

Clinical longevity of direct resin-based composite veneers on anterior teeth

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Abstract

Introduction: The growing demand for smiles' aesthetic improvement leads direct resin-based composite (RBC) veneers to gain increasing ground when it comes to renewing patients' dental appearance, mainly due to RBC cosmetic properties and the minimally invasive approach related to them. However, it is essential to know the success and survival rates and the main causes of failure of this technique. **Objective:** The aim of this study was to study the clinical longevity of direct RBC veneers on anterior teeth. **Method:** PICO framework guided the search strategies in the Pubmed, Google Scholar, and Periódicos Capes databases using a combination of the terms "composite resins, direct veneers, dental veneers, and longevity". Inclusion criteria was clinical follow-up studies of least 6 months, published in English from 2003 onwards, evaluating the performance of RBC veneers in anterior teeth. Books, book chapters, theses, editorials, in vitro studies, and articles that did not provide clinical follow-ups of RBC veneers were excluded. Using language (English) filter, 636 scientific articles were found, which were analyzed following the PRISMA statement and discarded if they did not meet the criteria. At the end, only four articles were selected, and their data collected. **Conclusion:** There was great variability in the time and criteria used to evaluate restorations in different studies, but the literature considers that direct RBC veneers have an acceptable clinical longevity, but may require repair appointments, and the main cause of failure.

Keywords: *composite resins, dental veneers, direct veneers, longevity, survival.*

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Introduction

A perfect smile is associated with physical, psychological, and socioeconomic well-being, as well as personal and professional success (1,2). Therefore, there is a growing demand for dental esthetics from patients who are dissatisfied with the appearance of their smile. Dental veneers are a cosmetic treatment indicated to correct undesirable tooth shape, color, positioning, and certain anomalies, such as peg teeth and microdontia (3). Indirect veneers are made from different ceramic materials, usually glass ceramic reinforced by leucite or a lithium-disilicate. They present higher compressive strength than resin-based composite (RBC), higher color stability (5,6) and literature supporting its long-term clinical survival rate of 95.5% (7).

RBC direct veneers, on the other hand, can be performed chairside, directly by the dentist, without the need for a dental technician. This approach reduces the cost of the procedure and makes it easier for the trained dentist to mimic shape and achieve shade matching with adjacent teeth. They are considered an excellent alternative for oral cosmetic restorations and are no longer seen as a secondary treatment but rather as a minimally invasive choice (Figure 1 and 2). The preservation of tooth structure, reduced number of appointments, and excellent aesthetics are reasons to elect RBC veneers as a cosmetic treatment of choice (8). One may also consider that RBC direct veneer allows the dentist independence from the dental laboratory workflow, leading to faster treatment completion.



Figure 1. Unesthetic upper teeth, presenting old RBC restorations, discolored tooth and inclination issues.



Figure 2. RBC veneers made using minimally invasive approach to achieve higher esthetic outcome.

These veneers present excellent esthetic immediate outcomes through the combination of a highly efficient polishing procedure and a wide variety of RBC shades and opaque and translucent colors, mimicking teeth polychromatism and texture [4]. However, it is important to evaluate the quality of the restorative materials and adhesive protocol to be used, as well as for the dentist to master the skills needed to perform this procedure and achieve long-term clinical success (9,10).

Direct RBC veneers can be made using different techniques. The direct technique, performed in a freehand style (Figure 3), requires great mastery of skills from the dentists once they prepare the tooth and build the veneer directly in the patient's mouth. This technique uses distinct types of RBCs to create a proper tooth morphology, and it can be accomplished in a single appointment, usually performed in single tooth restorations (11). When dealing with complex cases, such as full smile rehabilitation, the palatal-shell direct technique is preferred. It is based on waxing up the final case's outcome over the patient's digital or physical model, followed by making a PVS impression of the waxed-up model to serve as a guide for reconstructing the palatal area of the teeth (Figure 4). This technique allows controlling the final position of incisal edges, the multi-shade RBC placement, and results in fewer clinical adjustments. It provides reliable results for both the patient and the professional; nevertheless, it requires more work time, taking an average of two appointments, and a laboratory phase that performs the wax-up (12).



Figure 3. Multilayer RBC placement using different shades and opacities.

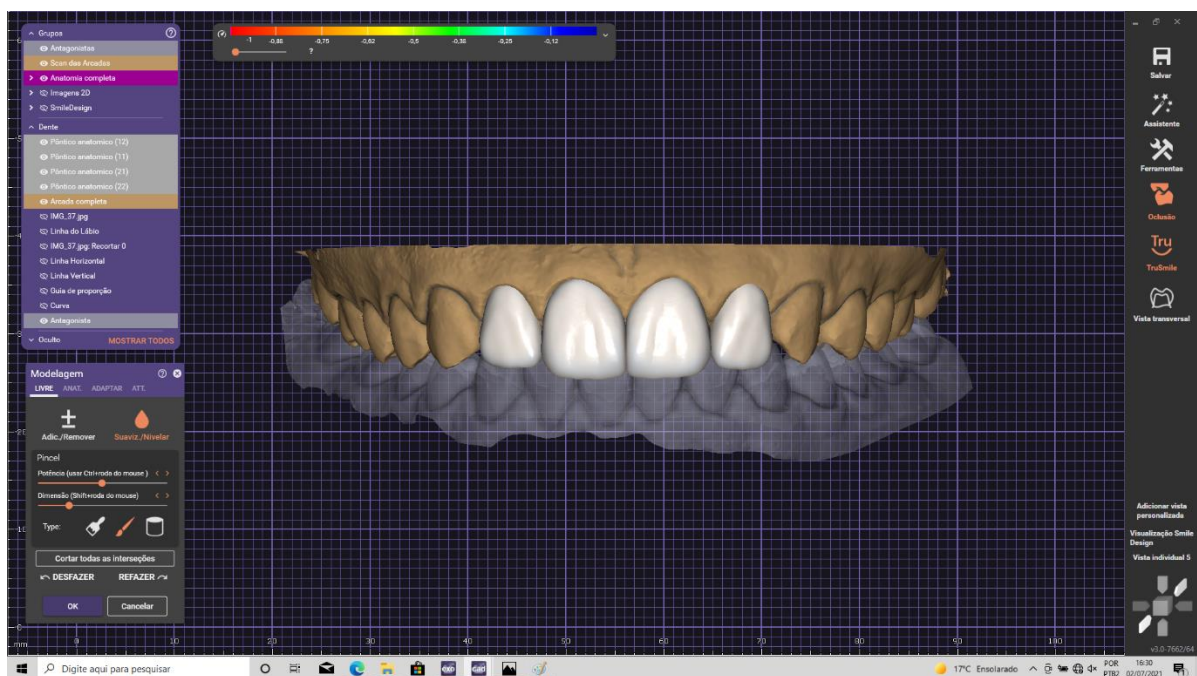


Figure 4. Digital wax-up planning for a smile rehabilitation.



Figure 5. RBC composite veneers made using the direct-indirect technique.

The direct-indirect technique works in the same way, but without any adhesive procedure. Once the restoration is completed, it is detached from the tooth surface, polished outside the mouth, and then adhesively cemented (Figure 5). This approach can be used as a "direct mock-up" to seek patients' approval and, once the dentist has their consent, one can cement the veneers using adhesive procedures (13).

Despite all the advantages, the dentist might question the clinical longevity of RBC veneers and how they behave compared to ceramic veneers. Most data published in the literature about RBC veneers are case reports and laboratory studies, and, once a few clinical evaluations are recently produced, there is a need for a better understanding of this matter. The aim of this study is to produce a literature review about the clinical longevity of RBC veneers on anterior teeth.

Method

This literature review was based on the question: "What is the clinical longevity of direct RBC veneers on anterior teeth? ". The following steps were taken to produce this literature review: delimiting the topic and drafting the guiding research question; searching for the descriptors needed for the best results in the selected databases; collecting data; classifying and analyzing the data from each material; discussing the results; and presenting the results found with a critical analysis of the

main results found in the articles. The PICO framework was used to guide the search strategies. Medical Subject Headings (MeSH) terms were assigned to Population, Intervention, Comparison, and Outcomes to structure the search, linking each term with the Boolean operator "AND" at the database portal search tool. A broader and more precise search was obtained by using different combinations of terms (Table 1).

Table 1. Search strategies and results from different databases.

Databse	Search strategy	Total number of papers	Excluded after title and abstract evaluation	Excluded after full-text evaluation	Selected papers
Pubmed	"composite resins" AND "dental veneers" AND "longevity"	19	17	1	1
Pubmed	"composite resins" AND "veneers" AND "longevity"	23	16	5	2
Pubmed	"direct composite veneers" AND "longevity"	4	0	2	2
Pubmed	"composite resins" AND "dental veneers" AND "survival"	41	36	4	1
Pubmed	"composite resins" AND "veneers" AND "survival"	48	42	4	2
Pubmed	"direct composite resins" AND "survival"	0	0	0	0
Google Scholar	"composite resins" AND "dental veneers" AND "longevity"	149	147	0	2
Google Scholar	"composite resins" AND "dental veneers" AND "survival"	215	214	0	1
Periódicos Capes	"composite resins" AND "dental veneers" AND "longevity"	26	25	0	1
Periódicos Capes	"composite resins" AND "dental veneers" AND "survival"	111	109	0	2

The articles were searched in the following databases: Pubmed, Google Scholar, and Periódicos Capes, during the month of April 2023. Only clinical follow-up studies, published in English from 2003 onwards (20 year-time arbitrarily based), evaluating the performance of RBC veneers in anterior teeth were included. Books, book chapters, theses, editorials, in vitro studies, and articles that did not provide clinical follow-ups of RBC veneers were excluded. The PRISMA statement oriented the track followed by the authors.

Two independent researchers (AA, RZ) performed the search and literature analysis. When they disagreed about any paper analysis, a third researcher was consulted (FFP). Studies were selected by applying inclusion and exclusion criteria to titles, abstracts, and full texts (Figure 6). Once all papers were selected, the data was extracted and merged into a table.

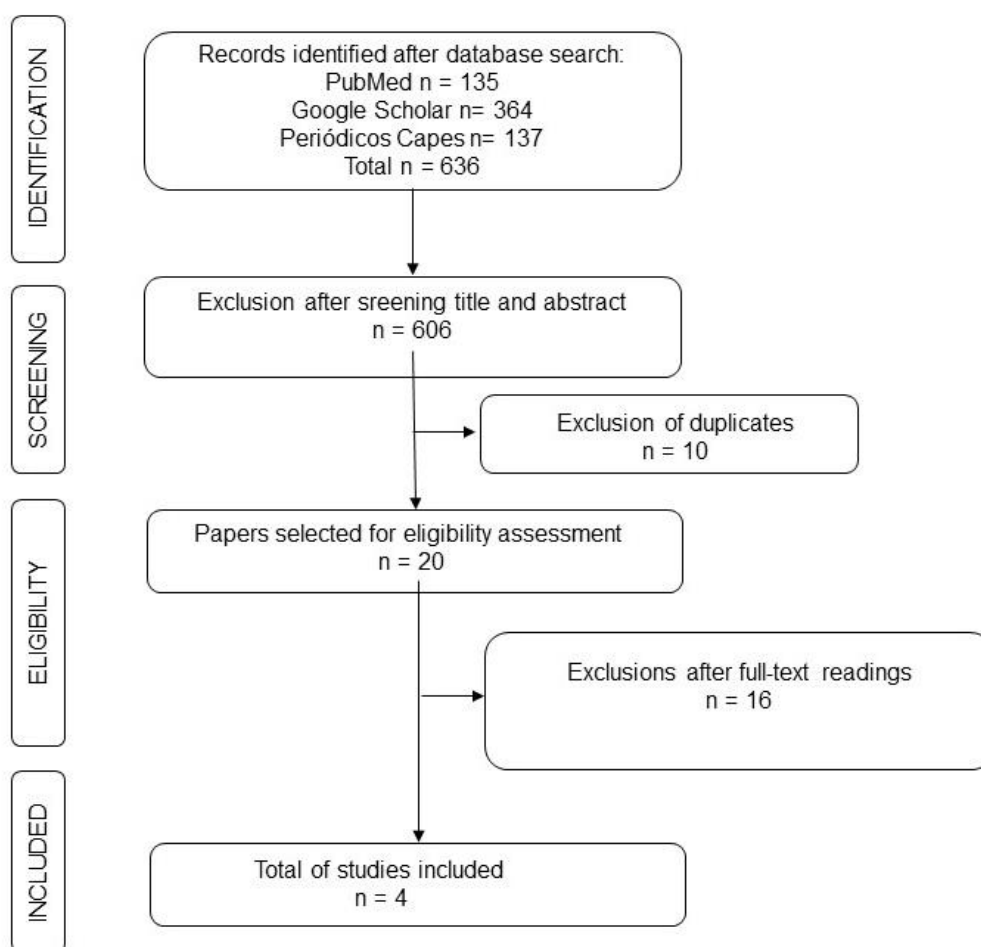


Figure 6. Literature search and selection workflow following PRISMA statement.

Results

The search strategies carried out in the different databases resulted in 636 scientific articles. All studies had their titles and abstracts evaluated following the inclusion and exclusion criteria, which resulted in the exclusion of 606 papers. Subsequently, duplicate articles were excluded ($n = 10$) and the remaining studies were read in full, which eliminated 16 studies. As shown in Figure 6, only 4 papers included in this literature review performed a long-term clinical longitudinal evaluation of RBC veneers (Table 2).

Table 2. Data from clinical studies evaluating longevity of direct composite veneers

Author/Year	Title	Objective	Sample size	Follow-up period	Evaluation method	Failure Rate	Success and/or Survival rate	Failure cause	Conclusions
Korkut et al (2023), Turquia	Two-year retrospective evaluation of monoshade universal composites in direct veneer and diastema closure restorations	to evaluate the short-term outcome of two monochromatic universal composite resins with high chameleon effect in direct anterior veneers and diastema closure restorations, and to investigate possible reasons for failure.	78	2 years	FDI and USPHS	2,6% - 1 year 5,1% - 2 years	Success rate 97,4% - 1 year Success rate 92,4% - 2 years	Fracture	anterior veneer restorations were considered successful. Despite the lack of shade selection, both monochromatic universal composites showed successful shade matching. Veneers presented more fractures than diastema closure restorations.
Mazzetti et al (2022) Brazil	10-year practice-based evaluation of ceramic and direct composite veneers	Compare the survival and success of composite resin and ceramic veneers placed between 2008 and 2014	1043	10 years	Not reported	2,8% - 3 years 3,9% - 5 years 4,1% - 10 years	Survival rate 66% - 10 years Success rate 35% - 10 years	Not reported	Ceramic veneers have greater longevity than direct composite resin veneers. However, both treatments still offer high survival rates and can be used in clinical practice.
Irgang et al (2020) Brazil	A clinical evaluation of direct veneers made with two types of composites	To provide a retrospective clinical evaluation of direct composite veneers performed with micro-particulate or universal composite resin, using two evaluation criteria (FDI and USPHS).	74	6 month to 10 years	FDI and USPHS	Not reported	Survival rate 77% - 6 month to 10 years	Fracture	Direct composite veneers have demonstrated acceptable clinical behavior. Micro-particulate composite veneers have shown better performance compared to universal composite resins. The two criteria (USPHS and FDI) were similar in the clinical evaluation process.
Coelho-de-Souza et al (2015) Brazil	Direct anterior composite veneers in vital and non-vital teeth: A retrospective clinical evaluation	Investigate the performance of direct veneers using different composites on vital and non-vital anterior teeth	196	3.5 years	FDI	4,9% - 3.5 years (vital) 9,8% - 3.5 years (non-vital)	Survival rate 80,1% - 3,5 years	Fracture	Direct composite resin veneers have shown satisfactory clinical performance, with no difference in survival rate for different composites. Veneers made on vital teeth have shown better performance than on non-vital teeth.

One study (14) evaluated the short-term outcome of two monochromatic universal RBC with a high chameleon effect in 78 anterior direct veneers and diastema closure restorations. The main cause of failure was fracture, and the failure rate was 2.6% at 1 year and 5.1% at 2 years of follow-up. Another investigation (15) assessed the clinical survival and success of RBC veneers and ceramic veneers placed between 2008 and 2014, using 459 veneer restorations, of which 1043 (71.5%) were direct RBC, and 416 (28.5%) were ceramic, placed in 341 patients, with a follow-up time of 10 years. The authors showed a failure rate for RBC of 2.8% at 3 years, 3.9% at 5 years, and 4.1% at 10 years. Irgang et al. (16) provided a retrospective clinical evaluation of RBC veneers performed with microparticulate or universal RBC, using the FDI (International Dental Federation) and USPHS (United States Public Health Service) evaluation criteria. Based on an analysis of 74 restorations, with follow-up times ranging from 6 months to 10 years, the main cause of failure was fracture, but the annual failure rate was not reported. Coelho-de-souza et al. (17) investigated the performance of direct veneers using different RBC on vital and non-vital anterior teeth. They followed 196 restorations over an average follow-up period of 3.5 years. The annual failure rate in vital teeth was 4.9%, and 9.8% in non-vital teeth.

Discussion

There is a growing demand for cosmetic restorations in dental offices, highly influenced by social media exposure (18). However, it is the dentist's responsibility to understand the patients' needs and offer them the most appropriate treatment. Even when a cosmetic procedure is feasible and the improvement of the smile is possible, there is a risk that the patient will feel dissatisfied after completing the treatment, especially in people with body dysphoric disorders (19).

Patients with single-tooth cosmetic demand at young ages (from 8 to 21 years-old) and who cannot afford ceramic materials may benefit from RBC direct veneers. In some young patients, teeth eruption is not finished, and the final position of the tooth might influence the outcome of the veneer in the mid-term. The gingival architecture also may change over time from youth to adulthood, exposing cervical margins and changing the esthetic result of a veneer. One may also consider the less invasive approach required for direct veneers, which can benefit young patients on the long-term, preserving tooth structure by avoiding extensive enamel reduction at very young ages.

RBC have several positive points, but one cannot fail to mention the disadvantages of using this material. Restorations made with RBC have a limited lifespan, most of which are less than 10 years (20). The durability of RBC veneers depends on many variables, from the tooth's preparation to the patient's oral health (21). On the other hand, ceramic veneers have greater clinical longevity as they have higher color stability without loss of gloss or color, in addition to providing higher mechanical resistance (22). However, a key point when choosing a restorative material is the possibility of maximum preservation of sound tooth structure. RBC restorations can be performed with minimal or even no tooth preparation and should be the first choice, especially in young patients [8].

Furthermore, one of the main advantages of this material is that it can be repaired quickly and at a low cost (23-25).

The limitations of the studies in this literature review are the short follow-up time and the difficulty of establishing similar evaluation methods. Irgang et al. (16) followed up on direct veneers for up to 10 years; however, more than 75% of their sample was only assessed for no more than 4 years. The same bias happened to two other studies that had a follow-up time of 2 and 3.5 years (14,17). On the other hand, Mazzetti et al. (15) had the largest sample size and the longest follow-up time but did not use any criteria for assessing the failure of direct RBC veneers.

Most of the selected studies used the USPHS system for assessing clinical outcomes. This system was created more than four decades ago, opposing the FDI system, which was proposed in 2007 and produces an improved and standardized evaluation (26,27). It was possible to identify that Coelho-de-Souza et al. (17) used only the FDI method to evaluate restorations, while Korkut et al. (14) and Irgang et al. (16) reported having evaluated their results using both the FDI and USPHS systems. However, Mazzetti et al. (15) did not report which method they used to evaluate the veneers.

Regarding the type of RBC, Mazzetti et al. (15) used micro-hybrid and nano-hybrid RBC, also used by Irgang et al. (16) and Coelho-de-Souza et al. (17, 28). Korkut et al. (13) used RBC with supra-nanometric particles with a spherical shape, which do not require color selection and facilitate the operative technique (29). Regarding the adhesive technique, Korkut et al. (14) used a universal adhesive system, as did Mazzetti et al. (15), who also used a total acid-etching adhesive system. Irgang et al. (16) and Coelho-de-Souza et al. (17) only used a total acid-etching adhesive system. After analyzing the articles, it was possible to identify a similar clinical longevity, regardless of the restorative material and adhesive technique selected. This data infers that the difference between the RBC used plays a minor role in the restoration's clinical longevity once techniques are applied properly by the dentist (30).

Rubber dam isolation was used by Korkut et al. (14) in all cases, while Mazzetti et al. (15) reported using it in almost all patients. Similarly, Coelho-de-Souza et al. (17) used either a rubber dam or relative isolation with lip retractors, while Irgang et al. (16) did not report whether there was any type of isolation during the procedures. It is known that adequate moisture control is fundamental to the success of adhesive treatments; however, there is low-quality evidence showing that absolute isolation in direct restorative treatments can lead to a lower rate of restoration failure compared to the use of relative isolation (31).

To assess the longevity of the veneers, the studies used the criteria of success (14, 15) and survival (15-17). Over the follow-up periods, a restoration that did not require any type of intervention was considered successful, while survival was considered when the restoration was still functional but had to undergo some repair (partial restoration). Finishing and polishing procedures were not considered interventions (15). The use of the survival criterion is the most reliable method for considering the longevity of a treatment once the repair of a restoration is a frequent procedure in dental practices and is essential to increasing the longevity of restorative treatments (32).

Demarco et al. (33) and Korkut et al. (14) report that the main reasons for failure of aesthetic RBC restorations in anterior teeth are related to color changes and marginal infiltration. On the other hand, some literature states that fracture is the main reason for failure (16,17).

Coelho-de-Souza et al. (17) were the only authors to compare treatment longevity in vital and non-vital teeth. The failure rate of direct RBC veneers after 3.5 years in vital teeth was 4.9%, while for non-vital teeth the failure rate was double, at 9.8%. The difference in results can be explained by the significant removal of tooth structure during endodontic treatment, which may not be limited to access to the pulp chamber, resulting in lower resistance to fracture in these teeth (34,35).

When comparing the direct RBC veneers and ceramic veneers, Mazzetti et al. (15) demonstrated 35% and 75% cumulative success rates in 10 years, respectively. The failure events for RBC veneers were 20.9%, and 7.7% for ceramic. As the 10-year cumulative survival rates of veneers was 66% for RBC and 89% for ceramic, one should consider the repair appointments these restorations need, and this should be agreed with the patient when choosing the restorative technique.

Conclusion

Considering the limitations of this study, one can conclude that the follow-up period for direct RBC veneers is still short and there is no standardization of failure assessment criteria. However, the authors consider that these veneers have acceptable clinical longevity but may require repair appointments. Regardless of the method used to assess the success and survival of restorations, the main cause of failure is the veneer fracture.

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