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THE ROLE OF Epigallocathecin-3-gallate AS AN ANTIOXIDANT AFTER DENTAL BLEACHING ON SHEAR BOND STRENGTH OF COMPOSITE RESIN RESTORATION

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Abstract

***Background**: Tooth discoloration can be treated with dental bleaching using Hydrogen peroxide (H_2O_2). Dental bleaching may interfere with the shear bond strength of composite resins because the remaining free radicals can affect bonding polymerization. Epigallocatcehin gallate (EGCG) as an antioxidant can neutralize the free radicals produced during bleaching process. **Objective**: Analyze the role of EGCG antioxidants in increasing the shear bond strength of composite resin after bleaching. **Methods**: Literature references used in the paper was from across various databases with descriptions of bleaching, natural antioxidants EGCG, clinical intervention in dentistry that is composite resin restorations, and results of shear bond strength test. **Review**: Of the seven journals included in this literature review, six journals reported significant difference, and one journal noted no significant difference in the shear bond strength of composite resin following the EGCG application. **Conclusion**: The use of EGCG can increase the shear bond strength value of post-bleaching composite resin restorations.*

***Keywords**: Epigallocathecin gallate, Dental Bleaching, Composite Resins, Shear Bond Strength, and Antioxidants.*

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Introduction

Tooth discoloration problems as well as the aesthetic demand for a whiter smile from patients can be treated with a procedure in dentistry called dental bleaching. The bleaching agent that is often used in the market is Hydrogen peroxide (H_2O_2). The mechanism of tooth whitening by H_2O_2 in is by the production reactive free radicals which will oxidize organic compounds from chromophores in cases of teeth with discoloration (Pandey *et al*., 2018).

Tooth whitening reaction with H_2O_2 will leave residual free radicals, Perihidroxyl (HO_2) which is a strong free radical and Onasen (O-) which is a weak free radical. In some cases, after the bleaching process, composite resin restoration is required, the residual free radicals will disrupt the polymerization of composite resin (Nofika *et al*., 2018). The remaining free radicals from the bleaching material will prevent the infiltration of the bonding material into the tooth structure so that after bleaching, the shear bond strength of the restoration will have a low value (Nari-Ratih and Widyastuti, 2019).

The solution that is often used in this problem is to delay composite resin restoration for 7-14 days after bleaching. One alternative procedure that can be done to reduce the time interval between the bleaching procedure and composite resin is the application of antioxidants. Antioxidants that are often used in neutralizing free radicals are ascorbic acid (vitamin C) and tocopherol (vitamin E), but these two vitamins have some disadvantages. Vitamin C has a pH of

1.8 (very acidic) so it can reduce enamel hardness, cause the accumulation of *Streptococcus mutans* bacteria on the enamel, and a short duration of action (Rana *et al*., 2019). Vitamin E is insoluble in water (Dhingra *et al*., 2017). Green tea Epigallocathecin gallate (EGCG) extract is a natural antioxidant that can be used as an alternative substance of choice, this is because the advantages of EGCG as a natural ingredient were that the side effects are minimal, long working duration, and a relatively low cost (Al Hassani, 2018). According to a University of Kansas study, EGCG has antioxidant properties 100 times more effective than vitamin C and 25 times more effective than vitamin E. The purpose of this literature review is to analyze the role of EGCG antioxidants in increasing the shear bond strength of post-bleaching composite resin restoration.

Review

1. Dental Bleaching

Tooth whitening or more popularly known as bleaching is the act of chemically whitening teeth using a strong oxidizing agent, namely hydrogen peroxide. In dentistry, there are two ways to do bleaching, external bleaching which is performed on vital teeth and internal bleaching on non-vital teeth. The indication of external bleaching is discoloration that occurs due to extrinsic factors, while the contraindications for external bleaching are severe black discoloration, close to the pulp horn, hypersensitive teeth, caries and severe enamel loss (Carey, 2014). The indication of internal bleaching is discoloration caused by intrinsic factors such as trauma that causes intrapulpal bleeding. Contraindications to this procedure are imperfect root treatment, untreated caries or abrasion, and loss the coronal part of the tooth (Rokaya et al.,2015). Hydrogen peroxide as a whitening agent can be applied by dentists in clinical practice (office whitening) with a concentration of 30-35% or by patients themselves at home under a doctor's supervision (house whitening) with a concentration of 10-15% (de Menezes *et al*., 2018). In dentistry, the most commonly used tooth whitening agent is 5-35% H_2O_2 because H_2O_2 penetrates faster than carbamide peroxide and sodium Perborate. Dental bleaching agents can be found in the form of toothpaste, gel, strips, soap, mouthguard, and trays (Pandey *et al*., 2018).

The mechanism of tooth whitening consists of three stages, the first stage is the infiltration of the whitening agent in to the tooth structure, the interaction between the whitening agent and chromogen, and last one is the change of color in tooth surface. After the H_2O_2 penetrates into the dentin, there will be a reaction between H_2O_2 and the chromogen that occur in the tooth structure. When H_2O_2 comes into contact with the tooth surface, an oxidation process will occur which is part of the redox reaction (Kwon & Wertz, 2015). H_2O_2 undergoes decomposition into hydrogen cations (H^+) and perihdroxyl anions (HO_2^-). Perihidroxyl anion (HO_2^-) will take other peroxide molecules to form hydroxyl free radicals (OH), perihidroxyl (HO_2), and onasen (O^-). Free radicals formed from the H_2O_2 redox reaction will release unpaired electrons which will bind to the chromogen molecule then breaks the chromogen bond, which was a complex bond to a simpler one so that a change to lighter color will occur (Young *et al*., 2012).

2. Antioxidant EGCG

Antioxidants are stable molecules that can donate electrons to reactive free radicals therefore they can inhibit the oxidation process by forming relatively stable unreactive free radicals. Due to this mechanism, antioxidants can protect cells from the damaging effects of reactive oxygen free radicals (Yadav et al.,2016). Antioxidants can come from within the body or are called endogenous and can be sourced from outside of the body, called exogenous antioxidants (Atta et al., 2017). In the advancement of technological developments, there are

many natural ingredients that have antioxidant properties to reduce free radicals. One natural ingredient which has had a lot of research on its antioxidant abilities is *Epigallocathecin gallate* (EGCG) from green tea extract. Green tea has many bioactive components, one of them which has the most benefits is flavonoids. Green tea phenolic compounds with the highest concentrations are gallic acid (GA), gallocatechin (GC), catechin (C), epicatechin (EC), epigallocatechin (EGC), epicatechin gallate (ECG), epigallocatechin gallate (EGCG), and gallocatechin-3- gallate (GCG), with the highest composition of EGCG by weight (Jinting He et al, 2018). EGCG has antioxidant, anti-inflammatory, anti-carcinogenic, and antimicrobial properties. The antioxidant effect of these catechins is based on the chemical structure, the combination of aromatic rings and hydroxyl groups that compose them so that they can bind and neutralize free radicals (Ozelin et al, 2014).

In a study by Lan-Sook *et al.,* (2014) regarding the quantitative analysis of catechin components in green tea using the DPPH, FRAP, and ABTS methods, EGCG was shown to have the highest results. Directly, the antioxidant effect of EGCG is by transfer of hydrogen atoms or single electrons which involve the hydroxyl group that belongs to EGCG (Khamverdi and Azarsina, 2019). EGCG compounds also have the ability to chelate metal ions and inhibit the production of Reactive Oxygen Species (ROS) by inhibiting xanthine oxidase enzymes (Legeay et al.,2015).

3. Shear Bond Strength Composite Resin Restoration

In dentistry, adhesive restorations have often been used on anterior and posterior teeth and have led to a change in the concept of the GV Black cavity preparation practice to be minimally invasive and preserve the remaining tooth structure properly. Composite resin restorations have an attachment to the tooth called bond strength, the adhesion mechanism with the bonding system to dentin is by forming a hybrid layer which is the bond between resin and dentin (Kumar & Jayalakshmi, 2016).

A parameter that is often used in laboratories to measure the adhesion of restorative materials to tooth structures is the shear bond strength test. Shear bond strength is the maximum resistance of a material to withstand loads that cause shear motion on the material before being released. The binding strength of a fixing material to the hard tooth tissue can be done by pushing the material against the tooth surface, the value of the shear bond strength obtained will provide an illustration of how the material adheres to the hard tissue of the tooth (Faltermeier *et al.,* 2011).

The measurement procedure uses the Universal Testing Machine (Zwick, USA). The subject is placed on the table and fixed so that it cannot move. Previously, on the table was already a load of 50 Kgf which would move down to shift the teeth that had been restored by composite resin with a crosshead speed of 0.50 mm/ minute, the monitor screen is connected to the Universal Testing Machine which would show a number indicating the shear force used in shifting the composite resin until it is released from the dentin surface, then the amount of F is recorded on the machine screen to calculate the shear bond strength value (Lijaya *et al.,* 2013).

Method

The method used in this article is literature study. The library sources used in the writing of this article are the PubMed, Google Scholar, Science Direct, and Open Access databases. Search for articles was by the following keywords: Epigallocathecin gallate, Dental Bleaching, Composite resins, Shear bond strength, and Antioxidants. The search process restriction is not only related to the theme, but also the year the article was published. The publication year of the articles used was from 2013 to 2020. The literature study used includes the results of in vitro

research to describe the theory and link it into a framework that aims to identify gaps between studies so that a common conclusion can be drawn.

Result

Author	Article Title	Concentration	Shear Bond Strength Result (MPa)			Conclusion	Source Of Journal
		EGCG	No *bleaching*	*Bleaching*	*Bleaching* + EGCG		
Khamverdi *et al*, 2016	In-Vitro Evaluation of the Effect of Herbal Antioxidants on *Shear bond strength* of Composite Resin to Bleached Enamel	1000 μmol	22.61±3.29	5.78±1.80	20.07±1.45	EGCG used in this study equally reversed the reduced bond strength of composite to bleached enamel.	PubMed
Nari Ratih & Widyastuti, 2016	Effect of antioxidants on the *shear bond strength* of composite resin to enamel following extra-coronal *bleaching*	10%	19.43	9.50	15.55	Application of EGCG increases the bond strength of composite resin to the bleached enamel	PubMed
Sharafeddin *et al*, 2016	Effect of Green Tea Extract as Antioxidant on *Shear bond strength* of Resin Composite to in-Office and Home-Bleached Enamel	5%	-	10.52	16.76	Surface treatment using green tea extract had significant increasing effect on the shear bond strength of resin composite to bleached enamel.	PubMed

Author	Article Title	Concentration	Shear Bond Strength Result (MPa)			Conclusion	Source Of Journal
		EGCG	No *bleaching*	*Bleaching*	*Bleaching* + EGCG		
Dhingra *et al*, 2017	Comparative Evaluation Of Immediate Bond Strength To Bleached Enamel Following Application Of Various Antioxidant Solutions	5%	19.30±1.81	7.83±2.21	13.72±4.16	Green tea extract group have comparable action in reversing the compromised bond strength to bleached enamel.	Google Schoolar
Khamverdi *et al*, 2013	Effect of Epigallocatechin Gallate on shear bond strength of composite resin to bleached enamel	1000 μmol	12.98±3.28	5.18±1.04	12.12±1.22	Application of EGCG increases the bond strength of composite resin to the bleached enamel.	PubMed
Guria & Bharath, 2020	An In Vitro Comparative Study Evaluating The Effect of Two Non-Enzymatic Antioxidants on Shear Bond Strength of Resin Based Composite Restored to Office Bleached Enamel	5%	25.55	12.14	19.72	Treatment of the bleached enamel surface with EGCG reverses the reduced bond strength and may be an alternative to delaying bonding procedure after bleaching.	Open Access
Jain *et al*, 2017	Effect of Herbal Antioxidant Extract on Bonding of Composite Resin to Bleached Enamel	5%	83.8±5.21	56.12±3.4	57.76±4.41	Treating bleached enamel surface with EGCG result in no significance shear bond strength of resin composite.	Google Schoolar

Discussion

In the field of dentistry, there is an aesthetic treatment for discoloration problems called bleaching. Bleaching agent that is often used is H_2O_2 which will cause the oxidation process of organic pigmentation on teeth, resulting in the teeth whitening process. In some cases, a composite resin restoration is required after bleaching (Alqahtani, 2014). After the bleaching process, remaining free radicals from H_2O_2 will be formed which will inhibit the polymerization of the composite resin. Composite resin restorations have an adhesive system called bonding which penetrates into the demineralized tooth structure and enters the dentinal tubules to form a resin tag and a hybrid layer which will affect the micromechanical retention of the fill with composite resin. The polymerization of composite resin consists of three stages: initiation, propagation and termination. The residual free radicals in the tooth structure after bleaching with H_2O_2 can react with free radicals from the bonding material which will interfere with the propagation of vinyl during light-cured causing premature termination of the polymer chain. Polymer chains that undergo early termination will have a decrease in quality so that the strength of the bonding material is reduced. The decreased strength of the bonding material will interfere with the penetration process of the bonding material through the dentin tubules therefore the bond between the resin-dentin (hema-collagen) cannot be formed completely, thus a regular hybrid layer will not be formed well (Nofika *et al.,* 2018). Inadequate polymerization of composite resin causes the adhesive system of the bonding between resin and teeth to become weak which will cause the shear bond strength value of post-bleaching composite restorations to be low (Guria and M.J, 2020).

Khamverdi *et al.,* (2016) evaluated the effect of herbal antioxidants on shear bond strength of composite resin on bleached enamel. Results showed that the average shear bond strength in group control (no bleaching) was 22.61 ± 3.29 MPa while in group 2 (bleaching) was only 5.78 ± 1.80 MPa. In group 3 (bleaching + EGCG) showed significant difference in bond strength which was 20.07 + 1.45 MPa. The results of the study showed the lowest bond strength in group 2. Also, significant differences were observed in bond strength between group 2 and group 3. It can be concluded that tooth bleaching results in a significant reduction in bond strength.

Diatri and Andina (2019) evaluated the effect of antioxidants on the *shear bond strength* of composite resin to enamel following extra-coronal *bleaching* which showed that teeth with composite resin restorations without bleaching have the highest shear bond strength value: 19.43 MPa, while teeth with direct composite resin restorations after bleaching has the lowest shear bond strength value: 9.50 MPa. After applying EGCG to the bleached teeth and immediately restoring the composite resin, the shear bond strength value increased to 15.55 MPa.

Sharafeddin *et al.,* (2016)., assessed the effect of green tea extract as antioxidant on the *shear bond strength* of resin composite to in-office and home-bleached enamel. According to their findings, teeth with post-bleaching composite resin restorations has the lowest shear bond strength value: 10.52 MPa, meanwhile after EGCG was applied to bleached enamel and composite resin restoration was immediately carried out, the value of shear bond strength increased to 16.76 MPa. The authors stated that differences in the type, concentration, and duration of application of antioxidants will result in an increase in the value of different shear bond strength.

Dhingra *et al.,* (2016)., compared the effect of using various antioxidant solutions on shear bond strength of composite resin to bleached enamel. Results showed that in group I as positive control: composite resin restoration without bleaching have the highest shear bond

strength value of 19.30 ± 1.81 MPa, while in group II as negative control: composite resin restoration after bleaching decreased the shear bond strength value significantly to 7.83 ± 2.21 MPa. After applying EGCG to bleached enamel and immediately performing composite resin restoration, the value of the shear bond strength increased to 13.72 ± 4.16 MPa.

Khamverdi *et al.,* (2013)., evaluated the effect of *Epigallocatechin gallate* on the shear bond strength of composite resin to bleached enamel. Result showed in group 1 control (no bleaching) that the average shear bond strength 22.61 ± 3.29 MPa, while for teeth that were bleached and then proceeded with composite restoration, the shear bond strength value decreased by 5.18 ± 3.28 MPa. After applying EGCG with a concentration of 1,000 µmol for 10 minutes on the bleached enamel then immediately performing composite resin restoration, the shear bond strength increased to 12.12 ± 1.22 MPa.

Guriea & Bharath (2020) compared the effect of two non-enzymatic antioxidants on the shear bond strength of resin based composite restoration to office bleached enamel. It was shown that group 1 control (no bleaching) had the highest shear bond strength value of 25.55 MPa, while teeth with direct composite resin restorations after bleaching had the lowest shear bond strength value of 12.14 MPa. After applying EGCG to bleached enamel and performing composite resin restoration, the value of shear bond strength increased to 19.72 MPa.

Jain *et al.,* (2017)., assessed the effect of herbal antioxidant extract on the bonding of composite resin to bleached enamel. It was shown that the group without bleaching had the highest shear bond strength value: 83.8 ± 5.21 MPa, while teeth with direct composite resin restorations after bleaching decreased to 56.12 ± 3.4 MPa. Then, after applying EGCG to bleached enamel and immediately performing composite resin restoration did not show any significant increase in shear bond strength value, the result was only 57.76 ± 4.41 MPa.

After the application of EGCG, the shear bond strength values of the six experiments all showed a significant increase, this was due to the presence of a hydroxyl group (OH) from ring B which is in the chemical structure of EGCG. The direct mechanism of action of EGCG as an antioxidant is by donating a hydrogen atom (H) and transferring a single electron by pairing it with free electrons belonging to free radicals from H_2O_2 (Alagöz *et al.,* 2019). Effective antioxidant compounds are those that have more than one active structure (OH) which have the ability to form *intramolecular hydrogen bonding* (iHB) and H (hydrogen) atoms that are not involved in this bond can be attracted to free radicals which will cause the free radicals to become more stable (Bendary *et al.,* 2013). The reaction of the hydrogen atom donor mechanism is as follows, one H atom from the flavonoid EGCG (Fl-OH) is transferred to perihidroxyl (HO_2) produced by H_2O_2 to form phenoxyl radicals (HOOH + Fl-O) which are more stable than perihidroxyl. In this process, there is also an electron transfer, HO_2 which is a free radical that requires one electron to stabilize itself by binding to the H in the flavonoid hydroxyl group, the flavonoids lose one electron to form oxygen radicals (Chen *et al.,* 2018).

In the six articles above the value of the shear bond strength of composite resin restoration to bleached enamel after application of EGCG have various results. The most effective was in the study by Khamverdi *et al.,* (2016) which showed SBS 20.07 ± 1.45 Mpa, EGCG is used in the form of a 1000 μmol solution which is applied with a microbrush for 10 minutes and re-applied every 1 minute on the tooth surface. Second, Guria & Bharath (2020) with the results of SBS 19.72 MPa, the author used EGCG 5% which was applied using a heated excavator with application method as often as possible for 10 minutes to prevent the solution from drying out. Third, Sharafeddin *et al.,* (2016) with the results of SBS 16.76 MPa, the author used EGCG 5% which was applied for 10 minutes. Fourth, Nari Ratih & Widyastuti (2016) with

the results of SBS 15.55 MPa, the author used 10% EGCG which was applied using a syringe in a size of 0.02 ml and smeared evenly on the enamel using a sponge pellet every 1 minute in the period of 10 minutes. Then, Dhingra *et al*., (2017) with the results of SBS 13.72 ± 4.16 Mpa, the authors used 5% EGCG solution which was applied using a syringe at a speed of 1 ml/ minute for 10 minutes. The last sequence of SBS value was found in Khamverdi *et al*., (2013): 12.12 ± 1.22 MPa, the sample was immersed in a 1000 μmol EGCG solution for 10 minutes. The various concentrations of EGCG: 5%, 10%, and 1000 μmol, have been proven to be successful in increasing the shear bond strength of composite resin after bleaching. The duration of EGCG application from the six journals above used the minimum duration for EGCG to give its antioxidant effect according to the research of Khamverdi *et al*., (2013) which is 10 minutes in accordance with the theory from previous studies.

Jain *et al*., (2017) showed that EGCG did not significantly increase the value of the shear bond strength of composite restorations after bleaching. This may occur due to limitations in the study, differences in concentration, and duration of EGCG application. In addition, an insignificant increase could also occur because the duration of the EGCG application that was used was only 8 minutes. This is supported by the results of research by Khamverdi *et al*., (2013) regarding differences in the concentration and duration of EGCG in increasing the shear bond strength value of teeth after bleaching proceeded with composite resin restorations. According to Khamverdi *et al*., the duration of EGCG application for 10 minutes is the minimum time for this material to provide an antioxidant effect. The most visible difference in shear bond strength numbers is in Jain *et al*., (2017) with a range of values from 50-80 MPa while the other six journals are only in the range of 10-20 MPa, this can occur because the average significance level used in the six the journal above was <P 0.05, while Jain *et al*., (2017) used a significance level of <P 0.01. The difference in the resulting shear bond strength values can also occur because of the universal testing machine protocol for measuring shear bond strength are different in every experiment.

The antioxidant activity of EGCG can reduce the side effects of bleaching by neutralizing the free radicals produced by H_2O_2 so that it can prevent interference with the polymerization of composite resin on teeth so composite resin restoration can be done as soon as possible after bleaching (Souza-Gabriel *et al*., 2020).

References

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4	Khamverdi, Zahra, Loghman Rezaei-Soufi, Shahin Kasraei, Negin Ronasi, and Shiva Rostami. "Effect of Epigallocatechin Gallate on shear bond strength of composite resin to bleached enamel: an in vitro study", Restorative Dentistry & Endodontics, 2013. Publication	1%
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Putignano, Sarah Dabbagh, Georges Haber, Louis Hardan. "The Effect of Different Bleaching Protocols, Used with and without Sodium Ascorbate, on Bond Strength between Composite and Enamel", Materials, 2020

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