The effect of veneers on cosmetic improvement

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IN BRIEF

- Evolution of composite materials means that ceramic veneers are not always the best option.
- Most cases for composite veneers are accomplished in one visit with a minimum of tooth intervention.
- Direct composites allow us to plan for the future and make appropriate changes if and when required. The results with composite can be as good as ceramic.

RESEARCH

Objectives This clinical study was designed to compare the patient's opinion of the cosmetic improvement after the placement of direct composite and indirect porcelain veneers. **Methods** This retrospective study involved a survey of 145 patients (96 responses) each treated with 10 direct composite (Vitaescence) or 10 porcelain (Fortress) veneers. Patients subjectively evaluated multiple aspects of their smile using visual analogue scales before and after treatment for colour, shape, size, smile line and overall facial appearance. **Results** There were no statistical differences between the cosmetic improvement achieved for porcelain and composite ($p \geq 0.05$). Cost factors were not significant. Significant factors were: tooth conservation ($p \leq 0.021$), time ($p \leq 0.012$), repair costs ($p \leq 0.009$) and replacement costs ($p \leq 0.024$) and favoured the direct composite veneers over the porcelain veneers. Correlation findings relating to what patients feel as the key components of the smile for overall cosmetic improvement showed medium to high correlations ($0.301 \leq r \leq 0.718$) with tooth shape, colour and level of tooth display, gingival level, gingival symmetry and tooth whiteness. **Conclusion** The choice of material (direct composite resin vs porcelain) when constructing maxillary anterior veneers does not significantly affect the patient's perception of cosmetic improvement. However, there was a preference towards accepting the composite veneer option. Overall aesthetic satisfaction is multifactorial. The results support the opinion that the more conservative composite veneers are justified and that, given the choice and information, patients may prefer this option.

INTRODUCTION

The overall decline in caries rate, the impact of fluoridation on caries and better control of periodontal disease has helped prolong the lifespan of the dentition. Patients now expect to keep their dentition for longer and for their dentist to satisfy their goal of retaining teeth for a lifetime.¹ The advent of new materials and bonding techniques has changed the face of dentistry enabling the profession to disguise the signs of aging through aesthetic treatment procedures.²⁻⁷

Dental appearance has been judged to be an important indicator when assessing

facial attractiveness,^{8,9} with physical beauty being a significant factor in a person's well-being.¹⁰ The oral region is a dynamic part of the face, with tooth and gingival display during functional lip movements creating an expression of aesthetics that is unique to an individual.¹¹

Although direct composite veneers were introduced in the late 1970s and early 1980s, they were disappointing due to poor colour stability, retention of polished surface and wear. Today's composites have much improved physical and aesthetic properties enabling minimally invasive treatment modalities to be performed with immediate results satisfying the most cosmetically discerning patients.^{4-6,12-14}

Porcelain veneers, on the other hand, require greater and irreversible tooth intervention. Indirect porcelain veneers have been judged by dentists to have overall better survival rates and aesthetics. However, they require at least two appointments and sometimes considerable tooth preparation.

Few systematic studies have been conducted to assess the effect of providing cosmetic dental improvement utilising veneers.¹⁵⁻¹⁸ One difficulty is in defining the large numbers of variables to be tested, and complex relationships have been described.^{19,20} Previous reports have been limited to one to four veneer placement, whether porcelain or composite, and focused on longevity of the restoration.^{6,14,21} The aim of this retrospective study was to measure the cosmetic improvement and the degree of patient satisfaction. In addition, the study was designed to identify potential factors that influence patients' decision-making process. Four hypotheses were tested:

1. Composite resin and porcelain veneers have the same cosmetic effect in terms of patient assessment
2. Patients choose composite veneers as an alternative to porcelain veneers mainly due to tooth conservation, cost and it being a one visit procedure
3. Patients choose porcelain veneers as an alternative to composite veneers mainly

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due to long-term performance even after considering postoperative side-effects and irreversible tooth reduction

4. Patient satisfaction for overall cosmetic improvement is multifactorial.

MATERIALS AND METHODS

This retrospective study involved the survey of 145 patients, (chosen randomly from records of 200 patients), treated with 10 composite or 10 porcelain veneers. These patients had their treatment completed within the period from 2001 until 2005. Of the 145 patients surveyed, 96 responded to the survey: 66 had received composite veneers and 30 had received porcelain veneers. The survey asked the patients to subjectively evaluate their smile from their perspective before and after treatment. Survey questions included questions regarding the colour, shape, size, smile line, overall facial appearance and their relation to the total cosmetic improvement/effect. Both direct composite and indirect porcelain veneers were placed by one of the authors (SN). One type of direct composite was used in this study: Vitalescence® (Ultradent Products, Inc., South Jordan, Utah 84095, USA). Also a single type of porcelain was used: Fortress® (Chameleon Dental Products, Kansas City, Kansas, USA). Examples are shown in Figures 1 and 2.

Patient satisfaction before and after placement of veneers was assessed using key questions to test the reason for the patient's choice of treatment (porcelain or composite). The survey was undertaken three months to four years after the completion of treatment. Visual analogue (VAS) scores were employed in both parametric and non-parametric statistical calculations. SPSS Version 13 was used in the analysis ($\alpha = 0.05$ considered statistically significant). The VAS scores were interpreted using both parametric and non-parametric tests.

To test the four hypotheses the 22 questions in the questionnaire were regrouped into 12 key questions for comparing smile analysis before and after using non-parametric tests. The initial questions were regrouped to enable the analysis of the key questions to test the null hypothesis because applying an individual test for each original question would inflate the Type 1 error rate.

Fig. 1 Case showing pre-operative aesthetic situation and post-op views following treatment with non-invasive composite veneers

Fig. 2 Case showing pre-operative aesthetic situation and post-op views following treatment with conventional porcelain veneers

Fig. 3 Analysis of questions 1–22 presented as box plots to test for normality of distribution of baseline/pre-treatment and after/post-treatment. It is apparent that there are similar mean VAS score and variances at baseline/pre-treatment and after/post-treatment, showing an improvement in aesthetics for both materials

RESULTS

The original 22 questions were considered first. A comparison of pre-treatment and post-treatment mean VAS scores for composite and porcelain veneers was performed. Highly significant cosmetic improvements were found for composite and porcelain veneers after treatment. The analysis of the mean VAS scores for both groups of composite and porcelain veneers showed that there was a significant overall improvement in aesthetics ($t_{43} = -3.38$; $p \leq 0.01$), as shown in Figure 3. This signifies an overall improvement in aesthetics as scored by the patient for both composite and porcelain veneers.

Initial cross-sectional analysis showed significant improvement for both porcelain and composite ($p \leq 0.05$). This showed no statistical differences on the cosmetic improvement achieved for porcelain and composite ($p \geq 0.05$).

The smile analysis was compared using the independent samples test (non-parametric) for the regrouped 12 key questions (comparing composite with porcelain) to further test the hypothesis that there was no correlation between the material used and the outcomes. This hypothesis was accepted at the 95% confidence level and therefore supports the view that smile improvement was independent on type of material used and both composite and porcelain veneers achieved the desired aesthetic result.

The construct validity of the questionnaire was further assessed (using

Table 1 Analysis results of selected factors influencing patients' decisions for cosmetic improvement/satisfaction

An attractive smile/satisfaction was correlated with:	
Shape of teeth	60% disliked before; 93.8% agreed/liked after treatment $r = 0.718$; significant correlation $p \leq 0.01$
Colour of teeth	Whiter teeth preferred by 78% of patients before; 78.2% disliked the colour before and 75.4% liked the colour after treatment $r = 0.551$; significant correlation $p \leq 0.01$
Teeth arrangement	Symmetry: 98% agreed/happy after treatment
Level of tooth display	90.8% agreed/happy after treatment $r = 0.650$; significant correlation $p \leq 0.01$
Gum display/harmony/symmetry	83% agreed/happy after treatment $r = 0.301$; medium correlation
Patient factors (including self-assessment rating /10)	95.4% were satisfied with general appearance of their smile $r = 0.598$; significant correlation $p \leq 0.01$
Facial appearance and perceived improvement in social acceptance	43.3% of patients before and 7.8% after treatment covered their mouth when smiling. 76.9% before treatment and 92.2% after perceived the improvement in social acceptance and the connection between teeth and facial aesthetics
Smile affects your facial appearance	87.7% agreed that your smile affects your facial appearance. 27.3% were confident smiling before treatment and 81.5% were confident after. From 65% before, only 20% hated close-up photos after treatment.

Spearman's non-parametric rank correlation) by checking the direction and strength to which factors with expectation of both good and poor correlation fulfil the prediction to further support the hypothesis, especially when there is no gold standard for aesthetic index available.³² High correlation findings affecting the patients' assessment of smile satisfaction and overall cosmetic improvement are provided in Table 1.

The results of the assessment of factors influencing patients' decisions for cosmetic improvement revealed that cost factors were not significant. Significant factors were: tooth conservation ($p \leq 0.021$), time (p

≤ 0.012), repair costs ($p \leq 0.009$) and replacement costs ($p \leq 0.024$) and these favoured composite. Maintenance requirements ($p \leq 0.863$) and patients with low initial VAS score, and also patients seeking the 'ultimate aesthetic result' favoured porcelain, although there was no significant difference in cosmetic improvement with porcelain.

DISCUSSION

The effect of veneers on cosmetic improvement is difficult to measure, as there is no gold standard for aesthetics. Satisfaction with aesthetics in general, including veneers, is a complex process and cannot be completely explained

by the colour and the shape of the teeth as it is subjective.^{14,17,18} This supports the findings of the present study regarding cosmetic improvement and the patients' decision-making processes.

A patient's input towards treatment outcome has also been researched²⁰ and the patients in our study presented had full knowledge of their treatment options and understood the risks and benefits of the treatment before finally deciding on their choice of veneers.^{22,23} This may partly explain why the overall satisfaction for both composite and porcelain veneers was highly significant.

Tooth conservation and maintaining the integrity of the original tooth rated highly significant ($p \leq 0.021$) in the decision-making process of our patients. This raises the question, are our patients completely aware of this biologic cost when considering the treatment options? Has consent been given after discussion of all the options of treatment?^{22,23} There may be situations where teeth with large composite restorations may benefit from porcelain veneer coverage that will strengthen the tooth.²⁴

The composite veneers placed in our study involved minimal intra-enamel preparation from sand-blasting or cleaning the enamel surface with pumice, and slight enamel contouring to correct tooth inclination and incisal overlap, requiring no local anaesthetic. This differs from most if not all porcelain veneer restorations, which require extensive preparations and necessitate some form of intervention when the restoration fails.

The greater the tooth reduction, the more likely it becomes that the enamel is removed, which is likely to jeopardize the retention of the planned aesthetic restoration.²⁵ Significantly increased failure rates have been associated with porcelain veneer placement over areas suffering from tooth surface loss or where there are existing restorations.²¹ There is a worrying trend that porcelain veneer preparations are becoming more destructive of irreplaceable tooth tissue. Studies have reported that a lack of adequate enamel is the main cause for patients presenting with partial or complete debonding of porcelain veneer restorations placed for elective aesthetics.^{26,27}

Meijering *et al.*,¹⁴ using Kaplan-Meier analysis of a 2.5 year clinical evaluation,

showed an overall survival of 78% for direct composite and 94% for porcelain veneers. Clinically acceptable porcelain veneers were 92% at 5 years decreasing to 64% in 10 years.³ Intact enamel remains the gold standard substrate to which etched porcelain and composite restorations can bond reliably. However, a durable aesthetic result cannot always be reassured in the long term due to wear and marginal discolouration.

Composite veneers require minimal intervention with all margins on the enamel, and can be repaired. The use of porcelain can lead to irreparable failures.^{3,28} However, most composites fail reparably and reversibly¹² while maintaining the integrity of the tooth structure, that is, tooth structure that is not compromised from past trauma, extensive restorations and tooth surface loss. The results obtained from the study presented here were highly significant for repair costs, and significant for replacement costs, better long-term results and tooth conservation.

It is interesting to note that patients who chose composite veneers would be happy to consider another set of composite veneers 76% of the time. Patients choosing porcelain veneers had lower mean scores initially than composite, expecting 'ultimate' aesthetics after the treatment as shown by the post-treatment VAS scores. This is in agreement with a study which showed high initial dissatisfaction correlated to high expectations from orthodontic treatment.⁹

It is accepted that the quality of the level of evidence from this retrospective study is medium to low (level IIb and III) as determined by Royal College of Surgeons National Clinical Guideline Criteria.²⁹ The design of the study does not minimise the potential for examiner and possibly patient bias as this is based on one practice setting. Observations made were both subjective and objective assessments. However, the conclusions may be valid for other dental practitioners contemplating the relative benefits of composite and porcelain veneers in their practice.

It is possible that this result is practice specific, as direct composite veneers do require considerable experience and are technique sensitive, whereas porcelain veneers rely upon the expertise of an experienced laboratory technician. It would,

however, be unfortunate if dentists were cutting sound tooth structure unnecessarily due to a lack of adequate experience.²⁷

The aim of the paper was to demonstrate that composites can provide similar aesthetic improvement, as assessed by the patients, as would feldspathic porcelain constructed by an experienced dental technician in one clinical laboratory setting. There has been no other research comparing objectively, from the patients' perspective, aesthetics achieved using composite veneers on ten upper teeth with porcelain veneers. This study could be repeated in multi-centre studies; however, operator variability is important as it has been shown to influence the success of aesthetic dentistry.^{4,5,30} Composite placement is a unique art form and experience is essential. For composite restorations to mimic natural tooth structure, the clinician must have a comprehensive understanding of the materials science and techniques involved in direct bonding procedures.^{4,5,7,31}

There is no golden index for aesthetics,^{6,8-11,17-20,32} however satisfaction with general appearance of the teeth correlated with satisfaction with shape of the teeth, level of tooth display, the colour of teeth and gum symmetry are key essentials for achieving predictable aesthetics for most patients.^{11,14,33-36} The importance of the shade and the shape of the tooth during composite or porcelain veneer construction cannot be overemphasised. However, satisfaction with veneers is a complex process and cannot be completely explained by the colour, shape of the teeth and arrangement.¹⁴

Despite the limitations of this study, the evidence suggests that composites can provide optimal aesthetics with minimal or no tooth intervention, immediately improving aesthetics while leaving options for future orthodontic and restorative care where the veneers can be removed/modified and orthodontic and complex restorative treatment carried out. Composites are the most versatile restorative material available to the dental professional, especially for aesthetically-conscious patients.^{4,30} Mastering anterior direct composite restorations is a necessity for the contemporary clinician who appreciates and understands the art and science of aesthetic dentistry.^{6,30}

The results of the study presented

here agree with observations made by Goldstein,⁶ Meijering¹⁴ and Tyas³⁷ that the clinician and patient must consider several factors, such as costs, tooth conservation and number of visits, and where the outcome is largely aesthetic then cost may not be the most crucial consideration for the patient. Cost was not significant ($p \leq 0.078$) in the present study. All the patients undergoing this research were aware that they would not receive large amounts back from their health funds if they were rebated at all and therefore would have to endure the complete cost of any treatment. The biological cost to the patient, which has implications for the longevity of the teeth retaining these restorations, therefore needs to be addressed.

Tyas³⁷ concluded that 'there is no ideal veneer' and the concept of the 'most effective' embraces several factors, not just failure of veneers. These include aesthetic outcome, degree of hard tissue destruction, cost, the number and duration of visits, and reparability. The research presented here has shown that the effect of composite and porcelain is similar on overall cosmetic improvement of maxillary anterior ten teeth, taking into account all parameters of aesthetics as seen by the patients such as tooth shape, colour, teeth arrangement, level of teeth display, gum symmetry, achieved desired aesthetics, facial balance restored and rating smile out of ten for an overall aesthetic result.

The aim of the study was to demonstrate the importance of tooth conservation in relatively sound teeth, using composite veneers instead of porcelain veneers that require invasive tooth intervention, for aesthetically demanding patients where the orthodontic treatment is not an option (for multitude of reasons) and tooth colour, shape and size modification is required. The results suggest that the aesthetic expectations of patients are complex and can change with time.³² Composite veneers can be considered as a viable minimal or non-invasive treatment alternative.^{31,37}

CONCLUSIONS

1. The choice of material (composite resin *vs* porcelain) when constructing anterior veneers does not significantly affect the patient's perception of cosmetic improvement
2. Patients may choose composite veneers as an alternative to porcelain veneers due to tooth conservation, cost and the one visit procedure
3. Patients choose porcelain veneers as an alternative to composite veneers due to ultimate aesthetics, long-term results and less maintenance, even after considering postoperative side-effects such as irreversible tooth invasion, predisposing future dental problems and sensitivity
4. Patient satisfaction for overall cosmetic improvement (since there is no gold standard to measure against) is multifactorial and complex.

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