-rinse had better results.
Comparison of Microleakage of Class V Restoration with Self-etch and Selective-etch Adhesive Systems: An <i>In Vitro</i> Study(25)	YALNIZ AM et al. (2019).	To measure the microleakage in both self-etch and selective-etch strategies.	48 caries-free and restoration teeth were used with standard class V cavities. A group for each technique was stored for 24 hours.	Clearfil S3 Bond Plus L-pop	Self-Etch Selective-Etch	The results show no significant difference between the methods.	Both self-etch and selective-etch demonstrated acceptable results.

<i>Title</i>	<i>Authors and year of publication</i>	<i>Objective</i>	<i>Materials and methods</i>	<i>Adhesives</i>	<i>Bonding Methods</i>	<i>Results</i>	<i>Conclusion</i>
Dentin Permeability and Nanoleakage of Universal Adhesives in Etch-and-rinse vs Self-etch Modes(26)	CRUZ et al. (2021).	To evaluate the loss of dentin permeability and nano leakage by comparing self-etch and etch-and-rinse.	80 extracted non-carious molars were selected to measure dentin before and after the adhesive application.	Scotchbond Universal Adhesive Optibond XTR Clearfil Universal Bond Adhese Universal	Self-Etch Etch-and-Rinse	The OptiBond XTR and Adhese Universal presented a higher reduction of the dentin when used with etch-and-rinse mode. Scotchbond Universal and Clearfil Universal Bond Quick showed no difference between the modes. All cases had some degree of nano leakage.	Scotchbond and Clearfil had the same performance at every strategy, while XTR and Adhese performed better when applied with self-etch. All systems presented nano leakage.
Effect of Cavity Disinfection with Chlorhexidine on Marginal Gap of Class V Composite Restorations Bonded with a Universal Adhesive Using Self-Etch and Etch-and-Rinse Bonding Strategy(27)	KIMYAI et al. (2020).	The study assessed the impact of chlorhexidine cavity disinfection on the marginal gaps of Class V restorations bonded with a universal adhesive, using both self-etch and etch-and-rinse bonding techniques	Placing the occlusal and gingival margins of cavities in 60 teeth was assessed. Self-etch and etch-and-rinse techniques were employed in both enamel and dentin. The impact of cavity disinfection was analyzed.	All-Bond Universal	Self-Etch Etch-and-Rinse	Cavity disinfection and bonding strategy significantly impacted the mean marginal gap size. Nevertheless, their interaction effect on the mean marginal gap size was not significant.	Chlorhexidine resulted in larger marginal gaps of class V restorations.



<i>Title</i>	<i>Authors and year of publication</i>	<i>Objective</i>	<i>Materials and methods</i>	<i>Adhesives</i>	<i>Bonding Methods</i>	<i>Results</i>	<i>Conclusion</i>
Evaluation of Microleakage with Total Etch, Self Etch and Universal Adhesive Systems in Class V Restorations: An In vitro study (28)	GUPTA et al. (2017).	The study aimed to compare microleakage in Class V composite resin restorations. The dye penetration method achieved this by applying etch-and-rinse, self-etch, and universal bonding agents.	The study used 120 recently extracted premolars with orthodontic treatment to prepare Class V cavities on their facial surface. The teeth were subjected to a dye leakage test.	Adper Single Bond Adper SE Plus Adper Single One	Self-Etch Etch-and-Rinse	This study found that microleakage was more significant at the gingival margin than the occlusal margin, with a statistically significant difference. Only Adper Easy One and Adper SE Plus showed a statistically significant difference at the occlusal margin, while no significant difference was found at the gingival margin.	Self-etch agents had lower microleakage than total etches and universal adhesive at the occlusal margin, with a higher degree of microleakage observed at the gingival margin than at the occlusal margin.
In vitro longevity of bonding properties of universal adhesives to dentin(29)	MUÑOZ et al. (2015).	To assess the immediate and 6-month bond strength to resin-dentin and the nano leakage, of universal adhesives applied using the etch-and-rinse and self-etch techniques.	40 caries-free extracted molars were tested immediately or after 6 months to check the bonding properties of universal adhesives.	Clearfil SE Bond (control) Adper Single Bond 2 (control) Peak Universal Scotchbond Universal Adhesive All-Bond Universal	Self-Etch Etch-and-Rinse	Peak Universal performed similarly to the control adhesives regarding initial bond strength but exhibited higher nano leakage and reduced strength over time. Scotchbond initially had moderate bond strength, which stabilized over time. All Bond Universal was the only adhesive that demonstrated variation based on the bonding technique used.	After 6 months of water storage, it was observed that universal adhesives containing MDP exhibited stronger and more durable resin-dentin bonding strength, along with reduced nano leakage at the interfaces.



<i>Title</i>	<i>Authors and year of publication</i>	<i>Objective</i>	<i>Materials and methods</i>	<i>Adhesives</i>	<i>Bonding Methods</i>	<i>Results</i>	<i>Conclusion</i>
Influence of a hydrophobic resin coating on the immediate and 6-month dentin bonding of three universal adhesives.(30)	SEZINANDO et al. (2015).	To evaluate the impact of a hydrophobic resin coating on the bond strengths and nano leakage of three universal adhesives when applied in self-etch or etch-and-rinse mode.	60 caries-free extracted molars were tested immediately after the application and after 6 months to evaluate the resin coating performance.	Scotchbond Universal Adhesive All-Bond Universal G-Bond Plus	Self-Etch Etch-and-Rinse	The hydrophobic resin coating increased dentin bonding strength in all adhesives.	Using a hydrophobic resin coating enhanced the performance of all three adhesive systems in Self-Etch mode at both 24 hours and 6 months.
Marginal Adaptation of Class V Restorations with a New Universal Adhesive(31)	KARAMAN, GÜMER. (2016).	This study assessed the microleakage of a new universal adhesive, in both self-etch and etch-and-rinse modes, compared to conventional adhesive systems.	50 premolar teeth were used to create Class V lesions on their buccal and lingual surfaces and divided into groups to compare the performance of the adhesives.	Clearfil SE (control) Adper Single Bond 2 Single Bond Universal Xeno V	Self-Etch Etch-and-Rinse	Xeno V demonstrated the highest microleakage scores on both enamel and dentin. Single Bond Universal exhibited comparable leakage levels to the control group (Clearfil SE).	The Xeno V adhesive could be an alternative to traditional adhesives, but more studies are needed.
Microshear Bond Strength of Scotchbond Universal Adhesive to Primary and Permanent Dentin: A Six-Month <i>in Vitro</i> Study(32)	GHAJARI et al. (2019).	To evaluate the bonding strength of a universal adhesive comparing self-etch and etch-and-rinse.	20 primary molars and 20 permanent molars, all carie-free, were divided into groups. The study evaluates 24-hour and 6-monthly results using both strategies.	Scotchbond Universal Adhesive	Self-Etch Etch-and-Rinse	The Scotchbond adhesive presented higher durability when applied by self-etch. Permanent teeth obtained better results in strength and durability.	Overall, the self-etch method had better results with Scotchbond. Bond durability decreased in all cases, and primary teeth had worse bonding.

Table 3: Resume of *in vivo* results.

<i>In vivo</i>	Studies	Significant differences in efficiency	NO significant differences in efficiency
Self-etch x Etch-and-rise	4	1	3
Self-etch x Selective-etch	2	0	2
Self-etch x Selective-etch x Etch-and-rise	2	2	0
Self-etch	1	0	1
Selective-etch	1	0	1

Table 4: Resume of *in vitro* results.

<i>In vitro</i>	Studies	Significant differences in efficiency	No significant differences in efficiency
Self-etch	1	0	1
Self-etch x Etch-and-rise	8	5	3
Self-etch x Selective-etch	1	0	1

5. Discussion

The results obtained in the present review did not correspond to the original hypothesis. However, based on the information obtained, the application strategy used to place the dental adhesives may affect the results regarding durability, aesthetics, microleakage, discoloration, and adaptability.

These characteristics were related to the combination of adhesive type and application strategy. For example, while some adhesives performed better with the self-etch technique (Scotchbond Universal adhesive)(22,29,32), others performed better with the total-etch approach (Prime & Bond)(16,24) and some with the GSL (Gluma universal-selective-etching) technique(21).

It is worth noting that some studies showed divergent results using the same types of adhesives, which can be attributed to methodological flaws or external problems (application, patients, etc.).

Both *in vivo* (14)(16)(18)(22) and *in vitro* (25) studies had an overall better performance evaluation of etch-and-rinse and selective etch strategies but mostly did not present statistically significant results. Besides, adhesives perform better when used in self-etch mode(23)(26). It is important to note that other factors, such as chlorhexidine(32) and monomer methacryloyloxydecyl dihydrogen phosphate (MDP)(28) composition, can interfere with the durability and microleakage of dental adhesives.

In addition, it is important to consider the patient's clinical context before choosing a particular adhesive and application technique. For example, patients at high risk of caries may benefit from using an adhesive with antimicrobial properties, such as chlorhexidine(32). On the other hand, patients with a history of allergic reactions to specific components of dental adhesives may need alternative products.

The adhesive's bond strength to both enamel and dentin is another significant factor in application(27). Enamel bonding is usually more accessible because the etching process creates a micromechanical bond. However, bonding to dentin can be more challenging, as the adhesive must create a hybrid layer that can withstand the stress of chewing.

Some newer adhesive systems have been developed to simplify the bonding process and improve the longevity of restorations. For instance, "universal" adhesives, such as Scotchbond, are designed to work with any substrate and can be applied using various

techniques. In addition, these adhesives typically contain a combination of etching agents, primers, and bonding agents in one bottle, simplifying the bonding process and reducing the risk of errors.

In addition to the adhesive itself, the curing process can significantly impact the performance of restorations. Proper light curing is critical to ensure complete adhesive polymerization, which can affect the bond's strength and durability. In addition, factors such as light intensity, exposure time, and distance from the tooth surface can influence the curing process.

Dentists must stay informed of the latest advancements and techniques as the dental industry evolves. By staying up to date with the latest research and continuing to refine their skills and knowledge, dentists can provide their patients with the highest quality care and ensure restorative treatments' long-term success.

Finally, it is important to consider the long-term effects of dental adhesives on tooth structure and surrounding tissues. For example, some research (15)(16)(20)(21)(23)(27)(29)(31) suggest that certain adhesives may contribute to the degradation of dentin and enamel over time, leading to discoloration, microleakage, and other problems.

While many studies have focused on short-term outcomes, such as bond strength and microleakage, the long-term durability and stability of the restoration are relevant and should also be monitored over time. In addition, factors such as the patient's oral hygiene habits and other dental conditions, such as periodontal disease or bruxism, can affect the long-term performance of dental restorations.

A glass ionomer is also a possibility for restoration for NCCLs. A glass-ionomer (GI) is composed of an ion-leachable glass powder and a polyacid liquid, when mixed, form a solid mass upon setting. Although resin-modified GIs have better adhesion to tooth structure than most composite resins(3). However, poor esthetic longevity and low wear resistance against abrasion have limited the use for restoring NCCLs.

In summary, dental adhesives are a crucial aspect of modern restorative dentistry. The choice of adhesive and application technique can significantly impact the restoration's durability, aesthetics, and overall success. Factors such as the patient's oral health, allergies, and long-term stability should be considered when choosing an adhesive and monitoring the performance of restorations over time.(3)

6. Conclusion

The effectiveness of adhesives depends on the strategy with which it is applied. In general, etch-and-rinse presented better bonding strength, although the difference is not always statistically significant. There is a need for more comparative studies using the same adhesive model with different techniques.

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