

No-preparation ceramic veneers: a systematic review

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ABSTRACT

Aim The main objective of the present systematic review was to investigate the validation of no-preparation ceramic veneers as restorations.

Materials and Methods Pubmed, Evidence-Based Dentistry, BMJ Clinical Evidence, Embase, Dynamed and Opengrey were analyzed in order to identify randomized controlled clinical trials evaluating the clinical outcomes of no-preparation ceramic veneers; manual researches were performed as well.

Results Database search produced 2551 records. After removal of duplicates and a careful examination of titles and abstracts, the reviewers excluded all of the studies. Manual and grey literature did not yield any other relevant article.

Conclusions Due to the lack of data, at the moment achieving a definitive clinical statement regarding the "no-prep" technique is not possible. Further clinical studies are needed to assess the effectiveness of no-preparation ceramic veneers. No-prep veneers can be considered as conservative treatments which should be carefully recommended and request a cautious selection of cases. Further controlled clinical researches are necessary to clearly identify predictable clinical protocols and evaluate the long-term outcomes of such restorations.

KEYWORDS Systematic review; No-preparation veneers; No-prep; Prepress; Ceramic veneers; Minimally invasive.

INTRODUCTION

In response to an increasing patients' demand for non-invasive, more and more esthetic and durable dental restorations, over the last decades the use of porcelain laminate veneers has become a widespread approach to restore worn, misaligned, fractured, discolored and malformed teeth. Moreover, the clinical indications of such restorations have been progressively increased due to the development of innovative ceramic materials that have been recently introduced in the market (1-4). The reduced thicknesses requested by the new biomimetic ceramic materials, together with an effective bonding to enamel and dentin, have allowed for a noticeable reduction of preparation invasiveness, leading to a significant preservation of tooth structure in agreement with the well consolidated principles of minimally invasive dentistry.

Compared to the aggressive preparations of the past, a conservative approach allows for a better management of different mechanical and clinical problems (5) in that it reduces flexing stress and strains inside the restorations (6-8), limiting at the same time the amount of exposed dentine and ensuring a higher amount of enamel substrate available for adhesion (9). It has been shown that the preservation of a large enamel surface and the positioning of the restoration margins within the enamel tissue are paramount factors for the achievement of good clinical outcomes with porcelain laminate veneers (10, 11).

Due to this clinical trend, in the last decade, additional partial veneers, "minimal preparation" and even "no-preparation (or prepress)" ceramic veneers have been

introduced for cases requiring a minimum addition of ceramic (i.e. thickness: 0.3–0.5 mm) for limited front teeth reshaping and closing diastemas or for treating microcracks, slight discolorations and enamel surface defects (12, 13).

To date, although such technique is becoming more and more popular in prosthetic dentistry for its limited operative invasiveness, clinical and research evidences seem to be quite limited in scientific literature.

The purpose of the present systematic review was to evaluate the level of scientific evidence regarding "no-prep/prepless" ceramic veneers.

SEARCH METHODS

The primary objective of this systematic review was to evaluate the clinical effectiveness of a minimally invasive approach for laminate veneers with the "no-prep" technique.

The secondary objective was to compare differences in survival rates between subgroups related to the following variables:

- preparation design;
- restorative materials.

The search strategy was based on a literature review of papers available in electronic databases (Pubmed, Evidence-Based Dentistry, BMJ Clinical Evidence, Embase and Dynamed). A systematic search for papers published between 1980 and 2017 was performed, since particular attention to a non-invasive approach in restorative dentistry began to be paid in the 80s; only articles written in English were considered.

The search was made using the following keywords:

- #1 "no-prep";
- #2 "partial-prep";
- #3 "minimal-prep";
- #4 "no-prep veneers";
- #5 "partial-prep veneers";
- #6 "minimal-prep veneers";
- #7 "no preparation";
- #8 "partial preparation";
- #9 "minimal preparation";
- #10 "no preparation veneers";
- #11 "partial preparation veneers";
- #12 "minimal preparation veneers";
- #13 "prepless"
- #14 "prepless veneers";
- #15 "non invasive veneers";
- #16 "porcelain veneers";
- #17 "ceramic veneers";
- #18 "porcelain laminate veneers";
- #19 "ceramic laminate veneers".

A manual search was performed as well and grey literature was analyzed on the website www.opengrey.eu, looking for eligible papers. The reviewers contacted

the authors of non-published or not electronically available studies. Two experienced and calibrated reviewers carried out data extraction independently; any disagreement was resolved by discussion with a third experienced and calibrated supervisor.

Inclusion criteria

The present systematic review was structured following the PRISMA guidelines. The eligibility of investigations was assessed according to the PICO process as follows.

1. Participants:
 - patients with at least 20 sound teeth in occlusion, periodontal status *ad integrum* and natural sound anterior teeth (i.e. maxillary and mandibular incisors).
2. Interventions:
 - randomized clinical trials (RCTs) evaluating the survival rates of no-prep veneers on anterior teeth over a minimum observational period of 36 months.
3. Comparison:
 - RCTs comparing veneers made up of different materials (i.e. feldspathic porcelain, leucite-reinforced glass ceramics, lithium disilicate ceramics);
 - RCTs comparing veneers fabricated with different preparation designs (i.e. no-prep, window, chamfer with palatal overlap, butt joint).
4. Outcomes:
 - survival rates and complications of no-prep veneers;
 - comparison of survival rates and complications between different groups of no-prep veneers.

All the studies that did not meet the inclusion criteria were not included in the present systematic review.

Quality assessment

The quality assessment of the included studies was carried out using the criteria reported by the Cochrane Handbook for Systematic Reviews of Interventions (14), as follows.

- Evaluation of random sequence generation (selection bias):
 - 0: no randomized;
 - 1: unclear risk;
 - 2: random component in the sequence generation process.
- Evaluation of allocation concealment (selection bias):
 - 0: participants could possibly foresee assignments;
 - 1: unclear risk;
 - 2: participants and investigators enrolling participants could not foresee assignment.
- Evaluation of blinding of participants and personnel (performance bias):
 - 0: inadequate;
 - 1: unclear;

Database	Search strategy	Results
Pubmed	(no-prep) OR (partial-prep) OR (minimal-prep) OR (no-prep veneers) OR (partial-prep veneers) OR (minimal-prep veneers) OR (no preparation) OR (partial preparation) OR (minimal preparation) OR (no preparation veneers) OR (partial preparation veneers) OR (minimal preparation veneers) OR (prepless) OR (prepless veneers) OR (non invasive veneers) OR (porcelain veneers) OR (ceramic veneers) OR (porcelain laminate veneers) OR (ceramic laminate veneers)	1968
Evidence-Based Dentistry	(no-prep) OR (partial-prep) OR (minimal-prep) OR (no-prep veneers) OR (partial-prep veneers) OR (minimal-prep veneers) OR (no preparation) OR (partial preparation) OR (minimal preparation) OR (no preparation veneers) OR (partial preparation veneers) OR (minimal preparation veneers) OR (prepless) OR (prepless veneers) OR (non invasive veneers) OR (porcelain veneers) OR (ceramic veneers) OR (porcelain laminate veneers) OR (ceramic laminate veneers)	438
BMJ Clinical Evidence	(no-prep) OR (partial-prep) OR (minimal-prep) OR (no-prep veneers) OR (partial-prep veneers) OR (minimal-prep veneers) OR (no preparation) OR (partial preparation) OR (minimal preparation) OR (no preparation veneers) OR (partial preparation veneers) OR (minimal preparation veneers) OR (prepless) OR (prepless veneers) OR (non invasive veneers) OR (porcelain veneers) OR (ceramic veneers) OR (porcelain laminate veneers) OR (ceramic laminate veneers)	73
Dynamed	(no-prep) OR (partial-prep) OR (minimal-prep) OR (no-prep veneers) OR (partial-prep veneers) OR (minimal-prep veneers) OR (no preparation) OR (partial preparation) OR (minimal preparation) OR (no preparation veneers) OR (partial preparation veneers) OR (minimal preparation veneers) OR (prepless) OR (prepless veneers) OR (non invasive veneers) OR (porcelain veneers) OR (ceramic veneers) OR (porcelain laminate veneers) OR (ceramic laminate veneers)	30
Embase	(no-prep) OR (partial-prep) OR (minimal-prep) OR (no-prep veneers) OR (partial-prep veneers) OR (minimal-prep veneers) OR (no preparation) OR (partial preparation) OR (minimal preparation) OR (no preparation veneers) OR (partial preparation veneers) OR (minimal preparation veneers) OR (prepless) OR (prepless veneers) OR (non invasive veneers) OR (porcelain veneers) OR (ceramic veneers) OR (porcelain laminate veneers) OR (ceramic laminate veneers)	42

TABLE 1 Search strategy for each database and relative results.

- 2: adequate.
- Incomplete outcome data (attrition bias):
 - 0: missing data;
 - 1: unclear risk;
 - 2: no missing data outcome.
- Selective reporting (reporting bias):
 - 0: yes;
 - 1: unclear;
 - 2: no/not possible.
- Evaluation of other bias:
 - 0: potential source of bias;
 - 1: insufficient information;
 - 2: the study appears to be free of other sources of bias.

Quality criteria, allocation concealment and blinding of outcome assessor were considered in order to assess the risk of bias according to the Cochrane Handbook for Systematic Reviews of Interventions (14).

SEARCH RESULTS

The search strategy and the relative results are reported in Table 1.

The database research produced 2551 records, many of which were duplicates; the grey literature and the manual search did not produce any other relevant article. All the duplicates were removed, thus all of the selected databases produced 2028 records.

After the examination of titles, abstracts and keywords, the reviewers excluded all of the studies, in that no study met the inclusion criteria of the present systematic review. The main reasons for exclusion were: not the

topic of interest, non-RCTs and studies without control. The workflow of the paper screening process is reported in Table 2.

DISCUSSION

To date, the conventional tooth preparation for laminate veneers using glass-ceramic materials can be considered a reliable restorative technique, showing good longevity and low complication rates, confirmed by several systematic reviews with follow-up periods ranging from 5 to 20 years, reporting survival rates ranging between 87% and 94% (15-17). Layton et al. (18) evidenced a 96% estimated cumulative survival rate for feldspathic veneers at 21-years.

The most frequently reported failure events related to porcelain veneers were fractures, microleakage and debonding (17, 19-21). Different factors affect the survival of ceramic veneers such as mechanical properties of the restoration (7), cementation material (8), occlusal forces, cavities and preparation design (16-20). In the scientific literature, different tooth preparation geometries were described (6), and the correlation between the preparation design and type of failure still remains a controversial topic (25, 26).

It has been widely pointed out that invasive tooth preparations affect both the biomechanical and the esthetic properties of ceramic veneers. The loss of a large amount of coronal structure increases coronal flexibility, introducing high amounts of stress and strain, and, at the same time, a smooth optical transition between the tooth and the restoration is more difficult to achieve,

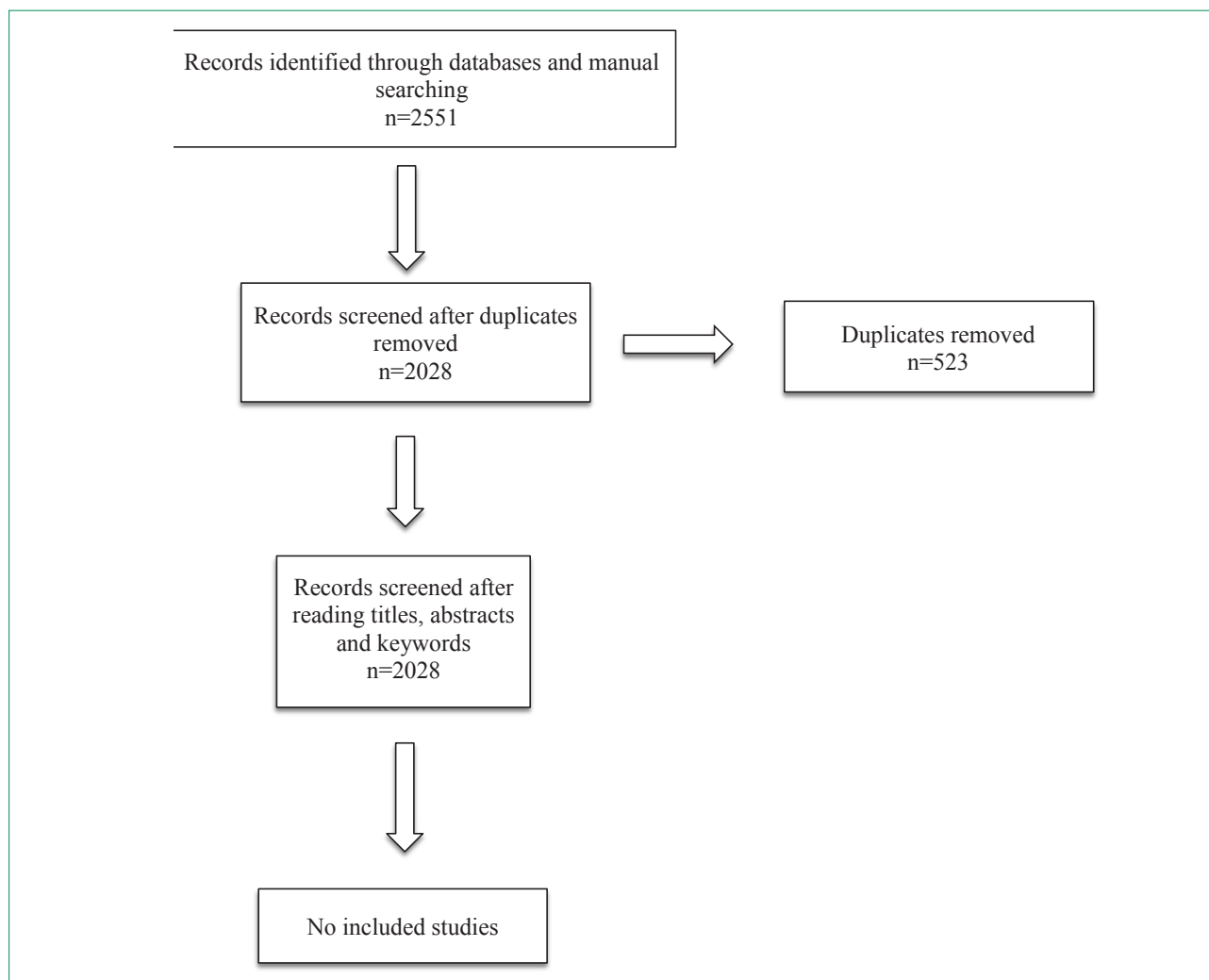


TABLE 2 Workflow of the paper screening process.

in the absence of a thin, "contact-lens" ceramic margin (27, 28). In particular, in a retrospective survey up to 12 years, the best clinical outcomes were observed for veneers with preparations confined to enamel with 99% survival rate while the results dropped to 94% for veneers with enamel only at the margins (10). Laminate veneers show high survival rates when extensively bonded to enamel and provide a safe and predictable treatment option that preserves tooth structure. Even if the tooth preparation often depends on the masking necessity and material thickness requirements, reducing dentin exposure as much as possible is suggested, in order to reduce risk of failures (11, 29). In the realm of minimally invasive dentistry, no-preparation ceramic veneers are increasingly gaining ground, for such clinical advantages as enamel preservation with optimum bonding efficiency, absence of post-operative sensitivity, no need for temporary restoration. Another benefit, frequently advertised to the patients, is the reversibility of the procedure, namely the removal of the veneers from the unprepared

tooth. In the authors' opinion, nevertheless, removing a veneer (either "prep" or "no-prep") successfully bonded to sound enamel is neither an easy nor a cheap technique, due to the need of grinding and wearing the ceramic out, with an undeniable difficulty in identifying the transitions between ceramic, bonding agent and enamel, eventually leaving a smooth and polished enamel surface.

In anterior regions, the main indications of "no-prep" and "minimal prep" are the following: slight coronal reshaping needing volume additions, small class III, IV and V defects, diastemata, enamel microfractures, chippings and slight discolorations (30-33). In particular cases, orthodontic therapies can be useful in repositioning teeth, in order to reduce the axial inclination and make the veneer preparation as minimally invasive as possible (34).

Despite the described good performances, no-preparation veneers should be carefully recommended in patients who are very motivated to maintain good oral hygiene and, generally, such procedure requires

additional skills for delivering, finishing and polishing the porcelain intraorally (35, 36).

Although prepress and minimally invasive veneers are sometimes described as simplified techniques, they actually represent operator-sensitive procedures, first of all due to the frequent difficulty in obtaining a fairly natural and harmonic shape, avoiding detrimental and unaesthetic overhangs; moreover, the thin restoration margins (around 0.3 mm) are exposed to high risk of chipping during handling, both in the dental laboratory and in the dental office; furthermore, the bonding procedure may lead to fracture of the veneers, due to the shrinkage occurring during the polymerization of resin cements (15, 23, 25).

Secondary caries, pigmentation of margins, bleeding on probing, fractures, loss of retention and hypersensitivity are the main reported complications (15, 37, 38).

These techniques are not indicated in the following cases: noticeable coronal reshaping, as required when teeth are triangular-shaped or when a reduction of tooth prominence is needed; relevant discolorations, difficult to mask by thin glass-ceramic restorations; large tooth fractures; severe teeth malpositions (35, 36).

Several clinical studies reported favorable results about minimally invasive veneers but long-term results about no-prep veneers have to be investigated further as most retrieved studies were case reports (15, 16, 39–43).

The main objective of the present systematic review was to investigate the clinical validity of no-prep veneers by means of a review of the scientific literature. Unfortunately, no RCTs were available. In the authors' opinion, such lack of data may be attributed to the continuous innovation of dental materials, which prevents clinicians from obtaining long-term outcomes. The most popular material today, may be obsolete tomorrow. Furthermore, practitioners have to select wisely clinical cases treatable with no-prep veneers: this kind of conservative restoration may easily result in an excessive thickness and an unnatural shape of teeth, which are in contrast to the esthetic demand of the patients and the predictability is not supported neither by clinical nor scientific evidences.

For future research, authors suggest:

- identify specific criteria in order to correctly select patients to whom propose no-prep veneers as valid and conservative treatment;
- design precise treatment protocols, taking into account different optical and mechanical properties among dental materials;
- conduct longitudinal studies so as to investigate long-term results and complications of such type of restorations.

CONCLUSIONS

According to the results of the present investigation,

no studies met the inclusion criteria of the present systematic review. To date, it is not possible to achieve a clear clinical statement about the investigated topic, due to the lack of available scientific and clinical data. Within the limitations of this systematic review, no-prep veneers should be considered as conservative treatment requiring a thorough diagnostic approach and cautious selection of cases.

Further controlled clinical researches are necessary to clearly identify predictable clinical protocols and evaluate the clinical effectiveness and long-term outcomes of such restorations.

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