INPLASY PROTOCOL

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Support: **None.**

Review Stage at time of this submission: **Data analysis.**

Conflicts of interest:
None declared.

Fatigue and fracture resistance and survival of occlusal veneers of composite resin and ceramics blocks in posterior teeth with occlusal wear: A protocol for a systematic review

Maldonado-Torres, K[1]; Espinoza-Cárdenas, J[2]; Astudillo-Rubio, D[3]; Bravo-Torres, W[4].

Review question / Objective: **The aim of this systematic review is to synthesize the scientific evidence that evaluates fatigue and fracture resistance, survival, and stress distribution, of composite resin CAD/CAM and ceramic CAD/CAM occlusal veneers in posterior teeth with severe occlusal wear.**
Condition being studied: **Currently there is an increase in cases of dental wear, due to several factors such as: excessive consumption of carbonated drinks, a diet high in acids, gastric diseases, anorexia, bulimia, dental grinding, use of highly abrasive toothpastes, or a combination of these[9] [10] [11] [12]; which affect the patient in several aspects: loss of vertical dimension, sensitivity due to the exposure of dentin, esthetics, affectation of the neuromuscular system[11] [13] [14]. With the advent of minimally invasive dentistry, occlusal veneers have been found to be a valid option to rehabilitate this type of cases and thus avoid greater wear of the dental structure with full coverage restorations. Sometimes when performing a tabletop it is not necessary to perform any preparation, thus preserving the maximum amount of dental tissue[3] [6] [15]. Due to the masticatory load either in patients without parafunction where the maximum masticatory force is approximately 424 N for women and 630 N for men or in those who present parafunction where the maximum bite force can vary from 780 to 1120N[7], it is necessary that the occlusal veneers support that load which makes indispensable a compilation of studies investigating both fatigue and fracture resistance and the survival rate of occlusal veneers in different materials and thicknesses.**

INPLASY registration number: This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 12 October 2021 and was last updated on 12 October 2021 (registration number INPLASY2021100036).

INTRODUCTION

Review question / Objective: **The aim of this systematic review is to synthesize the scientific evidence that evaluates fatigue and fracture resistance, survival, and stress distribution, of composite resin CAD/CAM and ceramic CAD/CAM occlusal veneers in posterior teeth with severe occlusal wear.**

Rationale: Thanks to advances in CAD/CAM technology, and improved adhesive protocols such as immediate dentin sealing,[1] [2] occlusal veneers can be fabricated in thin thicknesses without affecting their performance[3]. Although there is scientific evidence demonstrating the good performance of lithium disilicate occlusal veneers[4] [5], there are now more materials that are less brittle and have a modulus of elasticity more similar to dentin than ceramics, such as resin CAD/CAM blocks[2] [6] [7]. There are several studies, mostly laboratory studies evaluating both thickness and material on the performance of occlusal veneers[2] [8] [7]. But there is no update systematic review that allows the clinician to make a decision on which type of material is best for restoring teeth with occlusal wear defects.

Condition being studied: Currently there is an increase in cases of dental wear, due to several factors such as: excessive consumption of carbonated drinks, a diet high in acids, gastric diseases, anorexia, bulimia, dental grinding, use of highly abrasive toothpastes, or a combination of these[9] [10] [11] [12]; which affect the patient in several aspects: loss of vertical dimension, sensitivity due to the exposure of dentin, esthetics, affectation of the neuromuscular system[11] [13] [14]. With the advent of minimally invasive dentistry, occlusal veneers have been found to be a valid option to rehabilitate this type of cases and thus avoid greater wear of the dental structure with full coverage restorations. Sometimes when performing a tabletop it is not necessary to perform any preparation, thus preserving the maximum amount of dental tissue[3] [6] [15]. Due to the masticatory load either in patients without parafunction where the maximum masticatory force is approximately 424 N for women and 630 N for men or in those who present parafunction where the maximum bite force can vary from 780 to 1120N[7], it is necessary that the occlusal veneers support that load which makes indispensable a compilation of studies investigating both fatigue and fracture resistance and the survival rate of occlusal veneers in different materials and thicknesses.

METHODS

Search strategy: Pubmed/Medline: ((((((((((((((((((((((((((Tooth erosion[MeSH Terms]) OR (tooth wear[MeSH Terms])) OR (Dental restorations wear[MeSH Terms])) OR (Tooth erosion[Title/Abstract])) OR (tooth wear[Title/Abstract])) OR (Dental restorations wear[Title/Abstract])) OR (Severe wear[Title/Abstract])) OR (Wear tooth[Title/Abstract])) OR (Worn dentitions[Title/Abstract])) OR (Dental wear[Title/Abstract])) OR (Dental erosion[Title/Abstract])) OR (Severely worn[Title/Abstract])) OR (Wear into dentin[Title/Abstract])) OR (Erosive wear[Title/Abstract])) OR (Occlusal wear[Title/Abstract])) OR (Erosive lesions[Title/Abstract])) OR (Occlusal erosion[Title/Abstract])) OR (Eroded posterior teeth[Title/Abstract])) OR (Erosion of the occlusal surface[Title/Abstract])) OR (Erosion in tooth wear[Title/Abstract]))) OR (Worn teeth[Title/Abstract])) OR (dental wear[MeSH Terms])) AND ((((((((((((((((((((((((((((((composite resins[MeSH Terms]) OR (Composite resin block[Title/Abstract])) OR (composite resins[Title/Abstract])) OR (Composite resin cad cam[Title/Abstract])) OR (Occlusal veneers composite[Title/Abstract])) OR (Composite resin occlusal veneers[Title/Abstract])) OR (Cad cam occlusal veneers[Title/Abstract])) OR (Cad cam composite resin[Title/Abstract])) OR (Cad cam restorative material[Title/Abstract])) OR (Indirect restorations[Title/Abstract])) OR (Occlusal onlays[Title/Abstract])) OR (Occlusal veneers[Title/Abstract])) OR (Posterior occlusal veneers[Title/Abstract])) OR (Composite resin posterior occlusal veneers[Title/Abstract])) OR (CAD CAM composite occlusal veneers[Title/Abstract])) OR (Composite occlusal veneers[Title/Abstract])) OR (CAD/CAM composite resin occlusal veneers[Title/Abstract])) OR (CAD/CAM composite resin overlay[Title/Abstract])) OR (composite resin CAD CAM overlay[Title/Abstract])) OR (CAD CAM resin composite overlay[Title/Abstract])) OR (CAD/CAM onlay

restorations[Title/Abstract])) OR (resin nanoceramic[Title/Abstract])) OR (Hybrid resin[Title/Abstract])) OR (Nanoceramic composite[Title/Abstract])) OR (composite cad[Title/Abstract]))) OR (Resin cad[Title/Abstract])) OR (composite tabletops[Title/Abstract])) OR (resin tabletops[Title/Abstract])) OR (tabletops composite[Title/Abstract])) OR (tabletops nanoresin[Title/Abstract]))) OR (ultrathin occlusal veneers[Title/Abstract]))) AND ((((((((((((((((((((((((((((((Lithia disilicate[MeSH Terms]) OR (lithium disilicate occlusal veneers[Title/Abstract])) OR (lithium disilicate[Title/Abstract])) OR (Lithia disilicate[Title/Abstract])) OR (lithium disilicate ceramic[Title/Abstract])) OR (lithium disilicate restorations[Title/Abstract])) OR (lithium disilicate ceramic block[Title/Abstract])) OR (Lithium disilicate ceramic veneers[Title/Abstract])) OR (Lithium disilicate glass ceramic[Title/Abstract])) OR (Lithium Disilicate onlays[Title/Abstract])) OR (Glass-ceramic tabletops[Title/Abstract])) OR (Tabletop Ceramic Restorations[Title/Abstract])) OR (Ceramic occlusal veneers[Title/Abstract])) OR (Glass-ceramic occlusal veneers[Title/Abstract])) OR (Cad cam onlays[Title/Abstract])) OR (CAD-CAM ceramic onlays[Title/Abstract])) OR (Lithium Disilicate Posterior Overlays[Title/Abstract])) OR (lithium disilicato overlays[Title/Abstract])) OR (Lithium Disilicate Glass-Ceramic Onlays[Title/Abstract])) OR (IPS EMAX PRESS[Title/Abstract])) OR (IPS EMAX CAD[Title/Abstract])) OR (Lithium disilicate tabletops[Title/Abstract])) OR (Lithium disilicate glass ceramic occlusal veneers[Title/Abstract])) OR (Occlusal glass ceramic veneers[Title/Abstract])) OR (Occlusal veneers of lithium disilicate[Title/Abstract])) OR (CAD CAM Occlusal glass ceramics veneers[Title/Abstract])) OR (Ceramic tabletops[Title/Abstract])) OR (Lithium silicate[Title/Abstract])) OR (Dental ceramics[Title/Abstract])) OR (Glass-ceramic veneers[Title/Abstract])) OR (reinforced ceramics[Title/Abstract])) OR (Ceramics[Title/Abstract])) OR (IPS E.MAX PRESS[MeSH Terms])) OR (ceramics[MeSH Terms]))) AND ((((((((((((((((((((((((((((Survival rate[MeSH Terms])) OR (Tensile Strength[MeSH Terms])) OR (elastic modulus[MeSH Terms])) OR (hardness[MeSH Terms])) OR (hardness test[MeSH Terms])) OR (Dental Stress Analysis[MeSH Terms])) OR (Stress, Mechanical[MeSH Terms])) OR (Survival rate[Title/Abstract])) OR (Biomechanical analisis[Title/Abstract])) OR (elastic modulus[Title/Abstract])) OR (hardness[Title/Abstract])) OR (hardness test[Title/Abstract])) OR (fracture load[Title/Abstract])) OR (Dental Stress Analysis[Title/Abstract])) OR (Stress, Mechanical[Title/Abstract])) OR (Fatigue resistance[Title/Abstract])) OR (Fatigue behavior[Title/Abstract])) OR (fatigue strength[Title/Abstract])) OR (Fracture resistance[Title/Abstract])) OR (Fracture toughness[Title/Abstract])) OR (Fracture behavior[Title/Abstract])) OR (Stress Distribution[Title/Abstract])) OR (Mechanical stress[Title/Abstract])) OR (Mechanical properties[Title/Abstract])) OR (Tensile stress[Title/Abstract])) OR (Flexural strength[Title/Abstract])) OR (Tensile Strength[Title/Abstract])). Scopus: (("Tooth erosion" OR "Tooth wear" OR "Worn teeth" OR "Severe wear" OR "Wear tooth" OR "Severe tooth wear" OR "Worn dentitions" OR "Dental wear" OR "Dental erosion" OR "Severely worn" OR "Loss of tooth substance" OR "Erosive wear" OR "Occlusal wear" OR "Erosive lesions" OR "Occlusal erosion" OR "Eroded posterior teeth" OR "Erosion of the occlusal surface" OR "Erosion in tooth wear") AND ("Composite resin block" OR "Composite resin cad cam" OR "Occlusal veneers composite" OR "Composite resin occlusal veneers" OR "Cad cam occlusal veneers" OR "Cad cam composite resin" OR "Cad cam restorative material" OR "Occlusal onlays" OR "Occlusal veneers" OR "Posterior occlusal veneers" OR "Composite resin posterior occlusal veneers" OR "CAD CAM composite occlusal veneers" OR "Composite occlusal veneers" OR "CAD/CAM composite resin occlusal veneers" OR "CAD/CAM composite resin overlay" OR " composite resin CAD CAM overlay" OR "CAD CAM resin composite overlay" OR "CAD/CAM onlay restorations" OR "Resin nanoceramic" OR "Hybrid resin" OR "Nanoceramic composite" OR "Composite

cad" OR "Resin cad" OR "composite tabletops" OR "resin tabletops" OR "tabletops nanoresin" OR "tabletops composite") AND ("Lithia disilicate" OR "lithium disilicate occlusal veneers" OR "lithium disilicate" OR "IPS EMAX PRESS" OR "lithium disilicato ceramic" OR "lithium disilicate restorations" OR "lithium disilicate ceramic block" OR "Lithium disilicate ceramic veneers" OR "Lithium disilicate glass ceramic" OR "IPS EMAX CAD" OR "Glass-ceramic tabletops" OR "Tabletop Ceramic Restorations" OR "Ceramic occlusal veneers" OR "Glass-ceramic occlusal veneers" OR "Cad cam onlays" OR "CAD-CAM ceramic onlays" OR "Lithium Disilicate onlays" OR "Lithium Disilicate Glass-Ceramic Onlays" OR "lithium disilicato overlays" OR "Lithium Disilicate Posterior Overlays" OR "Lithium disilicato tabletops" OR "Lithium disilicate glass ceramic occlusal veneers" OR "Occlusal glass ceramic veneers" OR "Occlusal veneers of lithium disilicate" OR "CAD CAM Occlusal glass ceramics veneers" OR "Lithium silicate" OR "Ceramic tabletops") AND ("Survival rate" OR "ELASTIC MODULUS" OR "hardness" OR "Hardness test" OR "Dental Stress Analysis" OR "Stress, Mechanical" OR "Fatigue resistance" OR "Fatigue behavior" OR "fatigue strength" OR "Fracture resistance" OR "Fracture toughness" OR "Fracture behavior" OR "Stress Distribution" OR "Mechanical stress" OR "Mechanical properties" OR "Tensile Strength" OR "Tensile strees" OR "Flexural strenght")) AND (EXCLUDE (DOCTYPE , "bk") OR EXCLUDE (DOCTYPE , "ch")) Embase: P: tooth erosion OR tooth wear OR wear tooth OR dental wear OR dental erosion OR tooth disease OR worn teeth. I: composites resin OR computer aided design/computer aided manufacturing OR direct restorations OR oclussal veneers OR table tops OR overlay OR onlay. C: Ceramics OR lithium disilicates OR glass ceramics OR oclussal veneers OR table tops OR overlay OR onlay. O: Fatigue OR rate survival OR fatigue resistance OR mechanical properties. Web of science: P: Dental wear or Dental erosion OR tooth wear OR tooth erosion OR severe tooth wear I: Oclussal veneers OR tabletops OR indirect restorations OR overlay OR onlay OR composite resin OR composite CAD CAM C: Ceramics OR lithium disilicate OR glass ceramics OR indirect restoration O: fatigue resistance OR fracture resistance OR survival rate OR stress distribution OR mechanical properties. Grey literature: Key words: “Composite restorations” AND “Ceramic Restorations”” • Open gray • Redalyc • Dspace • Grey literature report • Clinical trials Hand searching: • Dental Materials • Journal of Dental Restoration • Journal of Dentistry • Journal of Oral Rehabilitation • Journal of Oral Esthetic.

Participant or population: This review will include posterior teeth with occlusal wear, excluding endodontic teeth.

Intervention: Composite Resin Blocks.

Comparator: Lithium disilicate CAD/CAM.

Study designs to be included: Randomized controlled trials, controlled trials, systematic review, in vitro studies.

Eligibility criteria: Inclusion criteria: Studies that evaluate occlusal veneers performed with machined materials on posterior teeth with occlusal wear comparing blocks of composite resin and ceramic.• Studies evaluating the mechanical properties of occlusal veneers such as resistance to fatigue, fracture resistance, survival rates, distribution of stress.• Randomized controlled trials, controlled trials, in vitro studies. Exclusion criteria: Studies that analyze indirect restorations made with materials machined with the CAD-CAM technique in anterior teeth• Studies analyzing indirect restorations made on dental implants.• Studies in which there is no comparison between composite resin blocks and ceramics.• Studies that analyze occlusal restorations with direct technique or occlusal restorations that do not use composite resin blocks.• Studies that evaluate occlusal restorations with indirect technique made with CAD-CAM machined materials in endodontic teeth. • Studies that evaluate crowns, onlays, inlays.• Case reports. Bibliographic reviews, expert opinions.

Information sources: Electronic database: • PUBMED (MEDLINE) • SCOPUS • COCHRANE • EMBASE • WEB OF SCIENCE. Hand searching: • Dental Materials • Journal of Dental Restoration • Journal of Dentistry • Journal of Oral Rehabilitation • Journal of Oral Esthetic and Restorative Dentistry • Dental materials Journal • Journal of material sciences. Grey literature: • Open Gray • REDALYC • DSPACE • Grey Literature Report • CLINICAL TRIALS.

Main outcome(s): The results expected to be obtained correspond to the survival of the occlusal veneers, at each time interval (defined by each load step), the difference between the specimens starting the interval intact and the specimens cracking or failing during that interval was counted, providing the survival probability in percentages (%) at each load step[2]. The fracture resistance measured in newtons, the fracture will be considered irreparable when the fracture line divided the tooth into two parts at the floor level of the pulp chamber. The fractures will be considered repairable when the fracture line involved only the restoration or all or part of the cusps[7].

Additional outcome(s): None.

Data management: A detailed electronic search of 5 electronic databases, grey literature and hand searching was conducted in duplicate, independently, by three reviewers (KM, JE and DA) in order to identify those with titles and abstracts that met the inclusion criteria. The articles on which both authors agreed were selected, if it was not possible to reach a consensus, a third author could be involved (DA). The full text of the articles selected on their titles and abstracts were read and the modified CONSORT criteria were applied to assess the methodological quality of the article as regards correct conduct and the structure of title, abstract, introduction, methods, results, discussion and conclusions. Disagreements concerning their inclusion were resolved through discussion with the third author (DA). A data extraction protocol was defined and assessed by two of the authors (KM and JE). The data were extracted independently from the full-text articles selected for inclusion, using a standardized form in electronic format (Office Excel 2011 software, Microsoft Corporation, Redmond, WA, USA). The authors classified the information on authors/year, study design, sample size, material, objectives, test used, mechanical property studied, results, conclusions and risk of bias.

Quality assessment / Risk of bias analysis: The authors (K.M y J.E) independently assessed the risk of bias of the studies included in this review according to a previous study[16]. The following parameters were evaluated: teeth randomization, use of teeth free from caries or restorations, use of materials following the instructions of manufacturers, use of teeth with similar dimensions, teeth preparation performed by the same operator, description of sample-size calculation and blinding of the operator of the testing machine. If the author reported the parameter, the article received a yes (Y) on that specific parameter; if it was not possible to find the information, the article received a no (N). The articles which reported 1 to 3 items were classified as having a high risk of bias, 4 or 5 items as medium risk of bias, and 6 or 7 items as low risk of bias. Disagreements concerning the risk of bias were resolved was by consensus. If it was not possible to reach a consensus, a third author could be involved (DA).

Strategy of data synthesis: This review will focus on a qualitative analysis of the data, because the lack of standardization of the methodology of the included studies does not allow for a meta-analysis.

Subgroup analysis: None.

Sensitivity analysis: None.

Language: There will be no language restriction.

Country(ies) involved: Ecuador.

Other relevant information: References 1. Magne P, Stanley K, Schlichting LH. Modeling of ultrathin occlusal veneers. Dent Mater. 2012 Jul;28(7):777-82. doi: 10.1016/j.dental.2012.04.002. Epub 2012 May 9. PMID: 22575740. 2. Magne P, Schlichting LH, Maia HP, Baratieri LN. In vitro fatigue resistance of CAD/CAM composite resin and ceramic posterior occlusal veneers. J Prosthet Dent. 2010 Sep;104(3):149-57. doi: 10.1016/S0022-3913(10)60111-4. PMID: 20813228. 3. Johnson AC, Versluis A, Tantbirojn D, Ahuja S. Fracture strength of CAD/CAM composite and composite-ceramic occlusal veneers. J Prosthodont Res. 2014 Apr;58(2):107-14. doi: 10.1016/j.jpor.2014.01.001. Epub 2014 Mar 11. PMID: 24636368. 4. Sasse M, Krummel A, Klosa K, Kern M. Influence of restoration thickness and dental bonding surface on the fracture resistance of full-coverage occlusal veneers made from lithium disilicate ceramic. Dent Mater. 2015 Aug;31(8):907-15. doi: 10.1016/j.dental.2015.04.017. Epub 2015 Jun 4. PMID: 26051232. 5. Krummel A, Garling A, Sasse M, Kern M. Influence of bonding surface and bonding methods on the fracture resistance and survival rate of full-coverage occlusal veneers made from lithium disilicate ceramic after cyclic loading. Dent Mater. 2019 Oct;35(10):1351-1359. doi: 10.1016/j.dental.2019.07.001. Epub 2019 Jul 25. PMID: 31351579. 6. Schlichting LH, Maia HP, Baratieri LN, Magne P. Novel-design ultra-thin CAD/CAM composite resin and ceramic occlusal veneers for the treatment of severe dental erosion. J Prosthet Dent. 2011 Apr;105(4):217-26. doi: 10.1016/S0022-3913(11)60035-8. PMID: 21458646. 7. Andrade JP, Stona D, Bittencourt HR, Borges GA, Burnett LH Júnior, Spohr AM. Effect of Different Computer-aided Design/Computer-aided Manufacturing (CAD/CAM) Materials and Thicknesses on the Fracture Resistance of Occlusal Veneers. Oper Dent. 2018 Sep/Oct;43(5):539-548. doi: 10.2341/17-131-L. Epub 2018 Mar 7. PMID: 29513638. 8. Al-Akhali M, Chaar MS, Elsayed A, Samran A, Kern M. Fracture resistance of ceramic and polymer-based occlusal veneer restorations. J Mech Behav Biomed Mater. 2017 Oct;74:245-250. doi: 10.1016/j.jmbbm.2017.06.013. Epub 2017 Jun 13. PMID: 28633093. 9. Bartlett D, Phillips K, Smith B. A difference in perspective--the North American.

Keywords: Tooth wear; Composite resin block; Composite resin occlusal veneers; lithium disilicate occlusal veneers; Fatigue resistance; Fracture resistance; survival rate.

Dissemination plans: We plan to disseminate the results by publishing the systematic review in a high impact journal, national and international congresses.

Contributions of each author:

Author 1 - KARELYS MALDONADO - The author drafted the introduction, writing the protocol and the results, data collection, data management, analysis of data, interpretation data.
Email: karelys.maldonado@ucuenca.edu.ec
Author 2 - JUAN ESPINOZA - The author drafted the materials and methods, data collection, data management, analysis of data, interpretation data.
Author 3 - DANIELA ASTUDILLO - Conceiving the review, Supervision, data collection, interpretation data.
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