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Survival rate of porcelain veneers versus indirect composite resin veneers in patients with Bruxism: A Systematic review.

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LIST OF SYMBOLS AND ACRONYMS

- **AB**: Awake Bruxism
- **Bis-GMA**: Bisphenol A-Glycidyl Methacrylate
- **CAD**: Computer-Aided Design
- **CAM**: Computer-Aided Manufacturing
- **CMD**: Craniomandibular Dysfunction
- **ECR:** Existing Composite Restoration
- **EMG**: Electromyography
- **IDS:** Immediate Dentin Sealing
- **IRC**: Indirect Composite Resin
- **OVD**: Occlusal Vertical Dimension
- **PSG**: Polysomnography
- **RCT:** Randomised controlled clinical trial
- **SB**: Sleep Bruxism

ABSTRACT

Introduction: Finding the best aesthetically pleasing and durable material for anterior restorations is the subject of increasing numbers of studies. The material of preference may also be influenced by factors like bruxism or tooth preparation. The aim of this systematic review was to compare the clinical outcomes of indirect composite laminate veneers and porcelain veneers in bruxism patients.

Material and Methods: An electronic search was performed in the PubMed, Scopus, and Web Of Science databases on porcelain veneers and indirect composite resin veneers in patients with bruxism until January 2023.

Results: Of 433 potentially eligible papers, 11 complied with the inclusion criteria: 8 articles described characteristics and survival rate of porcelain veneers, 2 made a comparison of survival rate of both porcelain veneers and indirect composite resin veneers and 1 illustrated the digital CAD CAM method.
It can be noted that the indirect composite resin (Estenia) veneers have a general lower survival expectancy: 87% after 20,3 months and 75% after 97 months. Regarding the survival rates of ceramic veneers: IPS-Empress ceramic 100% after 20,3 and 97 months and 89,5% after 11 years. Feldspathic ceramic reinforced with leucite crystals 95% after 11 years. Feldspathic ceramic 89,1% using an occlusal splint and 63,9% using no occlusal splint after 7 years.
Ceramic veneers have compared to indirect composite better properties as veneer materials. Fractures of the veneers are less frequent in patients who use an occlusal splint adequately.

Conclusions: Overall, the survival rate was higher for porcelain veneers. Ceramic veneers demonstrated superior properties compared to indirect composite resin veneers, including better aesthetic outcomes and durability. The use of functional or conventional dental preparation did not show any appreciable differences. Bruxism increased the risk of fractures in veneer

restorations, but the proper use of occlusal splints helped minimise these issues.

KEY WORDS

I. Bruxism
II. Sleep Bruxism
III. Bruxism, Sleep
IV. Nocturnal Teeth Grinding Disorder
V. Sleep Related Bruxism
VI. Adult Sleep Bruxism
VII. Teeth grinding disorder
VIII. Dental porcelain
IX. Porcelain laminate veneers
X. Porcelain veneers
XI. Ceramic laminate veneers
XII. Lithium Disilicate
XIII. Composite resins
XIV. Indirect composite resin veneers
XV. Prefabricated resin composite veneers
XVI. Survival rate

1. INTRODUCTION

Bruxism is a habit that creates significant concern due to its consequences: tooth destruction, restorative fracture, or the need for prosthetic rehabilitation (1). The patient's concern over the appearance of their short upper anterior teeth and the aesthetic impact that this is having is typically the primary motivator for restorative treatment (2).

According to initial studies on beauty, there is a physical attractiveness stereotype that is consistent with the notion: "what is beautiful is good.“ Physical attractiveness is associated with happiness, success, and socially desirable qualities, making it a key factor in social interaction. The mouth and teeth are important factors in the appraisal of physical appearance (3).

Nowadays, social media is driving demand for aesthetic dentistry, leading to the placement of veneers, orthodontic therapy, and other treatments. Dental veneers are the third most requested aesthetic procedure, behind Hollywood and teeth whitening (4).

As was already noted, one of the primary issues with bruxism patients is how their short upper anterior teeth appear. Typically, dental veneers are used to address this issue. The current systematic review intends to compare the clinical outcomes of porcelain veneers with indirect composite laminate veneers in individuals who have bruxism.

1.1. Bruxism

Bruxism, which derives from the Greek brygmos, or "grinding," is a recurrent masticatory muscle action characterised by tensing or moving the jaw without making contact with the teeth (5).
It is a contentious oral ailment that has drawn research from a variety of disciplines (6). A more recent definition emphasises the distinction between sleep and awake bruxism and the absence of other causative disorders (5).

Separate definitions for Awake Bruxism (AB) and Sleep Bruxism (SB) were offered by the international consensus meeting, “Assessment of Bruxism Status“:

- “Sleep bruxism is a masticatory muscle activity during sleep that is characterised as rhythmic (phasic) or non-rhythmic (tonic) and is not a movement disorder or a sleep disorder in otherwise healthy individuals.”
- “Awake bruxism is a masticatory muscle activity during wakefulness that is characterised by repetitive or sustained tooth contact and/or by bracing or thrusting of the mandible and is not a movement disorder in otherwise healthy individuals.” (6).

The adult prevalence rates for awake bruxism range from 22% to 30% and those for sleep bruxism from 8% to 15% (6). AB has a higher prevalence in women, whereas the prevalence of SB is independent of sex and decreases with age (5).

Human bruxism has a complex aetiology that is not fully understood. The occlusion plays a minor role according to the current literature (5).
There are many risk factors for bruxism, including mental stress, the use of stimulants like caffeine, alcohol, and tobacco, as well as conditions like anxiety disorder and sleep apnea syndrome. Additionally, disorders like nocturnal frontal lobe epilepsy, depression, reflux esophagitis, and respiratory illnesses are all linked to bruxism. A higher likelihood of bruxism is also associated with stress, emotional instability, and attenuated psychotic personality features. Moreover, bruxism has a hereditary component (7).

Attrition is caused by bruxism, which can occur as a result of AB, SB, or both types of bruxism (2).
In the anamnesis, patients are questioned about whether they or others have ever overheard them grinding their teeth at night or during the day. However, some patients are unaware that they grind their teeth, and bruxism is not always accompanied by sounds. The existence of eroded teeth is frequently only brought to their attention by the examiner (Table 1) (5).

Table 1: Indicators for bruxism (5).

Anamnesis:	Clinical indicators:
Externally observed teeth grinding	Attrition of teeth with non-carious tooth structure loss
Temporomandibular joint pain	Loss of dentures
Pain in the area of the masticatory and neck muscles	Tooth impressions on the tongue margin or buccal mucosa
Morning headaches in the temporal region	Prominent linea alba on the inside of the cheek
Impaired sleep	Non-inflammatory gingival atrophy
Sensitive or painful teeth	Masseter hypertrophy
Loose teeth	Restricted jaw opening that can be passively expanded

The dental examination also includes an evaluation of the occlusion and the search for enamel fractures, abfractions, and wedge-shaped tooth abnormalities on anterior and posterior teeth.

The only test that can definitively diagnose sleep bruxism is Polysomnography (PSG), which is expensive and time-consuming. Electromyography (EMG) monitoring screening tools are useful for home diagnostics, but there are no established standards for objective measurement techniques. A diagnostic grading system (Table 2) for assessing the probability of the presence of bruxism has been proposed by a group of experts.

Table 2: Diagnostic grading system (5).

Possible Sleep Bruxism / Awake Bruxism:	Positive indications from anamnesis/ questionnaire
Probable Sleep Bruxism / Awake Bruxism:	Positive evidence in the clinical examination with positive evidence in the medical history
Definitive Sleep Bruxism / Awake Bruxism:	Positive instrumental findings (PSG, EMG) with positive indications in the history and positive findings in the clinical examination

Occlusal abnormalities were long believed to be the root of bruxism. There has been a paradigm shift because there is insufficient proof. Occlusion issues have been demonstrated to be a possible side effect of bruxism (5).
Due of the muscle tension and contractions, awake and sleep bruxism are regarded as a risk factor for Craniomandibular Dysfunction (CMD). There is general agreement among experts that symptoms and clinical signs of bruxism should be checked for if CMD is present. These symptoms and signs include pain in the masticatory muscles, painful temporomandibular joint dysfunctions, and headaches. In contrast, when bruxism is identified, the doctor should conduct a thorough examination of the temporomandibular joints to find any early abnormalities (5).

1.1.1. Treatment

General treatment:

Primary bruxism does not have a causal therapy, so management or treatment options should be discussed. Regular self-observation, auditory cell phone signals, visual cues, posture adjustment, self-massage and stretching exercises can help reduce pain and tension. Botulinum toxin injections can reduce discomfort and muscle activation during the active phase of bruxism. Psychotherapeutic procedures and jaw physiotherapeutic treatments can also be used. There is no single target-oriented therapy. Rather, a detailed patient information should be aimed at an understanding of the patient's disease and an individual combination of therapies from relaxation procedures, biofeedback, splint and physiotherapy should be initiated as needed, as well as risk factors such as nicotine, caffeine, alcohol and drug consumption should be pointed out (5).

Dental treatment:

Tooth and denture preservation are the goals of dental treatment. In order to prevent tooth-to-tooth contact and preserve the teeth from increased attrition, oral splints are employed. Additionally, splint therapy can provide pain relief or shield the jaw joint from overload, protecting it and having a protective

impact (5). The clinical management of attrition may provide challenges because the patient's attritional tendencies are neurologically driven and cannot be cured by restorative treatment. Therefore, it is crucial that the patient is aware of the aetiology of this ailment and is prepared to commit to wearing a protective splint for an extended period of time, possibly for the rest of their lives. The importance of the patient's commitment to this long-term splint wearing increases with more complicated and thorough the treatment is (5).

Patients with bruxism have the option of wearing hard splints, soft splints, or hybrid splints with soft inner lining and a hard outer shell. Although there is not much information in the literature on which is ideal, splints can be placed in either the upper or lower arch. There is not enough concrete evidence to support this approach, but some dentists think it could be preferable to place a splint in the upper arch where the hard palate is accessible to distribute any occlusal loads more widely (5).

Even though it might be claimed that the clinical management of a bruxism patient is never definite because the danger for restoration failure is always present, treatment for bruxism can also be separated into an initial or diagnostic phase and a "definitive" treatment phase (5).

Therefore, it is frequently very helpful to start treatment with a "diagnostic" phase so the clinicians can persuade themselves that the patient would wear the splints. It is crucial to investigate any additional probable causes of the clinically apparent tooth wear at this early diagnostic phase, such as erosion. The restoration of the worn teeth might be considered if the dentist is confident that the patient is wearing his or her splint on a regular basis (5).

Typically the patient's anxiety over the appearance of their small upper anterior teeth and the aesthetic impact that this is having is the main motivator for treatment. Upper or lower anterior teeth alone, or both the upper and lower anterior teeth together, may be affected by anterior tooth wear that is isolated to the front teeth. Alternately, there may be more widespread wear affecting both the anterior and the posterior teeth. In such a case, the maxillary or the mandibular arch, or in the worst cases, both arches, may be the localised site of the wear (2).

The Dahl procedure, first introduced in 1975 by Dahl and his colleagues, is a well-known method for treating localised anterior tooth wear. Attrition, which includes tooth wear, is problematic since it often occurs slowly, with an average loss of fewer than 15 microns each year. As a result, compensatory over-eruption, a process where teeth shift into the gap left by worn teeth, occurs in the majority of patients. Because of this, the fundamental problem in many cases of tooth wear is a lack of anterior space for placing restorations like veneers or crowns. To solve this issue, the Dahl method was developed. The patient is fitted with a metal anterior bite elevating platform, which he wears for approximately 6 to 12 months. The posterior teeth are dislodged by this bite platform, and over the course of 6 to 12 months, they erupt back into contact at a higher occlusal vertical dimension (OVD) determined by the Dahl appliance. In addition to the eruption of the posterior teeth, the appliance also contributes to the intrusion of the lower anterior teeth (2).

A conservative approach of managing full arch tooth wear is to use adhesive gold onlays on molar teeth and the use of direct or indirect composite to restore the remaining teeth, increasing the OVD as necessary. A more traditional way of dealing with a full arch or mouth rehabilitation is to use conventional crowns (2).

1.2. Dental Veneers

A veneer is a thin covering of tooth-coloured material that is bonded to the surface of a tooth to correct inherent discolouration and localised or generalised defects. Chair-side composite, processed composite, porcelain, and compressed ceramic materials are used to make veneers. The process of lamination is the procedure of placing a thin veneer on a tooth made of prefabricated porcelain or composite resin. Laminates can successfully change smiles in a rapid, painless, and conservative manner with effects that last (8).

The teeth must first be prepared before dental veneers may be placed. There are several possible dental preparation designs:

- Window preparation: the incisal edge of the tooth is preserved.

- Feather preparation: the incisal edge of the tooth is prepared bucco-palatally, but the incisal length is not reduced.
- Bevel preparation: the incisal edge of the tooth is prepared bucco-palatally and the length of the incisal edge is reduced slightly by 0.5-1 mm.
- Incisal overlap preparation: the incisal edge of the tooth is prepared bucco-palatally and the length is reduced (about 2 mm), so the veneer is extended to the palatal aspect of the tooth (8).

1.3. Adhesion to dental substrates

Adhesion to dental substrates (enamel and dentin, rarely cementum) refers to the bonding of dental materials to the tooth structure, which is essential for the success of restorative and prosthodontics procedures (9).

Dental adhesives are solutions of resin monomers that bond a restorative material to a dental substrate once the monomers have been polymerised. While most adhesive joints have only two interfaces, dental adhesive joints can be more complicated, such as the enamel-adhesive-composite-adhesive-porcelain contact generated when a clinician bonds a porcelain restoration. Another illustration of a complicated adhesive junction is a bonded composite restoration. In order to increase the retention of an acrylic resin on enamel, Buonocore reported using 85% phosphoric acid in 1955. Due to the infiltration of resin monomers into the microporosities left by the acid dissolution of enamel and subsequent encapsulation of the exposed hydroxyapatite crystals with the polymerised monomers within the pores on the enamel surface, the interaction of dental adhesives with enamel has a micromechanical nature (9).This process is influenced by various factors such as the type of substrate, surface conditioning, and the composition of the bonding agent. Adhesion can be achieved through various mechanisms such as chemical bonding, physical bonding, or a combination of both. The strength of the bond between the material and tooth surface depends on various factors such as surface roughness, moisture control, and the type of bonding agent used. Research has shown that proper adhesion techniques can improve the longevity of dental

restorations and reduce the risk of failure (10).

1.3.1. Enamel and Dentin bonding

A bonded restoration's ultimate goal is to achieve a close fit between the restorative material and the dental substrate. Due to the fact that the bonding process for enamel and dentin are different, completing this task is challenging. In other words, dentin is more organic and humid than enamel. The mineral hydroxyapatite makes about 96% of the weight of enamel, whereas dentin contains a large quantity of water and organic material, primarily type-I collagen. Dentin's organic and humid makeup makes attaching to this hard tissue very challenging (9).

When tooth structure is removed with a bur or another tool, the leftover pieces build up on the surface to produce a "smear layer" of debris. This debris coats enamel and dentin uniformly, blocks the opening to the dentinal tubules, and decreases the permeability of the dentin. The smear layer needs to be removed or rendered permeable because it acts as an actual physical barrier that prevents the adhesive monomers from making direct contact with the dentin surface. Present adhesion tactics depend only on how dental adhesives interact with this smear layer, despite the fact that adhesive systems can be categorised in a variety of ways. Etch-and-rinse adhesives (full-etching) are one method; they etch the surface hydroxyapatite and smear layer away using a different acid gel. The second technique uses self-etching adhesives to partially remove the smear layer while still allowing for permeation (9).

1.4. Porcelain veneers

Porcelain veneers are thin-bonded ceramic prosthetics that replace the facial surface and some of the proximal surfaces of anterior teeth that need aesthetic treatment. Typically, they are made of thin porcelain shells whose fitting surfaces have been etched with hydrofluoric acid and coated with a silane coupling agent. The veneer is attached on enamel that has been treated with a phosphoric acid etchant using a resin-based cement. Porcelain veneers have

evolved into a dependable restorative process for the treatment of teeth in the front area of the mouth due to its high aesthetic appeal, as well as their demonstrated biocompatibility and long-term predictability (11).

1.4.1. Indications and contraindications for porcelain veneers

For the treatment of vital anterior teeth that are discoloured but do not respond well to whitening, porcelain veneers are ideal. With porcelain veneers, it is also possible to treat fractures and enamel hypo-calcification. They can also be used to repair congenital tooth malformations and to close mild gaps between anterior teeth. Porcelain veneers also offer a conservative treatment option for maxillary anterior teeth that need to be lengthened or reshaped (11).
On the other hand, teeth that have undergone endodontic treatment and are structurally weak are not good candidates for porcelain veneers because they require the reinforcement that full-coverage crowns give to retain their integrity. Since enamel is the primary source of retention for porcelain veneers, teeth that have undergone extensive restoration and have insufficient enamel are also not suitable choices. Dentition missing posterior support, poor dental hygiene, and existent parafunctional activity, such as bruxism, are further disqualifying factors. Although it has been claimed that patients who clench or grind their teeth experience a 60% reduction in success rates for porcelain veneers, this number was comparable to that of metal-ceramic crowns placed in the same situation (11).

1.4.2. Classification of dental ceramics

Dental ceramics are categorised using a variety of techniques, one of which is based on their composition. Dental professionals can choose a suitable ceramic by using the classification approach, which is based on the composition of ceramics. It is an easy-to-understand tool. Based on how they were made, dental ceramics can also be categorised. This classification is significant because it clarifies the processes used in dental repair creation (12).

Ceramic classification based on composition: (42)

1) Silicate ceramics:

    a) Feldspates:

In this particular situation, quartz or silica oxide predominates over alumina in a ratio of 46–66% to 11–17%. The following subclassifications apply to feldspathic porcelains:

- Conventional feldspathic porcelains. These offer very good aesthetic effects but the main problem is that they are fragile (low fracture resistance: 56.5 MPa). Examples include d-SING, Vintage, Luxor, Duceram, Flexoceram, Vivodent PE, IPS Classic, Empress aesthetic.
- High resistance feldspathic porcelains. In this case we have the following materials:
    - Feldspathic porcelain reinforced with leucite crystals:
      In this instance, aluminium oxide (18%) and quartz (68%) make up the chemical composition. The pressing procedure utilised to create these materials reduces porosity and results in appropriate and repeatable fit precision. During the cooling step and after resting, the leucite crystals are perfectly distributed throughout the glass matrix, which helps to raise resistance without considerably lowering translucency. 160–300 MPa is the range of resistance to flexion. Examples of this type of porcelain include IPS-Empress I, Optec HSP, Mirage, Finesse, Cergogold.
    - Feldspathic porcelain reinforced with lithium oxide:
      In this instance, quartz (57-80%), lithium oxide (11-19%), and aluminium oxide (0-5%), make up the chemical composition. Due to their significant volume (60%) and homogeneous interlocking structure of densely distributed elongated crystals, as well as the increase in crystal size after pressing, the incorporation of these crystalline particles increases the flexion resistance to 320-450 MPa, resulting in a more homogeneous microstructure. Only the inner coping of the restorations, which are afterwards covered in fluor-apatite ceramics, are made with these porcelains. Examples of this type of porcelain include IPS Empress II, Style-Press.

    b) Alumina porcelains

2) Oxide ceramics:
    a) Aluminium oxide ceramics
    b) Zirconium oxide ceramics

Ceramic classification based on its fabrication: (12)

1) Conventional technique (stacking and sintering)
2) Heat-/hot-pressing technique (lost-wax technique)
3) Slip-casting and the glass-infiltration (infusion) method (In-Ceram® ceramic group)
4) Dry-pressing method (Procera® ceramics)
5) CAD/CAM
    - Soft-machining (partially sintered state milling)
    - Hard-machining (fully sintered state milling)

1.5. Indirect composite resin veneers

In clinical practice, composites are frequently employed. They were first used in dentistry in the 1940s to address issues with acrylic resins, which took the place of silicate cement (13).

Dental composites are made up of two basic parts: an organic resin matrix and an organic or inorganic filler. The fillers in organic resins can be either organic or inorganic in nature and range in size (from nanometer to micrometer), shape, and function. Organic resins are composed of a mixture of multifunctional monomers and initiators. Even while modern restorative composites have better mechanical and physical qualities than classic composites, they only last on average for about ten years before requiring expert intervention. Recurrent dental caries and restorative bulk fractures are the usual causes of clinical failure (14). A coupling agent is needed that facilitates the fillers' binding to the matrix. An adhesive is used to attach the composites to the dental tissues (15).

1.5.1. Indications for indirect composite resin veneers

Prefabricated veneers made of composite materials have a clear potential in the following situations: (8)

1) Single facial restorations:
   - Large restorations / decays with loss of natural tooth buccal anatomy / colour
   - Non-vital, discoloured teeth
   - Severe/extended tooth fracture
   - Extended tooth dysplasia or hypoplasia
2) Full Smile facial rehabilitations:
   - Moderate to severe discolourations (ie, tetracycline staining and fluorosis)
   - Generalised enamel hypoplasia / dysplasia
   - Large serial restorations/decays with loss of natural tooth buccal anatomy / colour
   - Attrition of incisal edges (after proper occlusal and functional management)
   - Financial limitations
   - Young patients with immature gingival profile

1.5.2. Classification of dental composite resin

Since Bowen's introduction of Bis-GMA to dentistry in 1962, the composition of dental composites has undergone constant change. Due to the advancement of the composites' physical and optical qualities, the clinical use of resin-based composites has increased. Dental restorative composite resins can be generically divided into direct and indirect resin composites (IRCs). IRCs, also referred to as prosthetic or lab composites (13).

Classification of IRCs:

Classification based on the generations and type of fillers: (13)

1) Based on generations:
    a. First generation materials:
        - The first generation of IRC was introduced by Touati and Mormann in 1980
        - They had a comparable composition with direct composite resins
        - Drawbacks: Poor clinical performance, inadequate bond between organic matrix and inorganic fillers, poor wear resistance and high incidence of bulk fractures
    b. Second generation materials:
        - They were first made available in the middle of the 1990s and had distinct curing processes and improved formulations
        - Better mechanical qualities and wear resistance are achieved thanks to the "microhybrid" ceramic fillers, which have a diameter of 0.04 to 1 m and a filler content that is two times higher than in conventional fillers
        - As the resin content is decreased, polymerisation shrinkage lowers as well
        - With a resin composition of just around 33%, the inorganic filler content is between 70 and 80 percent by weight and 50 to 60 percent by volume
    c. Next-generation materials

2) Based on type of fillers:
    a. Micro filled composite
    b. Fine hybrid composite
    c. Coarse hybrid composite

Classification based on fabrication method: (13)

- Direct-indirect/semi-indirect method: In the direct step, the composite resin material is condensed into the cavity after the separating medium has been applied. After the initial intraoral curing, it can be easily removed thanks to this separating medium. The restoration is then taken out and given an indirect stage of extraoral heat processing at 110°C for 7 minutes. With this manufacturing technique, there is no need for an impression, and everything is finished in one session.
- Indirect fabrication method: For the cavity that has been prepared, a die is created. After applying a separating medium to the die, the composite material is incrementally condensed into the cavity. Each increment receives a light cure for 40 seconds. The light-cured inlay restoration is then taken out of the die and heated for 15 minutes at 100°C. This approach has the advantage of accurate proximal contour.

2. JUSTIFICATION AND HYPOTHESIS

Justification

Nowadays, veneers are increasingly frequently utilised as a cosmetic fix for dental problems like stained, broken, or misaligned teeth (4). A common dental ailment known as bruxism, or the habit of clenching and grinding teeth, can result in a number of oral health issues, including worn, fractured, or damaged teeth (5). Veneers are frequently utilised as a cosmetic and practical treatment for bruxism patients to enhance the look and function of their teeth. Porcelain and indirect composite resin veneers are two popular types of veneers utilised for this purpose. It is unclear, though, which kind of veneer offers individuals with bruxism a higher likelihood of survival (5).

Numerous studies have compared the survival rates of porcelain veneers with indirect composite resin veneers up to this point, but they did not include people with bruxism; instead, they were conducted on the general population. One of the elements that might affect the optimum course of treatment we ultimately decide to employ for patients who are interested in aesthetics of the anterior teeth is bruxism (16-18).
The purpose of the current systematic review is to summarise and critically evaluate the information on the survival rate of indirect composite resin veneers and porcelain veneers, but despite previous publications, the new focus of the present systematic review will be on patients with bruxism.

This systematic review will offer an exhaustive and thorough assessment of the evidence that is currently available. Furthermore it will indicate any gap in the evidence that may exist. It will also demonstrate recommendations for future research to increase the quality and reliability of the evidence and will guide clinical practice and enhance the standard of care for bruxism patients.

Hypothesis

The hypothesis of this systematic review is that porcelain laminate veneers have a superior quality of survival than indirect composite resin veneers.

3. OBJECTIVES

Primary objective:

1. This systematic review's main purpose is to compare the longevity of indirect composite resin veneers with porcelain veneers in bruxism patients.

Secondary objectives:

1. Compare the potential benefits and drawbacks of each kind of veneer in terms of the survivability rate for bruxism patients.
2. Determine the ideal preparation design for patients with bruxism when creating veneers.
3. Analyse whether using a night splint improves the efficacy of treatment with indirect composite resin and ceramic veneers in bruxism patients.

4. MATERIALS AND METHODS

The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guideline statement was followed when conducting the current systematic review (51).

4.1. PICO question identification

In order to find indexed articles on the comparison of the survival rates of porcelain veneers versus indirect composite resin veneers in patients with bruxism published through January 2023, the Medline-PubMed (United States National Library of Medicine), Web of Science, and Scopus databases were used, to answer the following question: In patients presenting bruxism, do porcelain veneers or indirect composite resin veneers have a higher survival rate?

The structured PICO question served as the basis for this study's query.

The question was established in the following format:

- **P** (population): Patients presenting bruxism.
- **I** (intervention): Performance of porcelain veneers, in terms of resistance to wear, during day and night without the use of an occlusal splint.
- **C** (comparison): Performance of indirect composite resin veneers, in terms of resistance to wear, during day and night without the use of an occlusal splint.
- **O** (outcome):
    - O1: Higher survival rate.
    - O2: Advantages and disadvantages of each kind of veneer.
    - O3: Ideal preparation design for patients with bruxism when creating veneers.
    - O4: If the use of an occlusal night splint improves the efficacy of treatment with veneers (porcelain and indirect composite resin) in patients with bruxism.

4.2. Eligibility criteria

Inclusion criteria:

- **Type of Study**: Randomised controlled clinical trials, prospective and retrospective cohort studies and case series; studies on human subjects, number of participants ≥5 patients; Publications in English, or German; Published until January 2022.
- **Type of Patient**: Patients presenting bruxism with the need of rehabilitation of the anterior teeth with veneers, without age or gender differences.
- **Type of Intervention**: Treatment with porcelain or indirect composite resin veneers, with a minimum follow-up of 12 months after placing the veneer.
- **Type of Outcome Variables**: Studies that will provide data related to survival rate of porcelain and indirect composite resin veneers as primary variables. And as secondary variables: potential benefits and drawbacks of each kind of veneer, role of dental preparation design and if using a night splint improves the efficacy of treatment with indirect composite resin and ceramic veneers in bruxism patients.

Exclusion criteria were: reviews, case reports, letters or comments to the editor, expert reports, in vitro and animal experimental studies. In addition, studies in comparing various veneer or restoration types, studies only about implants, crowns, onlays and inlays or posterior restorations, as well as research about veneers placed only in palatal, involving people under the age of 18 and studies about direct composite resin restorations were excluded. When necessary, authors were contacted to clarify missing information.

4.3. Sources of information and data search strategy

The following keywords were used in an automated search in the three databases indicated above (PubMed, Scopus, and Web of Science):
“Bruxism“, “Sleep Bruxisms“, “Bruxism, Sleep“, “Nocturnal Teeth Grinding Disorder“, “Sleep Related Bruxism“, “Adult Sleep Bruxism“, “Teeth grinding disorder“, “dental porcelain“, “Porcelain laminate veneers“, “Porcelain veneers“, “Ceramic laminate veneers“, “Lithium Disilicate“, “composite resins“, “indirect composite resin veneers“, “Prefabricated composite veneers“, “Indirect resin composite veneers“, “prefabricated resin composite veneers“, “survival rate“. The key words were combined using the boolean operators AND, OR, and NOT as well as controlled terms ("MeSH" for Pubmed) in an effort to obtain the best and most comprehensive Bing search results.

The Pubmed search was as follows: ((Bruxism[MeSH Terms]) OR (Sleep Bruxisms[MeSH Terms])) OR (Bruxism, Sleep)) OR (Nocturnal Teeth Grinding Disorder)) OR (Sleep Related Bruxism)) OR (Adult Sleep Bruxism)) OR (Teeth grinding disorder)) AND ((dental porcelain[MeSH Terms]) OR (Porcelain laminate veneers)) OR (Porcelain veneers)) OR (Ceramic laminate veneers)) OR (Lithium Disilicate)) OR ((composite resins[MeSH Terms]) OR (indirect composite resin veneers)) OR (Prefabricated composite veneers)) OR (Indirect resin composite veneers)) OR (prefabricated resin composite veneers)) AND ((survival rate[MeSH Terms]) OR (survival rate))
Filter: Year: 2012-2023

The SCOPUS search was as follows: (ALL ("Bruxism" OR "Sleep Bruxisms" OR "Bruxism, Sleep" OR "Nocturnal Teeth Grinding Disorder" OR "Sleep Related Bruxism" OR "Adult Sleep Bruxism" OR "Teeth grinding disorder") AND ALL ("dental porcelain" OR "Porcelain laminate veneers" OR "Porcelain veneers" OR "Ceramic laminate veneers" OR "Lithium Disilicate") OR ALL ("composite resins" OR "indirect composite resin veneers" OR "Prefabricated composite veneers" OR "Indirect

resin composite veneers" OR "prefabricated resin composite veneers") AND ALL ("survival rate"))
Filter: Year: 2012-2023

The Web of Science search was as follows: (((TS=(Bruxism OR Sleep Bruxisms OR Bruxism, Sleep OR Nocturnal Teeth Grinding Disorder OR Sleep Related Bruxism OR Adult Sleep Bruxism OR Teeth grinding disorder)) AND TS=(dental porcelain OR Porcelain laminate veneers OR Porcelain veneers OR Ceramic laminate veneers OR Lithium Disilicate)) OR TS=(composite resins OR indirect composite resin veneers OR Prefabricated composite veneers OR Indirect resin composite veneers OR prefabricated resin composite veneers)) AND TS=(survival rate)
Filter: Year: 2012-2023

The results of each database search are summarised in Table 1 in the Annexes section. To find any potentially suitable studies that the initial search may have missed, the search was completed by looking over the references included in the bibliography of each study.
Additionally, a hand search was done for scientific papers in the following journals of prosthodontics and aesthetic dentistry: Journal of Dental Research, Journal of Dentistry, Journal of Prosthetic Dentistry, International Journal of Prosthodontics, Journal of Aesthetic and Restorative Dentistry, Journal of Aesthetic Dentistry, Clinical Oral Implants Research, Quintessence International, Journal of Adhesive Dentistry, Journal of the American Academy of Aesthetic Dentistry, Journal of Cosmetic Dentistry and Journal of the Korean Academy of Prosthodontics.
A cross search of possibly insightful publications was then conducted for analysis. The authors of the papers were approached in order to acquire those that were not in full-text databases. The review was cleared of duplicate studies.

4.4. Study selection process

It involved a three-stage selection procedure. The selection of studies was carried out by two reviewers (ZV, SMS). Titles were used as a filter in the first stage to remove publications that were not relevant and duplications were removed. The second stage involved screening and selecting the abstracts.
In the third stage, the entire texts were screened by reading before moving on to data extraction using a previously created data collection form to ensure the studies' eligibility. At each level, disagreements between reviewers were settled through discussion and, if necessary, consultation with a third reviewer.

4.5. Data extraction

The following data was taken from the studies and organised in tables based on the kind of treatment (porcelain veneers versus indirect composite resin veneers): authors with year of publication, type of study (randomised controlled, prospective, prospective, retrospective, case series), number of patients, dental preparation design, whether a night guard is utilised or not, type of porcelain, type of composite.

Primary variable:

- **Survival rate**: Comparing the survival rates of porcelain veneers with indirect composite resin veneers in bruxism patients to determine which has a higher survival rate and hence is the preferable treatment choice.

Secondary variables:

- **Potential advantages and disadvantages of each kind of veneer (porcelain, indirect composite resin)**: An examination of the properties of the two types of veneers in terms of survival rate in patients with bruxism.
- **Preparation design**: Determine the best veneer preparation design for bruxism patients.

- **Use of a night splint**: Examine whether wearing a night splint makes indirect composite resin and porcelain veneers more effective for treating patients with bruxism.

4.6. Quality assessment

The Cochrane 5.1.0 guide (http://handbook.cochrane.org) was used to evaluate the quality of the randomised controlled clinical studies. Publications were considered "low risk of bias" when they met all the criteria, and "high risk of bias" when one or more criteria were not met and the study was therefore considered to present a possibility of bias. The risk of bias assessment was evaluated by two reviewers (ZV, SMS) in order to analyse the methodological quality of the included articles (either due to lack of information or uncertainty about the potential for bias). Nonrandomised observational studies were graded according to the Newcastle-Ottawa scale (20), with a score of > 6 indicating "low risk of bias" and a score of ≤ 6 indicating "high risk of bias“.

4.7. Data synthesis

The means of the values of the primary variables (“survival rate“) were grouped by research group (“patients presenting bruxism“) in order to summarise and compare the outcome variables between the various studies.

5. RESULTS

5.1. Selection of studies. Flow chart

A total of 366 articles were obtained from the initial search process: Medline - PubMed (n=203), SCOPUS (n=207) and Web of Science (n=23).

Of these publications, 39 were identified as potentially eligible articles by screening by titles and abstracts. Full-text articles were subsequently obtained and thoroughly evaluated. As a result, 11 articles met the inclusion criteria and were included in the present systematic review (fig. 1). Information regarding the excluded articles (and the reasons for their exclusion) is presented in table 3.

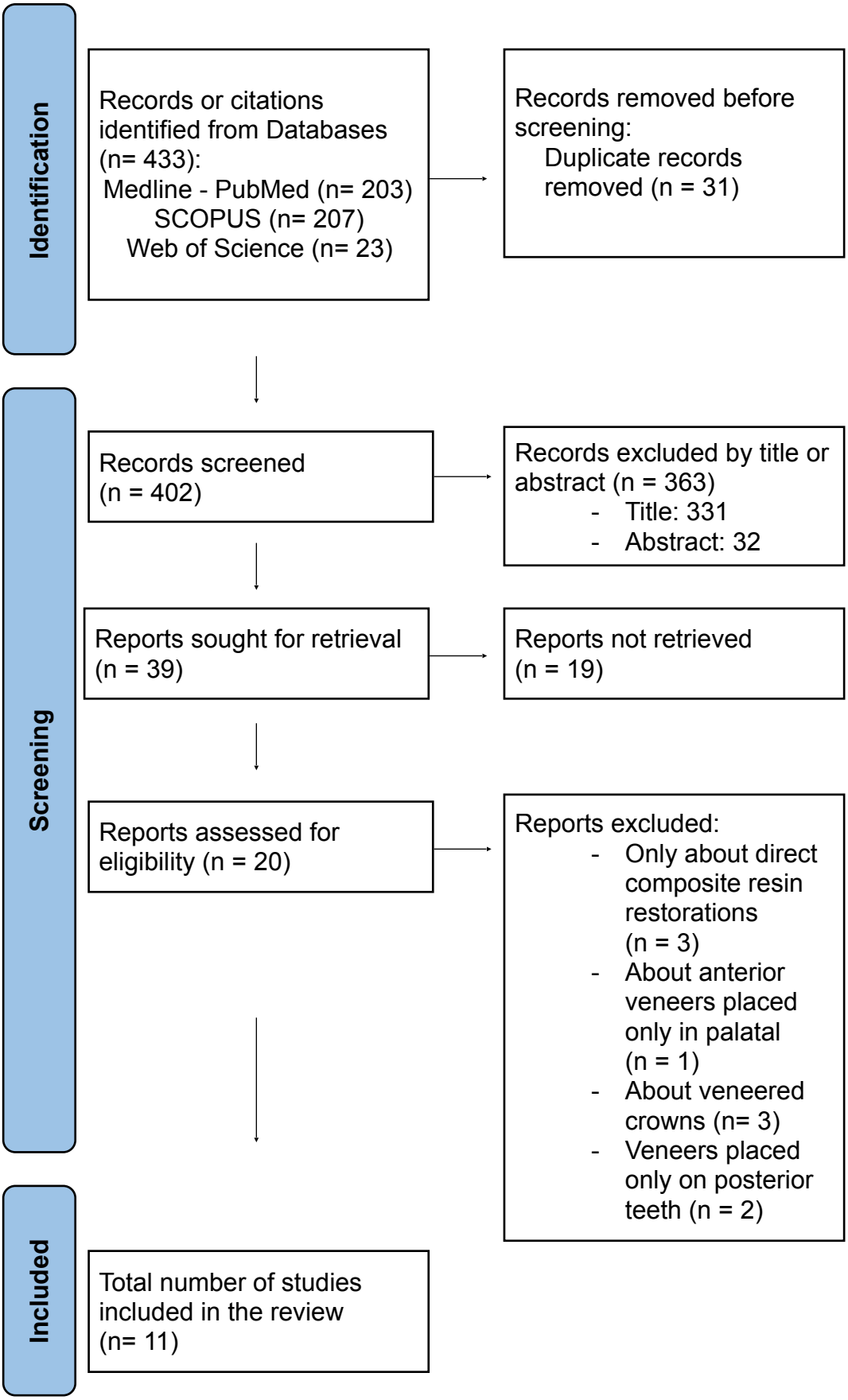

Fig. 1. Search flow diagram and title selection process during the systematic review.

Table 3: Articles excluded (and their reason for exclusion) from this systematic review.

Author. Year	Publication	Reason for exclusion
Ergin E, 2018 (22)	Niger J Clinc Pract	Only about direct composite resin restorations
Korkut B, 2021 (23)	J Esthet Restor Dent	Only about direct composite resin restorations
Montagner AF, 2018 (24)	Braz Dent J	Only about direct composite resin restorations
Crins LAMJ, 2021 (25)	Dent Mater	About anterior veneers placed only in palatal
Simeone P, 2015 (26)	Inter J Periodontics Restorative Dent	About veneered crowns
Levartovsky S, 2019 (27)	J Prosthodont Res	About veneered crowns
Strasding M, 2023 (28)	Clin Oral Implants Res	About veneered crowns
Schmitter M, 2022 (29)	J Clin Med	Veneers placed only on posterior teeth
Ravasini F, 2018 (30)	Inter J Periodontics Restorative Dent	Veneers placed only on posterior teeth

5.2. Analysis of the characteristics of the reviewed studies

Of the 11 articles included in the present review, 8 articles described characteristics and survival rate of porcelain veneers (31-38), 2 made a comparison of survival rate of both porcelain veneers and indirect composite resin veneers (39,40) and 1 illustrated the digital CAD CAM method (41).

2 articles were randomised controlled (39,40), 3 were prospective studies (31, 32, 33), 3 retrospective studies (35, 37, 38), 1 cohort study (34), 1 analytic study (36) and 1 clinical protocol (41). In the randomised studies the patient was the unit of randomisation.

A total of 415 patients were treated with a total of 2126 veneer restorations: 2079 porcelain veneers and 47 indirect composite resin veneers. The study by

Ustun O et al. (36) used three models simulating the cross section of a maxillary incisor. There was a range of the number of patients between 4-104 patients. Most veneers were placed in the anterior maxilla. Regarding the dental preparation, most investigations performed an incisal overlap. Moreover the majority of patients diagnosed with bruxism was instructed to use an occlusal splint.

Characteristics of the studies in general and specific for each study are displayed in tables 4 and 5.

Table 4: Characteristics of the reviewed studies. Overview.

Study characteristic variables		Porcelain	Indirect composite resin	Total
Type of study	Randomised	2	2	4
	Prospective	3	0	3
	Retrospective	3	0	3
	Cohort	1	0	1
	Analytic study	1	0	1
	Clinical protocol	1	0	1
N° of patients (range minimum to maximum)		4 - 104	10 - 11	4 - 104
Location	Maxilla	1958	47	2005
	Mandible	439	0	439
	Anterior	1668	47	1715
	Posterior	330	0	330
Tooth preparation	With incisal overlap	823	47	870
	Without incisal overlap (simple / window)	488	0	488

Table 5: Characteristics of the reviewed studies. Specific for each study.

Author (year)	Type of study	N° of patients	Dental preparation design	Splint: yes/no	Type of porcelain	Type of composite
Beier US et al. 2012 (38)	Prospective	84	-	Yes	Feldspar, Leucite heat-pressed c. or Lithium disilicate heat-pressed c.	-
Faus-Matoses V et al. 2020 (32)	Prospective	64	With incisal overlap	Yes	Feldspar	-
Germano F et al. 2017 (41)	Clinical protocol	4	-	No	Feldspar	-
Granell-Ruíz M et al. 2014 (37)	Retrospective	70	With/without incisal overlap	Yes	IPS-Empress	-
Gresnigt MM et al. 2013 (40)	RCT	10	With incisal overlap	-	IPS-Empress	Estenia
Gresnigt MM et al. 2013 (33)	Prospective	20	With incisal overlap	-	Feldspar	-
Gresnigt MM et al. 2019 (39)	RCT	11	With incisal overlap	-	IPS-Empress	Estenia
Gresnigt MM et al. 2019 (31)	Prospective	104	With incisal overlap	Yes	Feldspar (leucite crystals)	-
Klink A et al. 2018 (34)	Cohort	17	-	Yes	Feldspar, Leucite-reinforced lithium silicate Ceramic, lithium disilicate	-
Rinke S et al. 2020 (35)	Retrospective	31	With incisal overlap		Heat pressed leucite-reinforced glass-ceramic	-
Ustun O et al. 2018 (36)	Analytic	3 models	Featheredge Incisal bevel Overlapped	-	IPS e.max (lithium disilicate glass ceramic)	-

5.3. Assessment of methodological quality and risk of bias

For randomised studies, an unclear risk of bias was considered in all 2 studies (Table 6). For the non-randomised observational studies, all 7 were considered at low risk of bias (tables 7 and 8).

Performance, detection and attrition bias were items with unclear risk of bias (Fig. 2).

Table 6: Measurement of risk of bias of randomised studies according to the Cochrane guidelines.

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Gresnigt et al. 2013 (40)	+	+	?	?	+	+	+
Gresnigt et al. 2019 (39)	+	+	+	+	?	+	+

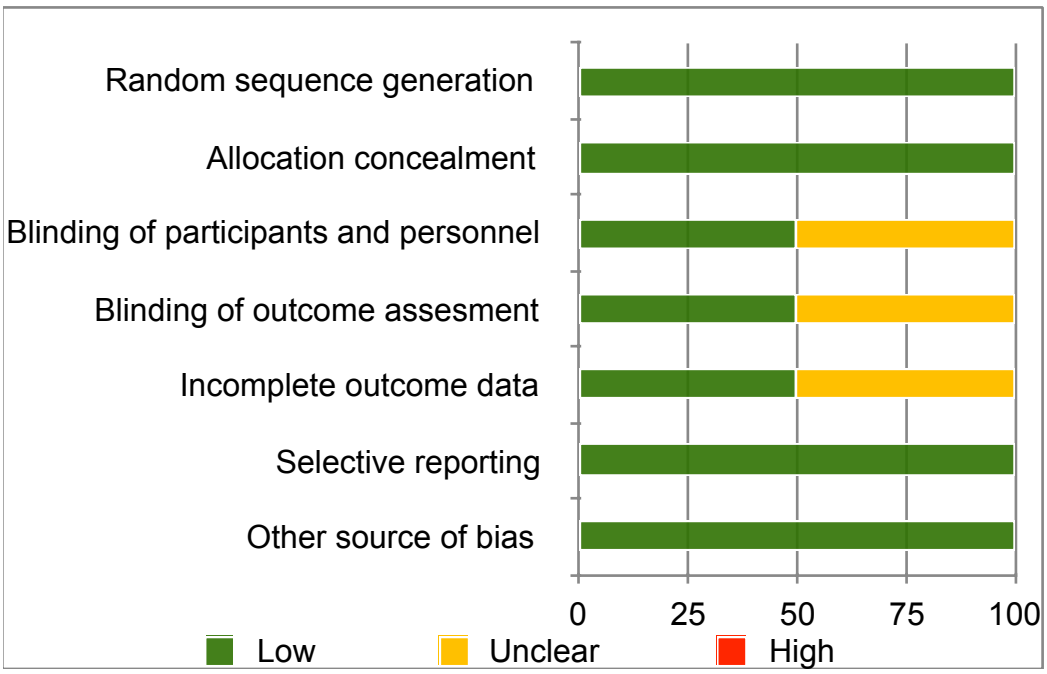

Fig. 2. Representation of the risk of bias

Table 7: Measurement of risk of bias of non-randomised observational studies with the Newcastle-Ottawa scale - observational studies with non-randomised control group.

	Definition of the cases	Representativeness	Selection of controls	Definition of controls	Comparability (most important factor)	Comparabilty (any other variable)	Exposure check	Same method for both groups	Dropout rate	Total
Gresnigt MMM et al. 2019 (31)	★	★	★	★	★	★	★	★	-	8
Faus-Matoses V et al. 2020 (32)	★	-	★	★	★	★	★	★	-	7
Granell-Ruíz Met al. 2014 (37)	★	-	-	★	★	★	★	★	★	7

Table 8: Measurement of risk of bias of non-randomised observational studies with the Newcastle-Ottawa scale - observational cohort studies without control group.

	Cohort representativeness	Unexposed cohort selection	Exposure check	Demonstration no variable presence	Comparability (most important factor)	Comparabilty (any other variable)	Measurement results	Enough follow up	Dropout rate	Total
Gresnigt MMM et al. 2013 (33)	-	★	★	★	★	★	★	★	-	7
Klink A et al. 2018 (34)	★	★	★	★	★	★	★	★	★	9
Rinke S et al. 2020 (35)	-	★	★	★	★	★	★	★	-	7
Beier US et al. 2012 (38)	-	★	★	★	★	★	★	★	-	7

5.4. Synthesis of results

5.4.1. Survival rate

Comparing the survival rates of indirect composite resin veneers and porcelain veneers, it can be noted that the indirect composite resin veneers had a general lower survival expectancy: 87% after 20,3 months (40) and 75% after 97 months (39). Both studies (39, 40) included patients presenting bruxism which were obligated to wear an occlusal splint. Further, the type of composite used in both researches was Estenia (39, 40), therefore no comparison can be drawn between different types of composite.
Regarding the number of failures, the study of Gresnigt MMM et al. (39) had in total 6 failures only in the indirect composite resin group (3 debondings and 3 fractures).

IPS-Empress ceramic veneers showed a survival rate of 100% after 20,3 and 97 months without failures (39, 40). Again patients with bruxism where advised to use an occlusal splint (39, 40). In addition to that the study of Granell-Ruíz M et al. (37) pointed out that IPS-Empress ceramic veneers have a survival rate of 89,5% after 11 years. Half of the bruxism population complied with the requirement to use an occlusal splint and the other half did not (37). Also, this study included 42 failures, 29 debondings and 13 fractures (37).

Porcelain veneers made of feldspathic ceramic reinforced with leucite crystals displayed a general survival rate of 95% after 11 years (31). Patients with parafunctional habits received an occlusal splint. 19 failures were observed in form of debonding (n=3), cracking and fracture (n=15) and extraction due to endodontic complications (n=1). Teeth with more than 50% dentin exposure without immediate dentin sealing (IDS) showed a survival of 84,6% and 16 failures. Teeth treated with IDS presented a survival of 99% and only 3 failures.
Nine failures occurred in patients who omitted to wear their prescribed occlusal appliance, 2 due to dental trauma, 5 due to adhesive failure and the rest is unknown (31).
Laminates made of feldspathic ceramic displayed an overall survival rate of 93,7% after 3 years, 91% after 5 years and 87,1% after 8 years (32). In patients

diagnosed with bruxism, the survival rate was 89,1% using an occlusal splint and 63,9% using no occlusal splint after 7 years. A total of 28 failures were observed, ten veneers were fractured in patients with bruxism that used no occlusal splint. Five patients presented debonding of 7 veneers; three of these occurred in a single patient affected by bruxism, who also used no occlusal splint (32).

Another study by Gresnigt MMM et al. (33) investigated about feldspathic ceramic veneers showing a general survival rate of 94,6%, 96% without existing composite restorations (ECR) and 93,5% with ECR. Patients with bruxism received splints after the cementation. A total of five absolute failures were observed in the form of debonding (n=1), chipping (n=1) and fractures (n=3) (33).

The study of Beier US et al. (38) used different materials, such as Feldspathic ceramic, Leucite heat-pressed ceramic, or Lithium disilicate heat-pressed ceramic showing a survival rate of 94,4% after 5 years, 93,5% after 10 years and 82,93% after 20 years. It pointed out a significantly higher failure rate for veneer restorations in patients who were bruxers (38).

Descriptive results on survival rate are shown in Table 9.

Table 9: Descriptive results of indirect composite resin and porcelain veneers regarding their survival rate.

Indirect composite resin:

	N° of veneers	N° of recalls	N° of dropouts	Type of material	Mean observation time	Bruxists (+ use of splint)	N° of failures	Survival rate
Gresnigt MMM et al. 2019 (39)	24	5	0	Estenia	97 months	2	6	75 %
Gresnigt MM et al. 2013 (40)	23	5	0	Estenia	20,3 months	2	3	87 %

Porcelain:

	N° of veneers	N° of recalls	N° of dropouts	Type of material	Mean observation time	Bruxists	N° of failures	Survival rate
Gresnigt MMM et al. 2019 (39)	24	5	0	IPS - Empress	97 months	2	0	100 %
Gresnigt MMM et al. 2019 (31)	384	4	14	Feldspar (leucite crystals)	55,8 months	18	19	95% (x^1); 84,6% (x^2); 99% (x^3)
Gresnigt MM et al. 2013 (40)	23	5	0	IPS - Impress	20,3 months	2	0	100 %
Faus-Matoses V et al. 2020 (32)	364	/	/	Feldspar	5,2 +/- 1.7 years	40	28	93,7% (x^4); 91% (x^5); 87,1% (x^6); 89,1% (x^7); 63,9% (x^8)
Gresnigt MMM et al. 2013 (33)	92	5	0	Feldspar	21,6 months	3	5	94,6% (x^9); 96% (x^{10}); 93,5% (x^{11})
Rinke S et al. 2020 (35)	101	/	6	Heat-pressed leucite-reinforced glass-ceramic	10 years	/	10	91,8 %
Granell-Ruíz M et al. 2014 (37)	323	/	/	IPS-Empress	11 years	15 (+splint) 15 (-splint)	42	89,5 %

Beier US et al. 2012 (38)	318	/	/	Feldspar, Leucite heat-pressed ceramic, or Lithium disilicate heat-pressed ceramic	118 +/- 63 months	42	29	94,4% (x^{12}); 93,5% (x^{13}); 82,93% (x^{14})

Legend for table above:

x^{1}: Overall survival rate after 11 years
x^{2}: Immediate dentin sealing (IDS) not applied
x^{3}: Immediate dentin sealing (IDS) applied
x^{4}: Overall survival rate after 3 years
x^{5}: Overall survival rate after 5 years
x^{6}: Overall survival rate after 8 years
x^{7}: Patients with bruxism using an occlusal splint (after 7 years)
x^{8}: Patients with bruxism using no occlusal splint (after 7 years)
x^{9}: Overall survival rate
x^{10}: Survival rate without existing composite restoration (ECR)
x^{11}: Survival rate with existing composite restoration (ECR)
x^{12}: Survival rate after 5 years
x^{13}: Survival rate after 10 years
x^{14}: Survival rate after 20 years

5.4.2. Benefits and drawbacks of each kind of veneer

In the study of Gresnigt MM et al. (40) it was observed that after 3 years marginal discrepancies were observed in 6 composite (Estenia) and 3 ceramic (IPS-Empress) veneers. Slight staining of the margins and surface roughness were more frequently observed in the indirect composite resin veneer group. Fractures, wear, secondary caries or postoperative sensitivity were not observed in any of the cases.

In the follow-up study (39) after 10 years, marginal discrepancies were observed in 14 of the composite and 10 of the ceramic veneers. Ceramic laminate veneers matched the colour of the surrounded teeth, composite restorations did not match for 8 laminate veneers. Slight staining at the margins was seen more frequent with the composite laminate veneers (n=12). Slightly rough surfaces were significantly more observed in the resin composite

laminate veneer group (n=18) until the final recall. Fractures were significantly more seen (n=6) in the indirect composite group and chipping of tooth material were more seen in the composite group as well. Wear of the restoration was significantly more seen in the indirect composite group (n=7). Wear or secondary caries were not observed in any of the cases.

In general, for all of these variables, the ceramic restorations were rated better.

Descriptive results on survival rate are shown in Table 10.

Because it is a safe, predictable, and personalised technique as well as one that seems to be simpler, faster, and less expensive than conventional protocols, the treatment with digital CAD/CAM chair-side workflow is a viable alternative to rehabilitate patients with worn dentition, resulting in almost 100% cumulative survival rate. The only negative occurrence was a veneer chipping; no occlusal problems, bridge fractures, veneer debonding, or pulp-type problems have been reported (40).

Table 10: Descriptive results of indirect composite resin and porcelain veneers regarding their advantages and disadvantages.

	Gresnigt MM et al. 2013 (40) - After 3 years - Total of 46 V.		Gresnigt MM et al. 2019 (39) - After 10 years - Total of 48 V.	
	Estenia (n=23)	IPS-Empress (n=23)	Estenia (n=24)	IPS-Empress (n=24)
Marginal discrepancies	6	3	14	10
Colour mismatch	0	4	8	0
Marginal discolouration	3	1	12	7
Surface roughness	18	0	18	0
Fracture of restoration	0	0	6	1
Fracture of tooth	0	0	3	0
Wear of restoration	0	0	7	1
Wear of antagonist	0	0	0	0
Caries	0	0	0	0
Postoperative sensitivity	0	0	1	1

5.4.3. Preparation design

The majority of dental preparation was done with incisal overlap and shallow chamfer line (0,5mm), positioned equi- or supra-gingival (39, 40, 33). All indirect composite resin veneers were prepared by this technique (39, 40), only the porcelain veneers varied in their preparation design (31-33, 39, 40, 35, 37).

Granell-Ruíz M et al. (37) compared the conventional (without incisal overlap) and functional (with incisal overlap) dental preparation design in the presence of bruxism activity. No significant differences were found between the type of dental preparation used (conventional or functional) and the presence of bruxism activity although in this study most patients with bruxism were fitted with the functional design.

Another study compared with the help of models three different preparation designs: Featheredge preparation, incisal bevel preparation and overlapped preparation. The incisal bevel preparation designs showed minimum stress values compared with the other preparation designs (36).

According to Faus-Matoses V et al. (32) dental preparations should be as conservative as possible (without incisal overlap) in order to preserve the enamel, as the ceramic-enamel bond is “stronger” in terms of long-term performance than ceramic veneers bonded to dentine.

Descriptive results on survival rate are shown in Table 11.

Table 11: Descriptive results of indirect composite resin and porcelain veneers regarding their dental preparation.

Indirect composite resin:

	With incisal overlap	Without incisal overlap	Labial	Palatal/ Lingual	Interproximal	Termination line
Gresnigt MMM et al. 2019 (39)	1-1,5mm		0,3-0,5 mm		Shallow chamfered marginal finish line extended inter-proximally	Shallow chamfer line (0,5mm) Equi- or supra-gingival
Gresnigt MMM et al. 2013 (40)	1-1,5mm		0,3-0,5 mm	Right-angled con- tour (butt joint) between the incisal edge and the palatal surface	Shallow chamfered marginal finish line extended inter-proximally	Shallow chamfer line (0,5mm) Equi- or supra-gingival

Porcelain:

	With incisal overlap	Without incisal overlap	Labial	Palatal/ Lingual	Interproximal	Termination line
Gresnigt MMM et al. 2019 (39)	1-1,5mm		0,3-0,5 mm		Shallow chamfered marginal finish line extended inter-proximally	Shallow chamfer line (0,5mm) Equi- or supra-gingival
Gresnigt MMM et al. 2019 (31)	1-1,5mm		0,1 (cervical) to 0,7mm (mid-height)		Marginal finish line extended inter-proximally	Shallow chamfer finish line (ca. 0.1 mm) Equi-gingivally or up to 0.5 mm intrasul-cular

Gresnigt MMM et al. 2013 (40)	1-1,5mm		0,3-0,5 mm	Right-angled con- tour (butt joint) between the incisal edge and the palatal surface	Shallow chamfered marginal finish line extended inter-proximally	Shallow chamfer line (0,5mm) Equi- or supra-gingival
Faus-Matoses V et al. 2020 (32)		x			When necessary, contact points were broken with metal strips	Curved chamfer line Juxtagingival
Gresnigt MMM et al. 2013 (33)	1-1,5mm		0,3-0,5 mm		Light chamfered marginal finish line extended interproximally	Shallow chamfer line (0,5mm) Equi- or supra-gingival
Rinke S et al. 2020 (35)	At least 1,0 mm while slightly bevelling incisor		0,5mm		Proximal contacts were removed	Labial chamfer (minimum preparation depth: 0.3 mm)
Granell-Ruíz M et al. 2014 (37)	x	x				

5.4.4. Night splint

Generally patients presenting bruxism were instructed to use an occlusal splint and that in case of non-compliance there would be a risk of failure of the veneers restorations (31,32,37,38,40). In the study of Beier US et al. (38), patients were informed before the dental preparation that there was an almost 8-times higher risk of failure resulting from bruxism as motivation to wear the guard during bruxing episodes.

According to the studies of Faus-Matoses V et al. (32) and Granell-Ruíz M et al. (37) fractures of the veneers were more frequent in the presence of bruxism but not statistically significant. In contrast to that statistically significant differences were found when examining the correct use of splints in patients with bruxism,

since fractures were less common in patients who use it adequately. Debonding, which is also observed to be more in bruxism patients, showed clear statistically significant difference between the two groups of patients (with and without bruxism activity). However, debonding did not statistically improve or worsen with or without the use a night splint (32,37).

6. DISCUSSION

This literature review provides evidence-based information on the results of the survival rates of veneers in patients diagnosed with bruxism using porcelain veneers in comparison to indirect composite resin veneers.
The objective of this review was to assess the survival rates of both types of veneers; secondary objectives included a study of each type of veneer's potential benefits and drawbacks, as well as the preparation design and the impact of wearing a night splint.

6.1. Survival rate

Laminate veneer restorations are recommended in restorative dentistry as a minimally invasive treatment strategy for a variety of aesthetic reasons. There is disagreement over whether ceramic or composite materials should be used as restorative materials, according to the literature (31,39). Laminate veneers offer one of the major possibilities to undertake an extremely cosmetic repair of buccal and proximal dental surfaces (32). However, given that veneers have a higher failure rate, several authors contend that parafunction (bruxism) is a contraindication to adhesive restorations (37, 38).

The findings of this systematic review, based on 11 scientific investigations, indicate that ceramic veneers demonstrate a higher survival rate than indirect composite resin veneers in patients with bruxism. This conclusion is consistent with several studies included in the analysis (37,39,40). The survival rate of indirect composite resin veneers is considerably lower, according to the research of Nazar A et al. (43), since this material has a lower resistance to crack propagation, a rougher surface and pigments in composite resin can undergo discolouration over time. A study is testing a new resin composite “NECO” (Heraeus Kulzer, GmbH) as a material for indirect restorations clinically showed survival rates of 91.6% after 3 years (44) and increases the survival rate from Estenia of 87% after 20,3 months (40) and 75% after 97 months (39). Further, the investigation of Kam Hepdeniz O et al. (45) results in a survival rate of 91,3% using indirect microhybrid composite material (Gradia, GC Dental) but

it has to be noted that no tooth preparation is performed. All comparing studies are not using Estenia (particulate-filled composite), as our initial studies (39, 40) but there are no other studies which are using Estenia as material for the indirect composite resin veneers.

According to Zimmer D et al. (46) one reason for the superior performance of ceramic veneers is their inherent material properties. Ceramic veneers, such as IPS-Empress and feldspathic ceramic reinforced with leucite crystals, exhibit excellent durability and resistance to wear and fractures (46). These materials are specifically designed to withstand the forces associated with bruxism, making them more suitable for individuals with this condition.

Additionally, ceramic veneers offer advantages in terms of aesthetics and natural appearance. Ceramic materials, especially feldspathic ceramics, have the ability to closely mimic the translucency and colour of natural teeth contributes to a more aesthetically pleasing result (48). Patients often express concern about the appearance of their anterior teeth, and ceramic veneers provide a superior option for achieving a desirable cosmetic outcome (2).

Moreover, ceramic veneers have been found to exhibit better resistance to minor imperfections, colour stability, and surface roughness compared to indirect composite resin veneers (49). These factors contribute to the longevity and overall success of the restorative treatment.

It is worth noting that the survival rates reported in the selected studies indicate remarkable longevity for ceramic veneers. IPS-Empress ceramic veneers demonstrate a survival rate of 100% after 20.3 months and 97 months, with a rate of 89.5% after 11 years (37,39,40). Similarly, feldspathic ceramic reinforced with leucite crystals exhibited a survival rate of 95% after 11 years (31). Simple feldspathic ceramic veneers display, in comparison, a lower survival rate of 93.7% after three years, 91% after five years, and 87.1% after eight years (32).

Based on the analysed evidence, ceramic veneers, mainly IPS-Empress and feldspathic ceramic reinforced with leucite crystals, exhibit a higher survival rate and offer advantages in terms of durability, aesthetics, and resistance to imperfections compared to indirect composite resin veneers in patients with bruxism.

In our research, we observed that teeth lacking immediate dentin sealing (IDS) with more than 50% of dentin exposed exhibited a lower survival rate of 84.6% when restored with porcelain veneers (31). This finding aligns with the work of Magne P et al. (47), who emphasises the importance of immediate dentin sealing in tooth preparation for indirect bonded restorations.

According to Magne P et al. (47), tooth preparation for indirect bonded restorations often results in significant dentin exposure. They recommend sealing these freshly cut dentin surfaces with a dentin bonding agent (DBA) immediately after tooth preparation and before taking the impression. This practice has shown positive effects on tooth structure preservation, patient comfort, and the long-term survival of indirect bonded restorations (47).

By applying immediate dentin sealing, the bonding interface between the tooth structure and the restoration is reinforced, providing better resistance against the forces generated by bruxism. This approach helps to minimise the risk of micro leakage, postoperative sensitivity, and secondary caries formation. As a result, porcelain veneers placed on teeth with IDS exhibit a significantly higher survival rate of 99% (31).

Therefore, the inclusion of immediate dentin sealing as a standard protocol during tooth preparation for indirect bonded restorations, including porcelain veneers, can greatly contribute to the preservation of tooth structure, enhance patient comfort, and improve the long-term survival of the restorations.

6.2. Advantages and disadvantages of each kind of veneer

After a follow-up period of 3 years, indirect composite resin veneers (Estenia) and ceramic veneers (IPS-Empress) exhibit the following properties: Marginal discrepancies, staining of margins and surface roughness are more frequently seen in composite veneers, whereas fractures, wear, secondary caries or postoperative sensitivity are not observed in indirect composite resin or ceramic veneers (40).

In comparison to that, 10 years later, there is a higher number of marginal discrepancies for both types of veneers but the indirect composite resin veneer still predominates. Regarding the colour match to the surrounding teeth, all

ceramic laminate veneers fulfil this requirement but not all of the indirect composite resin veneers are not able to do so. Moreover, slight staining at the margins, slightly rough surfaces, fractures and chipping of tooth material are more frequently seen with the indirect composite laminate veneers. Also the wear of the restoration is significantly higher in the indirect composite group. Neither wear nor secondary caries are observed in any of the cases (39).

These statements, regarding the advantages and disadvantages of indirect composite resin veneers and ceramic veneers, can be compared to the outcomes of the investigation of Alothman Y et al. (49). It is important to highlight beforehand that the comparing study is not only talking about Estenia and IPS-Empress as materials, as in our initial studies (39,40), but about materials in general for indirect composite resin and ceramic veneers.
The research supports the idea that composite resins are more prone to wear and discolouration when it comes to indirect composite resin veneers. Additionally, they list the benefits of composite resin, such as the lack of labor-intensive preparations, shorter chair sessions, and good initial aesthetics, as well as its drawbacks, like polymerisation shrinkage (49).
Speaking of ceramic veneers, the study also concurs that they are highly aesthetically pleasing, require little preparation, and have good mechanical qualities. They also have some drawbacks, such as fabrication technique sensitivity (require good care prior to bonding), difficulty in masking heavily discoloured teeth due to the thinness of the porcelain, and the possibility of micro-cracks developing when the porcelain is etched, which could eventually cause the veneer to break.
Additionally, new ceramic systems have been created recently, such as IPS e.max press from Ivoclar Vivadent, where leucite is added to the glass matrix to increase the strength of the ceramic. However, clinical studies examining the success of using these new systems as laminate veneers are lacking for these new systems. Future research in this area is thus necessary (49).

6.3. Preparation design

In this systematic review all indirect composite resin veneers are prepared with incisal overlap and shallow chamfer line (0,5mm), positioned equi- or supra-gingival (39,40). Therefore no comparisons can be drawn, in terms of preparation design, in the indirect composite resin veneer group.

The porcelain veneers vary in their preparation design: Granell-Ruíz M et al. (37) compares the conventional (without incisal overlap) and functional (with incisal overlap) preparation design, but no significant differences are found. Furthermore featheredge preparation, incisal bevel preparation and overlapped preparation are compared, where the incisal bevel preparation designs shows minimum stress values (36).

According to Faus-Matoses V et al. (32) dental preparations should be as conservative as possible (without incisal overllap).

The statements of our investigation are inconsistent with each other as to which preparation is the best.

In a research that examines the impact of preparation design on the longevity of the restoration, there are many viewpoints and outcomes, according to the study of Alothman Y et al. (49). The best support for the restoration appears to come from incisal overlap preparation, which also disperses occlusal stresses across a broader surface area. The incisal third experiences a great deal of occlusal stress during the window preparation, which could cause the restoration to fracture. Additionally, by reducing the incisal edge, incisal translucency can be obtained more effectively. However, it is debatable whether adding a chamfer finish line or having a shoulder finish line (butt joint) is preferable. According dental reports, a chamfer finish line is necessary for the restoration to tolerate occlusal stress. The suggestion is that a chamfer finish line does not increase the longevity of the restoration, on the other hand. They also claim that veneers with butt-joint finish lines could offer multiple insertion paths. However, having just one line of insertion can be advantageous since it stops the veneer from shifting during cementation. The study concludes that an overlap preparation with chamfer finish line does not reduce the treatment's durability and predictability. Since the anterior teeth only have a low biting force

(between 100 and 200 N) (Carlsson 1973), the choice of preparation design is primarily based on the preferences of the clinician. However, incisal overlap can always be used to restore anterior guidance (49).

6.4. Night splint

According to the studies of Faus-Matoses V et al. (32) and Granell-Ruíz M et al. (37) statistically significant differences are found when examining the correct use of splints in patients with bruxism, since fractures are less common in patients who use it adequately. Debonding does not statistically improve or worsen with or without the use a night splint (32, 37).
These results are consistent with the study by Mengatto CM et al. (50), talking about the importance of using an interocclusal splint device before and after the restorative treatment with composite or ceramic veneers for bruxism patients, either for muscular and joint repositioning or to protect the restored structures.

6.5. Limitations of this study

Only two of the 11 included investigations were randomised controlled, which is why the current analysis found a lack of randomised comparative clinical investigations. According to Richards (51), the scarcity of this kind of study design suggests low levels of evidence, making it impossible to do a meta-analysis that could establish whether a strategy was preferable. Because of this, it is advised to use caution when interpreting the data, which were descriptive for each study group.
Another limitation encountered is the variability in follow-up time, as well as the lack of data regarding different materials used for indirect composite resin veneers. In this study, only one material, Estenia, is used for this type of veneer. This limits the ability to draw general conclusions about the effectiveness of other materials for indirect composite resin veneers.
Additionally, more studies are needed to make direct comparisons between indirect composite resin veneers and porcelain veneers. While there may be a wealth of information available for porcelain veneers alone, there is only few

information available about porcelain and indirect composite resin veneers together. Therefore, it may be difficult to generalise the findings for porcelain veneers to indirect composite resin veneers.

Further, the review may reveal a need for more studies on different preparation designs in relation to indirect composite resin veneers. This is important because the way in which the tooth is prepared can impact the success and longevity of the veneer. Without sufficient data on different preparation designs, it may be challenging to make informed decisions about the most effective techniques to use.

Lastly, the review may highlight the need for more investigation into different types of occlusal splints and which type is most suitable for each kind of veneer (composite or porcelain). This is important because occlusal splints can help to prevent damage to the veneer and ensure proper alignment of the bite. Without clear guidance on which type of splint to use for each type of veneer, practitioners may struggle to make informed decisions.

Overall, while systematic reviews can provide valuable insights into the effectiveness of different treatments, they are not immune to limitations. As such, it is important to acknowledge these limitations and to continue conducting research to address any gaps in our understanding of these treatments.

7. CONCLUSION

Primary conclusions:

1. Both materials, indirect composite resin and porcelain, show a high survival rate, being higher for the porcelain group.

Secondary conclusions:

1. Ceramic veneers outperformed indirect composite resin veneers in terms of imperfections, colour matching, discolouration, surface roughness, fractures, and wear, indicating their potential advantages.
2. Conservative approaches, including both avoiding and implementing incisal overlap in dental preparations, show promising results for long-term veneer performance.
3. Bruxism may increase the risk of fractures and debonding in veneer restorations, but proper use of occlusal splints by bruxism patients can help mitigate these issues.

BIBLIOGRAPHY

1. Godoy de Oliveira PT, Somacal DC, Júnior LHB, Spohr AM. Aesthetic rehabilitation in teeth with wear from bruxism and acid erosion. Open Dent J [Internet]. 2018;12(1):486–93. Available from: http://dx.doi.org/10.2174/1874210601812010486
2. Rees JS, Somi S. A guide to the clinical management of attrition. Br Dent J [Internet]. 2018;224(5):319–23. Available from: http://dx.doi.org/10.1038/sj.bdj.2018.169
3. Eli I, Bar-Tal Y, Kostovetzki I. At first glance: social meanings of dental appearance. J Public Health Dent [Internet]. 2001 Summer;61(3):150–4. Available from: http://dx.doi.org/10.1111/j.1752-7325.2001.tb03382.x
4. Abbasi MS, Lal A, Das G, Salman F, Akram A, Ahmed AR, et al. Impact of social media on aesthetic dentistry: General practitioners' perspectives. Healthcare (Basel) [Internet]. 2022;10(10):2055. Available from: http://dx.doi.org/10.3390/healthcare10102055
5. Vavrina J, Vavrina J. Bruxism: Classification, Diagnostics and treatment. Praxis (Bern 1994) [Internet]. 2020;109(12):973–8. Available from: http://dx.doi.org/10.1024/1661-8157/a003517
6. Manfredini D, Colonna A, Bracci A, Lobbezoo F. Bruxism: a summary of current knowledge on aetiology, assessment and management. Oral Surg [Internet]. 2020;13(4):358–70. Available from: http://dx.doi.org/10.1111/ors.12454
7. Kuhn M, Türp JC. Risk factors for bruxism. Swiss Dent J. 2018;128(2):118–24.
8. Dietschi D, Devigus A. Prefabricated composite veneers: historical perspectives, indications and clinical application. Eur J Esthet Dent. 2011 Summer;6(2):178–87.
9. Perdigão J. New developments in dental adhesion. Dent Clin North Am [Internet]. 2007;51(2):333–57, viii. Available from: http://dx.doi.org/10.1016/j.cden.2007.01.001
10. Sofan E, Sofan A, Palaia G, Tenore G, Romeo U, Migliau G. Classification review of dental adhesive systems: from the IV generation to the universal

type. Ann Stomatol (Roma) [Internet]. 2017;8(1):1–17. Available from: http://dx.doi.org/10.11138/ads/2017.8.1.001

11. El-Mowafy O, El-Aawar N, El-Mowafy N. Porcelain veneers: An update. Dent Med Probl [Internet]. 2018;55(2):207–11. Available from: http://dx.doi.org/10.17219/dmp/90729
12. Warreth A, Elkareimi Y. All-ceramic restorations: A review of the literature. Saudi Dent J [Internet]. 2020;32(8):365–72. Available from: http://dx.doi.org/10.1016/j.sdentj.2020.05.004
13. Agathian R, Manoharan PS, Rajkumar E. Indirect resin composite - A literature review. J Adv Clin Res Insights [Internet]. 2021;8(1):13–8. Available from: http://dx.doi.org/10.15713/ins.jcri.322
14. Elfakhri F, Alkahtani R, Li C, Khaliq J. Influence of filler characteristics on the performance of dental composites: A comprehensive review. Ceram Int [Internet]. 2022;48(19):27280–94. Available from: http://dx.doi.org/10.1016/j.ceramint.2022.06.314
15. Chaput F, Faure A-C. Dental composites. Techniques de l'Ingénieur Technologies Biomédicales [Internet]. 2021 [cited 2023 Feb 3]; Available from: https://hal.science/hal-03453701
16. Alenezi A, Alsweed M, Alsidrani S, Chrcanovic BR. Long-Term Survival and Complication Rates of Porcelain Laminate Veneers in Clinical Studies: A Systematic Review. J Clin Med. 2021;10(5):1074.
17. AlJazairy YH. Survival Rates for Porcelain Laminate Veneers: A SystematicReview. Eur J Dent. 2021;15(2):360-68.
18. Petridis HP, Zekeridou A, Malliari M, Tortopidis D, Koidis P. Survival of ceramic veneers made of different materials after a minimum follow-up period of five years: a systematic review and meta-analysis. Eur J Esthet Dent. 2012;7(2):138-52.
19. Stang A. Critical evaluation of the Newcastle-Ottawa scale for the assessment of the quality of nonrandomized studies in meta-analyses. European Journal of Epidemiology. 2010;25:603–5.

20. Landis JR, Koch GG. An application of hierarchical kappa-type statistics in the assessment of majority agreement among multiple observers. Biometrics. 1977;33:363–74.
21. Ergin E, Kutuk ZB, Cakir FY, Gurgan S. Comparison of two different composite resins used for tooth reshaping and diastema closure in a 4-year follow-up. Niger J Clin Pract [Internet]. 2018 [cited 2023 May 8];21(9):1098–106. Available from: https://pubmed.ncbi.nlm.nih.gov/30156192/
22. Korkut B, Türkmen C. Longevity of direct diastema closure and recontouring restorations with resin composites in maxillary anterior teeth: A 4-year clinical evaluation. J Esthet Restor Dent [Internet]. 2021 [cited 2023 May 8];33(4): 590–604. Available from: https://pubmed.ncbi.nlm.nih.gov/33354867/
23. Montagner AF, Sande FH van de, Müller C, Cenci MS, Susin AH. Survival, reasons for failure and clinical characteristics of anterior/posterior composites: 8-year findings. Braz Dent J [Internet]. 2018 [cited 2023 May 8]; 29(6):547–54. Available from: https://pubmed.ncbi.nlm.nih.gov/30517477/
24. Crins LAMJ, Opdam NJM, Kreulen CM, Bronkhorst EM, Sterenborg BAMM, Huysmans MCDNJM, et al. Randomized controlled trial on the performance of direct and indirect composite restorations in patients with severe tooth wear. Dent Mater [Internet]. 2021 [cited 2023 May 8];37(11):1645–54. Available from: https://pubmed.ncbi.nlm.nih.gov/34497023/
25. Simeone P, Gracis S. Eleven-year retrospective survival study of 275 veneered lithium disilicate single crowns. Int J Periodontics Restorative Dent [Internet]. 2015 [cited 2023 May 8];35(5):685–94. Available from: https://pubmed.ncbi.nlm.nih.gov/26357698/
26. Levartovsky S, Pilo R, Shadur A, Matalon S, Winocur E. Complete rehabilitation of patients with bruxism by veneered and non-veneered zirconia restorations with an increased vertical dimension of occlusion: an observational case-series study. J Prosthodont Res [Internet]. 2019 [cited 2023 May 8];63(4):440–6. Available from: https://pubmed.ncbi.nlm.nih.gov/30904358/
27. Strasding M, Hicklin SP, Todorovic A, Fehmer V, Mojon P, Sailer I. A multicenter randomized controlled clinical pilot study of buccally micro-veneered lithium-disilicate and zirconia crowns supported by titanium base

abutments: 1-year outcomes. Clin Oral Implants Res [Internet]. 2023 [cited 2023 May 8];34(1):56–65. Available from: https://pubmed.ncbi.nlm.nih.gov/36321877/

28. Schmitter M, Bömicke W, Behnisch R, Lorenzo Bermejo J, Waldecker M, Rammelsberg P, et al. Ceramic crowns and sleep bruxism: First results from a randomized trial. J Clin Med [Internet]. 2022 [cited 2023 May 8];12(1):273. Available from: https://pubmed.ncbi.nlm.nih.gov/36615073/
29. Ravasini F, Bellussi D, Pedrazzoni M, Ravasini T, Orlandini P, Meleti M, et al. Treatment outcome of posterior composite indirect restorations: A retrospective 20-year analysis of 525 cases with a mean follow-up of 87 months. Int J Periodontics Restorative Dent [Internet]. 2018 [cited 2023 May 8];38(5):655–63. Available from: https://pubmed.ncbi.nlm.nih.gov/30113605/
30. Gresnigt MMM, Cune MS, Schuitemaker J, van der Made SAM, Meisberger EW, Magne P, et al. Performance of ceramic laminate veneers with immediate dentine sealing: An 11 year prospective clinical trial. Dent Mater [Internet]. 2019;35(7):1042–52. Available from: https://www.sciencedirect.com/science/article/pii/S0109564118312673
31. Faus-Matoses V, Ruiz-Bell E, Faus-Matoses I, Özcan M, Salvatore S, Faus-Llácer VJ. An 8-year prospective clinical investigation on the survival rate of feldspathic veneers: Influence of occlusal splint in patients with bruxism. J Dent [Internet]. 2020 [cited 2023 May 8];99(103352):103352. Available from: https://pubmed.ncbi.nlm.nih.gov/32413382/
32. Gresnigt MMM, Kalk W, Özcan M. Clinical longevity of ceramic laminate veneers bonded to teeth with and without existing composite restorations up to 40 months. Clin Oral Investig [Internet]. 2013 [cited 2023 May 8];17(3):823–32. Available from: https://pubmed.ncbi.nlm.nih.gov/22821429/
33. Klink A, Groten M, Huettig F. Complete rehabilitation of compromised full dentitions with adhesively bonded all-ceramic single-tooth restorations: Long-term outcome in patients with and without amelogenesis imperfecta. J Dent [Internet]. 2018 [cited 2023 May 8];70:51–8. Available from: https://pubmed.ncbi.nlm.nih.gov/29275170/
34. Rinke S, Bettenhäuser-Hartung L, Leha A, Rödiger M, Schmalz G, Ziebolz D. Retrospective evaluation of extended glass-ceramic ceramic laminate

veneers after a mean observational period of 10 years. J Esthet Restor Dent [Internet]. 2020 [cited 2023 May 8];32(5):487–95. Available from: https://pubmed.ncbi.nlm.nih.gov/32452164/

35. Ustun O, Ozturk AN. The evaluation of stress patterns in porcelain laminate veneers with different restoration designs and loading angles induced by functional loads: A three-dimensional finite element analysis study. Niger J Clin Pract [Internet]. 2018 [cited 2023 May 8];21(3):337–42. Available from: https://pubmed.ncbi.nlm.nih.gov/29519983/

36. Granell-Ruíz M, Agustín-Panadero R, Fons-Font A, Román-Rodríguez J-L, Solá-Ruíz M-F. Influence of bruxism on survival of porcelain laminate veneers. Med Oral Patol Oral Cir Bucal [Internet]. 2014 [cited 2023 May 8]; 19(5):e426-32. Available from: https://pubmed.ncbi.nlm.nih.gov/23986018/

37. Beier US, Kapferer I, Burtscher D, Dumfahrt H. Clinical performance of porcelain laminate veneers for up to 20 years. Int J Prosthodont [Internet]. 2012 [cited 2023 May 8];25(1):79–85. Available from: https://pubmed.ncbi.nlm.nih.gov/22259802/

38. Gresnigt MMM, Cune MS, Jansen K, van der Made SAM, Özcan M. Randomized clinical trial on indirect resin composite and ceramic laminate veneers: Up to 10-year findings. J Dent [Internet]. 2019 [cited 2023 May 8]; 86:102–9. Available from: https://pubmed.ncbi.nlm.nih.gov/31181242/

39. Gresnigt MM, Kalk W, Ozcan M. Randomized clinical trial of indirect resin composite and ceramic veneers: up to 3-year follow-up. J Adhes Dent [Internet]. 2013 [cited 2023 May 8];15(2):181–90. Available from: https://pubmed.ncbi.nlm.nih.gov/23534025/

40. Germano F. Clinical protocol with digital cad/cam chairside workflow for the rehabilitation of severely worn dentition patients. Oral Implantol (Rome) [Internet]. 2017 [cited 2023 May 8];10(3):247. Available from: https://pubmed.ncbi.nlm.nih.gov/29285327/

41. Font AF, Ma F, Granell Ruíz M, Rueda CL, Martínez González A, Antonio P, et al. Choice of ceramic for use in treatments with porcelain laminate veneers [Internet]. Isciii.es. 2006 [cited 2023 May 15]. Available from: https://scielo.isciii.es/pdf/medicorpa/v11n3/en_17.pdf

42. Nazar A, Bader Munir M, Rafiq A, Khalid S, Hassan H. Success of veneers with indirect Resin Composite. Pakistan Journal of Medical and Health Sciences [Internet]. 2021;15(12):3619–22. Available from: https://pjmhsonline.com/2021/dec/3619.pdf
43. Jongsma LA, Kleverlaan CJ, Feilzer AJ. Clinical success and survival of indirect resin composite crowns: results of a 3-year prospective study. Dent Mater [Internet]. 2012;28(9):952–60. Available from: https://www.sciencedirect.com/science/article/pii/S0109564112001133
44. Kam Hepdeniz O, Temel UB. Clinical survival of No-prep indirect composite laminate veneers: a 7-year prospective case series study. BMC Oral Health [Internet]. 2023 [cited 2023 Jun 13];23(1):257. Available from: https://pubmed.ncbi.nlm.nih.gov/37138297/
45. Zimmer D, Gerds T, Strub JR. Survival rate of IPS-Empress 2 all-ceramic crowns and bridges: three year's results. Schweiz Monatsschr Zahnmed [Internet]. 2004 [cited 2023 Jun 13];114(2):115–9. Available from: https://pubmed.ncbi.nlm.nih.gov/15119706/
46. Magne P. Immediate dentin sealing: a fundamental procedure for indirect bonded restorations. J Esthet Restor Dent [Internet]. 2005 [cited 2023 Jun 13];17(3):144–54; discussion 155. Available from: https://pubmed.ncbi.nlm.nih.gov/15996383/
47. Morimoto S, Albanesi RB, Sesma N, Agra CM, Braga MM. Main clinical outcomes of feldspathic porcelain and glass-ceramic laminate veneers: A systematic review and meta-analysis of survival and complication rates. Int J Prosthodont [Internet]. 2016 [cited 2023 Jun 13];29(1):38–49. Available from: https://pubmed.ncbi.nlm.nih.gov/26757327/
48. Alothman Y, Bamasoud MS. The success of dental veneers according to preparation design and material type. Open Access Maced J Med Sci [Internet]. 2018 [cited 2023 Jun 13];6(12):2402–8. Available from: https://pubmed.ncbi.nlm.nih.gov/30607201/
49. Mengatto CM, Coelho-de-Souza FH, de Souza Junior OB. Sleep bruxism: challenges and restorative solutions. Clin Cosmet Investig Dent [Internet]. 2016;8:71–7. Available from: http://dx.doi.org/10.2147/CCIDE.S70715

50. Richards D. GRADING – levels of evidence. Evidence-Based Dentistry. 2009;10:24–5.
51. Moher D, Liberati A, Tetzlaff J, Altman DG, PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. Int J Surg. 2010;8:336–41.

ANNEXES

Table 1: summary of the searches of each of the databases consulted.

Databases	Search algorithm	Date	Number of articles
Pubmed	((Bruxism[MeSH Terms]) OR (Sleep Bruxisms[MeSH Terms])) OR (Bruxism, Sleep)) OR (Nocturnal Teeth Grinding Disorder)) OR (Sleep Related Bruxism)) OR (Adult Sleep Bruxism)) OR (Teeth grinding disorder)) AND ((dental porcelain[MeSH Terms]) OR (Porcelain laminate veneers)) OR (Porcelain veneers)) OR (Ceramic laminate veneers)) OR (Lithium Disilicate)) OR ((composite resins[MeSH Terms]) OR (indirect composite resin veneers)) OR (Prefabricated composite veneers)) OR (Indirect resin composite veneers)) OR (prefabricated resin composite veneers)) AND ((survival rate[MeSH Terms]) OR (survival rate)) Filter: Year: 2012-2023	January 2023	202
SCOPUS	(ALL ("Bruxism" OR "Sleep Bruxisms" OR "Bruxism, Sleep" OR "Nocturnal Teeth Grinding Disorder" OR "Sleep Related Bruxism" OR "Adult Sleep Bruxism" OR "Teeth grinding disorder") AND ALL ("dental porcelain" OR "Porcelain laminate veneers" OR "Porcelain veneers" OR "Ceramic laminate veneers" OR "Lithium Disilicate") OR ALL ("composite resins" OR "indirect composite resin veneers" OR "Prefabricated composite veneers" OR "Indirect resin composite veneers" OR "prefabricated resin composite veneers") AND ALL ("survival rate")) Filter: Year: 2012-2023	January 2023	140
Web of Science	(((TS=(Bruxism OR Sleep Bruxisms OR Bruxism, Sleep OR Nocturnal Teeth Grinding Disorder OR Sleep Related Bruxism OR Adult Sleep Bruxism OR Teeth grinding disorder)) AND TS=(dental porcelain OR Porcelain laminate veneers OR Porcelain veneers OR Ceramic laminate veneers OR Lithium Disilicate)) OR TS=(composite resins OR indirect composite resin veneers OR Prefabricated composite veneers OR Indirect resin composite veneers OR prefabricated resin composite veneers)) AND TS=(survival rate) Filter: Year: 2012-2023	January 2023	23

PRISMA guideline

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	**Front page**
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	**3-4**
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	**23-24**
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	**26**
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	**29**
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	**30-31**
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	**30-31**
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	**32**
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	**32-33**
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	**33**
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	**29**
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	**33**
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	**33**
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	**32-33**
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	**32-33**
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	**32-33**
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	**35-37**
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	**35-37**
Study characteristics	17	Cite each included study and present its characteristics.	**37-39**
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	**40-42**
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	**43-51**
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	**40-42**
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	**53-58**
	23b	Discuss any limitations of the evidence included in the review.	**58-59**
	23c	Discuss any limitations of the review processes used.	**58-59**
	23d	Discuss implications of the results for practice, policy, and future research.	
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	
Competing interests	26	Declare any competing interests of review authors.	
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	

SURVIVAL RATE OF PORCELAIN VENEERS VERSUS INDIRECT COMPOSITE RESIN VENEERS IN PATIENTS WITH BRUXISM: A SYSTEMATIC REVIEW

Running title: Survival rate of porcelain veneers versus indirect composite resin veneers in patients with Bruxism

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Abstract

Introduction: Finding the best aesthetically pleasing and durable material for anterior restorations is the subject of increasing numbers of studies. The material of preference may also be influenced by factors like bruxism or tooth preparation. The aim of this systematic review was to compare the clinical outcomes of indirect composite laminate veneers and porcelain veneers in bruxism patients.

Material and Methods: An electronic search was performed in the PubMed, Scopus, and Web Of Science databases on porcelain veneers and indirect composite resin veneers in patients with bruxism until January 2023.

Results: Of 433 potentially eligible papers, 11 complied with the inclusion criteria: 8 articles described characteristics and survival rate of porcelain veneers, 2 made a comparison of survival rate of both porcelain veneers and indirect composite resin veneers and 1 illustrated the digital CAD CAM method. It can be noted that the indirect composite resin (Estenia) veneers have a general lower survival expectancy: 87% after 20,3 months and 75% after 97 months. Regarding the survival rates of ceramic veneers: IPS-Empress ceramic 100% after 20,3 and 97 months and 89,5% after 11 years. Feldspathic ceramic reinforced with leucite crystals 95% after 11 years. Feldspathic ceramic 89,1% using an occlusal splint and 63,9% using no occlusal splint after 7 years.Ceramic veneers have compared to indirect composite better properties as veneer materials. Fractures of the veneers are less frequent in patients who use an occlusal splint adequately.

Conclusions: Overall, the survival rate was higher for porcelain veneers. Ceramic veneers demonstrated superior properties compared to indirect composite resin veneers, including better aesthetic outcomes and durability. The use of functional or conventional dental preparation did not show any appreciable differences. Bruxism increased the risk of fractures in veneer restorations, but the proper use of occlusal splints helped minimise these issues.

Key words: *Bruxism, Porcelain veneers, Indirect composite resin veneers, Survival rate*

Introduction:

Bruxism is considered as one of the great challenges and risk factor in the field of prosthodontics and restorative dentistry, especially when it comes to restoring anterior teeth with veneers (1). Porcelain veneers and indirect composite resin veneers represent appropriate materials for the reconstruction of the anterior teeth (2,3). Porcelain veneers, such as IPS-Empress and feldspathic ceramic reinforced with leucite crystals, exhibit excellent durability and resistance to wear and fractures, making these materials specifically suitable to withstand the forces associated with bruxism (4). There are several published systematic reviews comparing porcelain veneers and indirect composite resin veneers (5-7); however, in these reviews, patients with bruxism are not included. However, the present systematic review has focused on evaluating the survival rate of porcelain veneers versus indirect composite resin veneers in patients presenting bruxism.

The aim of the present systematic review was to systematically review the following question: In patients presenting bruxism, do porcelain veneers or indirect composite resin veneers have a higher survival rate?
This was done by firstly assessing the survival rate, and secondly identifying advantages and disadvantages of each kind of veneer, the ideal preparation design, and evaluating if the use of an occlusal night splint improves the efficacy of treatment with veneers in patients with bruxism.

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Material and methods:

This systematic review complies with the PRISMA statement (Preferred Reporting Items for Systematic reviews and Meta-Analyses) (7).

- Focus question:

The focus question was established according to the PICO structured question:
P (population): Patients presenting bruxism.
I (intervention): Performance of porcelain veneers, in terms of resistance to wear, during day and night without the use of an occlusal splint.
C (comparison): Performance of indirect composite resin veneers, in terms of resistance to wear, during day and night without the use of an occlusal splint.
O (outcomes):

- O1: Higher survival rate
- O2: Advantages and disadvantages of each kind of veneer.
- O3: Ideal preparation design for patients with bruxism when creating veneers.
- O4: If the use of an occlusal splint improves the efficacy of treatment with veneers (porcelain and indirect composite resin) in patients with bruxism.

- Eligibility criteria:

The inclusion criteria were:

- Study design: Randomised controlled clinical trials, prospective and retrospective cohort studies and case series; studies on human subjects, number of participants ≥5 patients; Publications in English, or German; Published until January 2022.
- Patient: Patients presenting bruxism with the need of rehabilitation of the anterior teeth with veneers, without age or gender differences.
- Intervention: Treatment with porcelain or indirect composite resin veneers, with a minimum follow-up of 12 months after placing the veneer.

- Outcomes: Studies that will provide data related to survival rate of porcelain and indirect composite resin veneers as primary variables. And as secondary variables: potential benefits and drawbacks of each kind of veneer, role of dental preparation design and if using a night splint improves the efficacy of treatment with indirect composite resin and ceramic veneers in bruxism patients.

Exclusion criteria were reviews, case reports, letters or comments to the editor, expert reports, in vitro and animal experimental studies. In addition, studies in comparing various veneer or restoration types, studies only about implants, crowns, onlays and inlays or posterior restorations, as well as research about veneers placed only in palatal, involving people under the age of 18 and studies about direct composite resin restorations were excluded. When necessary, authors were contacted to clarify missing information.

No restrictions were imposed according to the year of publication. Authors were contacted for clarification of missing information when necessary.

- Information sources and data search:

An automatized electronic and manual literature searches were conducted in three major electronic databases (PubMed, Scopus and Web of Science) with the following keywords: “Bruxism“, “Sleep Bruxisms“, “Bruxism, Sleep“, “Nocturnal Teeth Grinding Disorder“, “Sleep Related Bruxism“, “Adult Sleep Bruxism“, “Teeth grinding disorder“, “dental porcelain“, “Porcelain laminate veneers“, “Porcelain veneers“, “Ceramic laminate veneers“, “Lithium Disilicate“, “composite resins“, “indirect composite resin veneers“, “Prefabricated composite veneers“, “Indirect resin composite veneers“, “prefabricated resin composite veneers“, “survival rate“. Keywords were combined with a combination of the controlled terms (MeSH for Pubmed) to obtain the best search results.
The following search strategy in Pubmed was carried out: ((Bruxism[MeSH Terms]) OR (Sleep Bruxisms[MeSH Terms])) OR (Bruxism, Sleep)) OR (Nocturnal Teeth Grinding Disorder)) OR (Sleep Related Bruxism)) OR (Adult Sleep Bruxism)) OR (Teeth grinding disorder)) AND ((dental porcelain[MeSH Terms]) OR (Porcelain laminate veneers)) OR (Porcelain veneers)) OR

(Ceramic laminate veneers)) OR (Lithium Disilicate)) OR ((composite resins[MeSH Terms]) OR (indirect composite resin veneers)) OR (Prefabricated composite veneers)) OR (Indirect resin composite veneers)) OR (prefabricated resin composite veneers)) AND ((survival rate[MeSH Terms]) OR (survival rate)). Filter: Year: 2012-2023. To identify any eligible studies that the initial search might have missed, the search was completed with a review of the references provided in the bibliography of each study. On the other hand, a manual search of scientific articles from the following journals of prosthodontics and aesthetic dentistry: Journal of Dental Research, Journal of Dentistry, Journal of Prosthetic Dentistry, International Journal of Prosthodontics, Journal of Aesthetic and Restorative Dentistry, Journal of Aesthetic Dentistry, Clinical Oral Implants Research, Quintessence International, Journal of Adhesive Dentistry, Journal of the American Academy of Aesthetic Dentistry, Journal of Cosmetic Dentistry and Journal of the Korean Academy of Prosthodontics.

- Search strategy:

It involved a three-stage selection procedure. The selection of studies was carried out by two reviewers (ZV, SMS). Titles were used as a filter in the first stage to remove publications that were not relevant and duplications were removed. The second stage involved screening and selecting the abstracts.
In the third stage, the entire texts were screened by reading before moving on to data extraction using a previously created data collection form to ensure the studies' eligibility. At each level, disagreements between reviewers were settled through discussion and, if necessary, consultation with a third reviewer.

- Data extraction:

The following data was taken from the studies and organised in tables based on the kind of treatment (porcelain veneers versus indirect composite resin veneers): authors with year of publication, type of study (randomised controlled, prospective, prospective, retrospective, case series), number of patients, dental preparation design, whether a night guard is utilised or not, type of porcelain, type of composite.

- Quality and risk of bias assessment:

The Cochrane 5.1.0 guide (http://handbook.cochrane.org) was used to evaluate the quality of the randomised controlled clinical studies. Publications were considered "low risk of bias" when they met all the criteria, and "high risk of bias" when one or more criteria were not met and the study was therefore considered to present a possibility of bias. The risk of bias assessment was evaluated by two reviewers (ZV, SMS) in order to analyse the methodological quality of the included articles (either due to lack of information or uncertainty about the potential for bias). Nonrandomised observational studies were graded according to the Newcastle-Ottawa scale (9), with a score of > 6 indicating "low risk of bias" and a score of ≤ 6 indicating "high risk of bias“.

- Data synthesis:

With the aim of summarising and comparing studies, average data on main variables were grouped for each study group. As the average data found in the analysed studies came from different samples, weighted arithmetic mean was calculated to obtain feasible outcomes. A meta-analysis was not able to be performed due to the lack of randomised studies comparing both materials.

Results:

- Study selection:

A total of 366 articles were obtained from the initial search process: Medline - PubMed (n=203), SCOPUS (n=207) and Web of Science (n=23). Of these publications, 39 were identified as potentially eligible articles by screening by titles and abstracts. Full-text articles were subsequently obtained and thoroughly evaluated. As a result, 11 articles met the inclusion criteria and were included in the present systematic review (fig. 1).

- Study characteristics:

Of the 11 articles included in the present review, 8 articles described characteristics and survival rate of porcelain veneers (10-17), 2 made a comparison of survival rate of both porcelain veneers and indirect composite resin veneers (18, 19) and 1 illustrated the digital CAD CAM method (20). 2 articles were randomised controlled (18,19), 3 were prospective studies (10,11,12), 3 retrospective studies (14,16,17), 1 cohort study (13), 1 analytic study (15) and 1 clinical protocol (20). In the randomised studies the patient was the unit of randomisation. A total of 415 patients were treated with a total of 2126 veneer restorations: 2079 porcelain veneers and 47 indirect composite resin veneers. The study by Ustun O et al. (15) used three models simulating the cross section of a maxillary incisor. There was a range of the number of patients between 4-104 patients. Most veneers were placed in the anterior maxilla. Regarding the dental preparation, most investigations performed an incisal overlap. Moreover the majority of patients diagnosed with bruxism was instructed to use an occlusal splint. Characteristics of the studies in general and specific for each study are displayed in tables 1 and 2.

- Risk of bias:

For randomised studies, an unclear risk of bias was considered in all 2 studies (Table 3). For the non-randomised observational studies, all 7 were considered at low risk of bias (tables 7 and 8).
Performance, detection and attrition bias were items with unclear risk of bias (Fig. 2).

- Synthesis of results:

<u>Survival rate:</u>

Comparing the survival rates of indirect composite resin veneers and porcelain veneers, it can be noted that the indirect composite resin veneers have a general lower survival expectancy: 87% after 20,3 months (40) and 75% after 97 months (18). The type of composite used in both researches was Estenia (18,19), therefore no comparison can be drawn between different types of

composite. IPS-Empress ceramic veneers showed a survival rate of 100% after 20,3 and 97 months (18, 19). After 11 years IPS-Empress ceramic veneers displayed a survival rate of 89,5% (16). Porcelain veneers made of feldspathic ceramic reinforced with leucite crystals displayed a general survival rate of 95% after 11 years (10). Teeth with more than 50% dentin exposure without immediate dentin sealing (IDS) showed a survival of 84,6%. Teeth treated with IDS presented a survival of 99%. Laminates made of feldspathic ceramic displayed an overall survival rate of 93,7% after 3 years, 91% after 5 years and 87,1% after 8 years (11). In patients diagnosed with bruxism, the survival rate was 89,1% using an occlusal splint and 63,9% using no occlusal splint after 7 years. Feldspathic ceramic veneers showing a general survival rate of 94,6%, 96% without existing composite restorations (ECR) and 93,5% with ECR (12). Feldspathic ceramic, Leucite heat-pressed ceramic, or Lithium disilicate heat-pressed ceramic showing a survival rate of 94,4% after 5 years, 93,5% after 10 years and 82,93% after 20 years (17). Descriptive results on survival rate are shown in Table 6.

Benefits and drawbacks of each kind of veneer:

After 3 years marginal discrepancies were observed in 6 composite (Estenia) and 3 ceramic (IPS-Empress) veneers. Slight staining of the margins and surface roughness were more frequently observed in the indirect composite resin veneer group. Fractures, wear, secondary caries or postoperative sensitivity were not observed in any of the cases (19). After 10 years, marginal discrepancies were observed in 14 of the composite and 10 of the ceramic veneers. Ceramic laminate veneers matched the colour of the surrounded teeth, composite restorations did not match for 8 laminate veneers. Slight staining at the margins was seen more frequent with the composite laminate veneers (n=12). Slightly rough surfaces were significantly more observed in the resin composite laminate veneer group (n=18) until the final recall. Fractures were significantly more seen (n=6) in the indirect composite group and chippings of tooth material were more seen in the composite group as well. Wear of the restoration was significantly more seen in the indirect composite group (n=7). Wear or secondary caries were not observed in any of the cases (18).

In general, for all of these variables, the ceramic restorations were rated better. Descriptive results on survival rate are shown in Table 10.

Preparation design:

All indirect composite resin veneers were prepared with incisal overlap and shallow chamfer line (0,5mm), positioned equi- or supra- gingival (12,18,19). Therefore no comparisons can be drawn, in terms of preparation design, in the indirect composite resin veneer group. The porcelain veneers varied in their preparation design: Conventional (without incisal overlap) and functional (with incisal overlap) preparation designs were compared, but no significant differences are found (16). Furthermore featheredge preparation, incisal bevel preparation and overlapped preparation were compared, where the incisal bevel preparation designs shows minimum stress values (15). Another point of view was that dental preparations should be as conservative as possible (without incisal overlap) in order to preserve the enamel, as the ceramic-enamel bond is “stronger” in terms of long-term performance than ceramic veneers bonded to dentine (11).

Night splint:

Generally patients presenting bruxism were instructed to use an occlusal splint and that in case of non-compliance there would be a risk of failure of the veneers restorations (10,11,16,17,19). Fractures of the veneers are more frequent in the presence of bruxism but not statistically significant (16). In contrast to that statistically significant differences were found when examining the correct use of splints in patients with bruxism, since fractures are less common in patients who use it adequately. Debonding, which is also observed to be more in bruxism patients, shows clear statistically significant difference between the two groups of patients (with and without bruxism activity). However, debonding does not statistically improve or worsen with or without the use a night splint (table 8) (11, 16).

Discussion:

The lack of randomised studies comparing both techniques made it impossible to perform a meta-analysis. For this reason, the results presented here should be interpreted with caution and were presented descriptively in each study group.

Survival rate:

The findings of this systematic review revealed that ceramic veneers demonstrate a higher survival rate than indirect composite resin veneers in patients with bruxism. This conclusion is consistent with several studies included in the analysis (16,18,19). The survival rate of indirect composite resin veneers is considerably lower, according to the research of Nazar A et al. (21), since this material has a lower resistance to crack propagation, a rougher surface and pigments in composite resin can undergo discolouration over time. According to Zimmer D et al. (22) one reason for the superior performance of ceramic veneers is their inherent material properties. Ceramic veneers, such as IPS-Empress and feldspathic ceramic reinforced with leucite crystals, exhibit excellent durability and resistance to wear and fractures (22). Additionally, ceramic veneers offer advantages in terms of aesthetics and natural appearance. Ceramic materials, especially feldspathic ceramics, have the ability to closely mimic the translucency and colour of natural teeth contributes to a more aesthetically pleasing result (23). Moreover, ceramic veneers have been found to exhibit better resistance to minor imperfections, colour stability, and surface roughness compared to indirect composite resin veneers (24).

Benefits and drawbacks of each kind of veneer:

After 3 years, composite veneers showed more frequent marginal discrepancies, staining of margins, and surface roughness, but no fractures, wear, secondary caries, or postoperative sensitivity (19). After 10 years, both types of veneers exhibited a higher number of marginal discrepancies, with the composite veneers still having more. Ceramic veneers fulfilled the colour match requirement, but not all composite veneers did. Indirect composite veneers also showed staining at margins, rough surfaces, fractures, and chipping of tooth

material more frequently. The wear of the restoration was significantly higher in the composite group, but neither wear nor secondary caries are observed in any cases (18). Alothman et al. (24) supported these findings, stating that composite resins are more prone to wear and discolouration in indirect composite veneers. They also mentioned the benefits of composite resin, such as easier preparations and shorter chair sessions, as well as its drawbacks like polymerisation shrinkage. Ceramic veneers are aesthetically pleasing, require minimal preparation, and have good mechanical qualities, but they have drawbacks like fabrication technique sensitivity and difficulty in masking heavily discoloured teeth (24).

Preparation design:

All indirect composite resin veneers, of the included studies of this systematic review, were prepared with incisal overlap and a shallow chamfer line, positioned equi- or supra-gingival (18,19). As a result, no comparisons can be made regarding preparation design within the indirect composite resin veneer group. However, porcelain veneers exhibited variations in their preparation design. Comparing conventional (without incisal overlap) and functional (with incisal overlap) designs, but no significant differences were found (16). Another study compared featheredge, incisal bevel, and overlapped preparations, revealing that incisal bevel preparation demonstrated minimum stress values (36). According to a separate study, dental preparations should aim to be as conservative as possible, without incisal overlap (11). The statements from different investigations regarding the best preparation approach are inconsistent. This agrees with the study of Alothman Y et al. (24), saying that due to the low biting force of anterior teeth, the choice of preparation design primarily relies on clinician preferences, although incisal overlap can be utilised to restore anterior guidance.

Night splint:

According to the studies of Faus-Matoses V et al. (11) and Granell-Ruíz M et al. (16) statistically significant differences are found when examining the correct use of splints in patients with bruxism, since fractures are less common in

patients who use it adequately. Debonding does not statistically improve or worsen with or without the use a night splint (11,16). These results are consistent with the study by Mengatto CM et al. (25), talking about the importance of using an interocclusal splint device before and after the restorative treatment with composite or ceramic veneers for bruxism patients, either for muscular and joint repositioning or to protect the restored structures.

Despite the limitations, both materials offer a predictable way of veneering anterior teeth in patients with bruxism, although porcelain veneers, especially IPS-Empress and feldspathic ceramic reinforced with leucite crystals, appear to achieve excellent durability and resistance to wear and fractures. However, current evidence is limited due to inadequate follow-up and lack of information on methodological quality.

References:

(1) Rees JS, Somi S. A guide to the clinical management of attrition. Br Dent J [Internet]. 2018;224(5):319–23. Available from: http://dx.doi.org/10.1038/sj.bdj.2018.169

(2) Dietschi D, Devigus A. Prefabricated composite veneers: historical perspectives, indications and clinical application. Eur J Esthet Dent. 2011 Summer;6(2):178–87.

(3) El-Mowafy O, El-Aawar N, El-Mowafy N. Porcelain veneers: An update. Dent Med Probl [Internet]. 2018;55(2):207–11. Available from: http://dx.doi.org/10.17219/dmp/90729

(4) Magne P. Immediate dentin sealing: a fundamental procedure for indirect bonded restorations. J Esthet Restor Dent [Internet]. 2005 [cited 2023 Jun 13];17(3):144–54; discussion 155. Available from: https://pubmed.ncbi.nlm.nih.gov/15996383/

(5) Alenezi A, Alsweed M, Alsidrani S, Chrcanovic BR. Long-Term Survival and Complication Rates of Porcelain Laminate Veneers in Clinical Studies: A Systematic Review. J Clin Med. 2021;10(5):1074.

(6) AlJazairy YH. Survival Rates for Porcelain Laminate Veneers: A SystematicReview. Eur J Dent. 2021;15(2):360-68.

(7) Petridis HP, Zekeridou A, Malliari M, Tortopidis D, Koidis P. Survival of ceramic veneers made of different materials after a minimum follow-up period of five years: a systematic review and meta-analysis. Eur J Esthet Dent. 2012;7(2):138-52.

(8) Kuhn M, Türp JC. Risk factors for bruxism. Swiss Dent J. 2018;128(2):118–24.

(9) Landis JR, Koch GG. An application of hierarchical kappa-type statistics in the assessment of majority agreement among multiple observers. Biometrics. 1977;33:363–74.

(10) Faus-Matoses V, Ruiz-Bell E, Faus-Matoses I, Özcan M, Salvatore S, Faus-Llácer VJ. An 8-year prospective clinical investigation on the survival rate of feldspathic veneers: Influence of occlusal splint in patients with bruxism. J Dent [Internet]. 2020 [cited 2023 May 8];99(103352):103352. Available from: https://pubmed.ncbi.nlm.nih.gov/32413382/

(11) Gresnigt MMM, Kalk W, Özcan M. Clinical longevity of ceramic laminate veneers bonded to teeth with and without existing composite restorations up to 40 months. Clin Oral Investig [Internet]. 2013 [cited 2023 May 8];17(3): 823–32. Available from: https://pubmed.ncbi.nlm.nih.gov/22821429/

(12) Klink A, Groten M, Huettig F. Complete rehabilitation of compromised full dentitions with adhesively bonded all-ceramic single-tooth restorations: Long-term outcome in patients with and without amelogenesis imperfecta. J Dent [Internet]. 2018 [cited 2023 May 8];70:51–8. Available from: https://pubmed.ncbi.nlm.nih.gov/29275170/

(13) Rinke S, Bettenhäuser-Hartung L, Leha A, Rödiger M, Schmalz G, Ziebolz D. Retrospective evaluation of extended glass-ceramic ceramic laminate veneers after a mean observational period of 10 years. J Esthet Restor Dent [Internet]. 2020 [cited 2023 May 8];32(5):487–95. Available from: https://pubmed.ncbi.nlm.nih.gov/32452164/

(14) Ustun O, Ozturk AN. The evaluation of stress patterns in porcelain laminate veneers with different restoration designs and loading angles induced by functional loads: A three-dimensional finite element analysis study. Niger J Clin Pract [Internet]. 2018 [cited 2023 May 8];21(3):337–42. Available from: https://pubmed.ncbi.nlm.nih.gov/29519983/

(15)Granell-Ruíz M, Agustín-Panadero R, Fons-Font A, Román-Rodríguez J-L, Solá-Ruíz M-F. Influence of bruxism on survival of porcelain laminate veneers. Med Oral Patol Oral Cir Bucal [Internet]. 2014 [cited 2023 May 8]; 19(5):e426-32. Available from: https://pubmed.ncbi.nlm.nih.gov/23986018/

(16)Beier US, Kapferer I, Burtscher D, Dumfahrt H. Clinical performance of porcelain laminate veneers for up to 20 years. Int J Prosthodont [Internet]. 2012 [cited 2023 May 8];25(1):79–85. Available from: https://pubmed.ncbi.nlm.nih.gov/22259802/

(17)Gresnigt MMM, Cune MS, Jansen K, van der Made SAM, Özcan M. Randomized clinical trial on indirect resin composite and ceramic laminate veneers: Up to 10-year findings. J Dent [Internet]. 2019 [cited 2023 May 8]; 86:102–9. Available from: https://pubmed.ncbi.nlm.nih.gov/31181242/

(18)Gresnigt MM, Kalk W, Ozcan M. Randomized clinical trial of indirect resin composite and ceramic veneers: up to 3-year follow-up. J Adhes Dent [Internet]. 2013 [cited 2023 May 8];15(2):181–90. Available from: https://pubmed.ncbi.nlm.nih.gov/23534025/

(19)Germano F. Clinical protocol with digital cad/cam chairside workflow for the rehabilitation of severely worn dentition patients. Oral Implantol (Rome) [Internet]. 2017 [cited 2023 May 8];10(3):247. Available from: https://pubmed.ncbi.nlm.nih.gov/29285327/

(20)Font AF, Ma F, Granell Ruíz M, Rueda CL, Martínez González A, Antonio P, et al. Choice of ceramic for use in treatments with porcelain laminate veneers [Internet]. Isciii.es. 2006 [cited 2023 May 15]. Available from: https://scielo.isciii.es/pdf/medicorpa/v11n3/en_17.pdf

(21)Jongsma LA, Kleverlaan CJ, Feilzer AJ. Clinical success and survival of indirect resin composite crowns: results of a 3-year prospective study. Dent Mater [Internet]. 2012;28(9):952–60. Available from: https://www.sciencedirect.com/science/article/pii/S0109564112001133

(22)Magne P. Immediate dentin sealing: a fundamental procedure for indirect bonded restorations. J Esthet Restor Dent [Internet]. 2005 [cited 2023 Jun 13];17(3):144–54; discussion 155. Available from: https://pubmed.ncbi.nlm.nih.gov/15996383/

(23)Alothman Y, Bamasoud MS. The success of dental veneers according to preparation design and material type. Open Access Maced J Med Sci [Internet]. 2018 [cited 2023 Jun 13];6(12):2402–8. Available from: https://pubmed.ncbi.nlm.nih.gov/30607201/

(24)Mengatto CM, Coelho-de-Souza FH, de Souza Junior OB. Sleep bruxism: challenges and restorative solutions. Clin Cosmet Investig Dent [Internet]. 2016;8:71–7. Available from: http://dx.doi.org/10.2147/CCIDE.S70715

(25)Richards D. GRADING – levels of evidence. Evidence-Based Dentistry. 2009;10:24–5.

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Table 1: *Characteristics of the reviewed studies. Overview.*

Study characteristic variables		Porcelain	Indirect composite resin	Total
Type of study	Randomised	2	2	4
	Prospective	3	0	3
	Retrospective	3	0	3
	Cohort	1	0	1
	Analytic study	1	0	1
	Clinical protocol	1	0	1
N° of patients (range minimum to maximum)		4 - 104	10 - 11	4 - 104
Location	Maxilla	1958	47	2005
	Mandible	439	0	439
	Anterior	1668	47	1715
	Posterior	330	0	330
Tooth preparation	With incisal overlap	823	47	870
	Without incisal overlap (simple / window)	488	0	488

Table 2: *Characteristics of the reviewed studies. Specific for each study.*

Author (year)	Type of study	N° of patients	Dental preparation design	Splint: yes/no	Type of porcelaine	Type of composite
Beier US et al. 2012 (38)	Prospective	84	-	Yes	Feldspar, Leucite heat-pressed c. or Lithium disilicate heat-pressed c.	-
Faus-Matoses V et al. 2020 (32)	Prospective	64	With incisal overlap	Yes	Feldspar	-
Germano F et al. 2017 (41)	Clinical protocol	4	-	No	Feldspar	-
Granell-Ruíz M et al. 2014 (37)	Retrospective	70	With/without incisal overlap	Yes	IPS-Empress	-
Gresnigt MM et al. 2013 (40)	RCT	10	With incisal overlap	-	IPS-Empress	Estenia
Gresnigt MM et al. 2013 (33)	Prospective	20	With incisal overlap	-	Feldspar	-
Gresnigt MM et al. 2019 (39)	RCT	11	With incisal overlap	-	IPS-Empress	Estenia
Gresnigt MM et al. 2019 (31)	Prospective	104	With incisal overlap	Yes	Feldspar (leucite crystals)	-
Klink A et al. 2018 (34)	Cohort	17	-	Yes	Feldspar, Leucite-reinforced lithium silicate Ceramic, lithium disilicate	-
Rinke S et al. 2020 (35)	Retrospective	31	With incisal overlap		Heat pressed leucite-reinforced glass-ceramic	-
Ustun O et al. 2018 (36)	Analytic	3 models	Featheredge Incisal bevel Overlapped	-	IPS e.max (lithium disilicate glass ceramic)	-

Table 3: *Measurement of risk of bias of randomised studies according to the Cochrane guidelines.*

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assesment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reportin g bias)	Other bias
Gresnigt et al. 2013 (40)							
Gresnigt et al. 2019 (39)							

Table 4: *Measurement of risk of bias of non-randomised observational studies with the Newcastle-Ottawa scale - observational studies with non-randomised control group.*

	Definition of the cases	Representativeness	Selection of controls	Definition of controls	Comparability (most important factor)	Comparabilty (any other variable)	Exposure check	Same method for both groups	Dropout rate	Total
Gresnigt MMM et al. 2019 (31)	★	★	★	★	★	★	★	★	-	**8**
Faus-Matoses V et al. 2020 (32)	★	-	★	★	★	★	★	★	-	**7**
Granell-Ruíz Met al. 2014 (37)	★	-	-	★	★	★	★	★	★	**7**

Table 5: *Measurement of risk of bias of non-randomised observational studies with the Newcastle-Ottawa scale - observational cohort studies without control group.*

	Cohort representativeness	Unexposed cohort selection	Exposure check	Demonstration no variable presence	Comparability (most important factor)	Comparabilty (any other variable)	Measurement results	Enough follow up	Dropout rate	Total
Gresnigt MMM et al. 2013 (33)	-	★	★	★	★	★	★	★	-	7
Klink A et al. 2018 (34)	★	★	★	★	★	★	★	★	★	9
Rinke S et al. 2020 (35)	-	★	★	★	★	★	★	★	-	7
Beier US et al. 2012 (38)	-	★	★	★	★	★	★	★	-	7

Table 6: *Descriptive results of indirect composite resin and porcelain veneers regarding their survival rate.*

Indirect composite resin:

	N° of veneers	N° of recalls	N° of dropouts	Type of material	Mean observation time	Bruxists (+ use of splint)	N° of failures	Survival rate
Gresnigt MMM et al. 2019 (39)	24	5	0	Estenia	97 months	2	6	75 %
Gresnigt MM et al. 2013 (40)	23	5	0	Estenia	20,3 months	2	3	87 %

Porcelain:

	N° of veneers	N° of recalls	N° of dropouts	Type of material	Mean observation time	Bruxists	N° of failures	Survival rate
Gresnigt MMM et al. 2019 (39)	24	5	0	IPS - Empress	97 months	2	0	100 %
Gresnigt MMM et al. 2019 (31)	384	4	14	Feldspar (leucite crystals)	55,8 months	18	19	95% (x^1); 84,6% (x^2); 99% (x^3)
Gresnigt MM et al. 2013 (40)	23	5	0	IPS - Impress	20,3 months	2	0	100 %
Faus-Matoses V et al. 2020 (32)	364	/	/	Feldspar	5,2 +/- 1.7 years	40	28	93,7% (x^4); 91% (x^5); 87,1% (x^6); 89,1% (x^7); 63,9% (x^8)
Gresnigt MMM et al. 2013 (33)	92	5	0	Feldspar	21,6 months	3	5	94,6% (x^9); 96% (x^{10}); 93,5% (x^{11})

Rinke S et al. 2020 (35)	101	/	6	Heat-pressed leucite-reinforced glass-ceramic	10 years	/	10	91,8 %
Granell-Ruíz M et al. 2014 (37)	323	/	/	IPS-Empress	11 years	15 (+splint) 15 (-splint)	42	89,5 %
Beier US et al. 2012 (38)	318	/	/	Feldspar, Leucite heat-pressed ceramic, or Lithium disilicate heat-pressed ceramic	118 +/- 63 months	42	29	94,4% (x^{12}); 93,5% (x^{13}); 82,93% (x^{14})

Legend for table above:

x^{1}: Overall survival rate after 11 years
x^{2}: Immediate dentin sealing (IDS) not applied
x^{3}: Immediate dentin sealing (IDS) applied
x^{4}: Overall survival rate after 3 years
x^{5}: Overall survival rate after 5 years
x^{6}: Overall survival rate after 8 years
x^{7}: Patients with bruxism using an occlusal splint (after 7 years)
x^{8}: Patients with bruxism using no occlusal splint (after 7 years)
x^{9}: Overall survival rate
x^{10}: Survival rate without existing composite restoration (ECR)
x^{11}: Survival rate with existing composite restoration (ECR)
x^{12}: Survival rate after 5 years
x^{13}: Survival rate after 10 years
x^{14}: Survival rate after 20 years

Table 7: *Descriptive results of indirect composite resin and porcelain veneers regarding their advantages and disadvantages.*

	Gresnigt MM et al. 2013 (40) - After 3 years - Total of 46 V.		Gresnigt MM et al. 2019 (39) - After 10 years - Total of 48 V.	
	Estenia (n=23)	IPS-Empress (n=23)	Estenia (n=24)	IPS-Empress (n=24)
Marginal discrepancies	6	3	14	10
Colour mismatch	0	4	8	0
Marginal discolouration	3	1	12	7
Surface roughness	18	0	18	0
Fracture of restoration	0	0	6	1
Fracture of tooth	0	0	3	0
Wear of restoration	0	0	7	1
Wear of antagonist	0	0	0	0
Caries	0	0	0	0
Postoperative sensitivity	0	0	1	1

Table 8: *Descriptive results of indirect composite resin and porcelain veneers regarding their dental preparation.*

Indirect composite resin:

	With incisal overlap	Without incisal overlap	Labial	Palatal/ Lingual	Interproximal	Termination line
Gresnigt MMM et al. 2019 (39)	1-1,5mm		0,3-0,5 mm		Shallow chamfered marginal finish line extended inter-proximally	Shallow chamfer line (0,5mm) Equi- or supra-gingival
Gresnigt MMM et al. 2013 (40)	1-1,5mm		0,3-0,5 mm	Right-angled con- tour (butt joint) between the incisal edge and the palatal surface	Shallow chamfered marginal finish line extended inter-proximally	Shallow chamfer line (0,5mm) Equi- or supra-gingival

Porcelain:

	With incisal overlap	Without incisal overlap	Labial	Palatal/ Lingual	Interproximal	Termination line
Gresnigt MMM et al. 2019 (39)	1-1,5mm		0,3-0,5 mm		Shallow chamfered marginal finish line extended inter-proximally	Shallow chamfer line (0,5mm) Equi- or supra-gingival
Gresnigt MMM et al. 2019 (31)	1-1,5mm		0,1 (cervical) to 0,7mm (mid-height)		Marginal finish line extended inter-proximally	Shallow chamfer finish line (ca. 0.1 mm) Equi-gingivally or up to 0.5 mm intrasul-cular

Gresnigt MMM et al. 2013 (40)	1-1,5mm		0,3-0,5 mm	Right-angled con- tour (butt joint) between the incisal edge and the palatal surface	Shallow chamfered marginal finish line extended inter-proximally	Shallow chamfer line (0,5mm) Equi- or supra-gingival
Faus-Matoses V et al. 2020 (32)		x			When necessary, contact points were broken with metal strips	Curved chamfer line Juxtagingival
Gresnigt MMM et al. 2013 (33)	1-1,5mm		0,3-0,5 mm		Light chamfered marginal finish line extended interproximally	Shallow chamfer line (0,5mm) Equi- or supra-gingival
Rinke S et al. 2020 (35)	At least 1,0 mm while slightly bevelling incisor		0,5mm		Proximal contacts were removed	Labial chamfer (minimum preparation depth: 0.3 mm)
Granell-Ruíz M et al. 2014 (37)	x	x				

Fig. 1: *PRISMA flowchart of searching and selection process of titles during the systematic review*