Clinical Note

A Comparative Study of Direct Resin Veneers and Porcelain Veneers in the Esthetic Restoration of Anterior Teeth with Dental Fluorosis

Cui-min Zeng

Department of stomatology, Cangzhou People's Hospital, Hebei, Cangzhou, China
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Abstract: To evaluate the clinical effect of direct resin veneers and porcelain veneers in the esthetic restoration of anterior teeth affected by dental fluorosis, 64 patients suffering from dental fluorosis (328 teeth) between February 2015 and June 2016 were selected. Of these patients, 34 were given direct resin veneers (196 teeth) and 30 were given porcelain veneers (132 teeth). Clinical follow-up observation was carried out for 24 months on restoration integrity, marginal fit, gingival index, secondary caries, and patient satisfaction. After 24 months of restoration, it was found that there was no secondary caries in the direct resin veneer or porcelain veneer restoration, and the integrity of the restorations, marginal adhesiveness, and gingival condition examination scores were evaluated as excellent. The scores for patient satisfaction were 80.27 and 90.63, respectively, and the difference was statistically significant (p < 0.05). The results demonstrated that direct resin veneers and porcelain veneers can both achieve a positive clinical therapeutic effect in dental fluorosis esthetic restoration, but patient satisfaction after porcelain veneer restoration is higher.

Key words: Direct resin veneers, Porcelain veneers, Fluorinated teeth

Introduction

With the improvement in living standards, people have increasingly higher expectations for the beauty of their teeth. The Cangzhou area is a high fluoride area, and dental fluorosis is very common. It is often clinically manifested as chalky plaque or a depression on the labial and buccal surface of multiple teeth, which is brownish yellow in color. In severe cases, the teeth are defective. Traditional direct resin and porcelain veneers are the common methods used to repair dental fluorosis. In this paper, recent cases involving the esthetic restoration of anterior teeth with direct resin and porcelain veneers were selected for the long-term observation and comparison of their clinical effects.

Materials and Methods

For the present study, the cases of 64 patients (a total of 328 teeth) with dental fluorosis who were treated in our hospital between February 2015 and June 2016 were selected, including 34 cases with direct resin veneers (196 teeth) and 30 cases with porcelain veneers (132 teeth). The patients were 18–30 years old, and all the operations were performed by one person. Inclusion criteria: ① there was no dislocation or torsion of the labial and lingual direction of the affected teeth; ② the anterior teeth were superficially covered with shallow coverage, and the occlusal relationship was normal; ③ teeth with mild fluorosis: only white spots or plaque on the enamel; teeth with moderate fluorosis: the enamel of the tooth surface was sunken and brownish yellow; teeth with severe fluorosis: the enamel surface was defective; ④ no caries or periodontal disease; ⑤ the pulp vitality was normal. This study was conducted in accordance with the Declaration of Helsinki and approved by the ethics committee of Cangzhou People's Hospital (20150218-1) and informed consent was obtained from all parents.

Materials and equipment

The materials and equipment are listed in the Table 1.

Method

Preoperative preparation

64 patients were given routine oral-health education and supragingival scaling to ensure the health of the periodontal tissue, which was conducive to the smooth progress of the veneer repair. A follow-up was conducted seven days later.

Restorative treatment

Before the operation, photos of the affected teeth were taken, and direct resin veneers or porcelain veneers were selected according to the requirements of the patients. Based on the background color of the affected teeth, the neck margin was designed to be a gingival or subgingival shallow concave shoulder of 0.5 mm with a shoulder width of 0.2–0.5 mm. Gingival retraction was performed, and then silicone-rubber impression material was used to take the impression and super anhydrite was used to infuse the model. Colorimetric photos were taken, and the preoperative photos, colorimetric photos, and models were sent to the denture processing center so that the porcelain veneers could be made. After the porcelain veneers were made, a trial was carried out to check whether they were suitable, the resin adhesive was fixed, the teeth were adjusted and polished, and the post-restoration precautions were explained. For the direct resin veneer restoration, a technician prepared the veneers in accordance with the condition of the teeth, and the shoulder preparation was performed by the porcelain veneer restoration techni-
Clinical evaluation

Re-examination was performed 12 and 24 months after the restoration, and a clinical effect evaluation was carried out according to the modified United States Public Health Service evaluation (see Table 2). The clinical follow-up and evaluation were completed by the same physician.

Satisfaction evaluation

The visual analogue scale (VAS) was used to evaluate patient satisfaction immediately after the repair. Patients marked their satisfaction on a 10-cm line, with the left end of the line being the least satisfied (0 points) and the right end being the most satisfied (100 points). The score obtained was the VAS satisfaction score.

Statistical analysis

SPSS 24.0 statistical software was used to analyze the data in this study. The measurement data used mean ± standard deviation (x ± S), and the t-test was used for statistical analysis. The relevant measurement data were expressed as a percentage (%), and the chi-square test was used. P < 0.05 was considered to be a statistically significant difference.

Results

Comparison of the effects of the two restoration methods

The results of the statistical analysis of the direct resin veneer restoration group and the porcelain veneer restoration group after 24 months of follow-up reviews and clinical examinations are set out in Table 3.

Comparison of the effect of the complete restoration rate of the two restoration methods

Following 24 months of follow-up reviews and clinical examinations, there was no significant difference in edge suitability between the direct resin veneer restoration group and the porcelain veneer restoration group. The results are shown in Table 4.

Comparison of the incidence of gum symptoms between the two restoration methods

Following 24 months of follow-up reviews and clinical examinations, compared with the porcelain veneer restoration group, the incidence of gum-related symptoms in the direct resin veneer restoration group was significantly higher than that of the porcelain veneer restoration group (p < 0.05). The results are shown in Table 5.

Survey results of patient satisfaction with the two restoration methods

Compared with the direct resin veneer restoration group, the patient satisfaction of the porcelain veneer restoration group was higher. The average patient satisfaction score for the direct resin veneer restoration group was 80.20, and the average satisfaction score for the porcelain veneer restoration group was 90.63. As shown in Fig. 1, the difference was

| Evaluation item                        | Grade | Resin veneer restoration group (pieces) | Porcelain veneer restoration group (pieces) |
|----------------------------------------|-------|----------------------------------------|--------------------------------------------|
| Completion 196/132                     | A     | 186                                    | 130                                        |
|                                        | B     | 6                                      | 2                                          |
|                                        | C     | 4                                      | 0                                          |
| Edge suitability                       | A     | 187                                    | 132                                        |
|                                        | B     | 7                                      | 0                                          |
|                                        | C     | 2                                      | 0                                          |
| Secondary caries                       | A     | 196                                    | 132                                        |
|                                        | B     | 0                                      | 0                                          |
| Gum condition                          | A     | 185                                    | 131                                        |
|                                        | B     | 9                                      | 1                                          |
|                                        | C     | 2                                      | 0                                          |
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Typical cases

Typical case of direct resin veneers

The patient was a 21-year-old female, who went to the doctor mainly because the dental fluorosis was affecting her appearance.

Examination: uneven white spots on the labial and buccal surface of the whole mouth, obvious yellow-brown plaque on the labial surface of the bilateral maxillary central incisors, normal oral hygiene, calculus (+), and slight bleeding during probing.

Diagnosis: dental fluorosis

Treatment: Complete mouth cleansing was performed, and oral-hygiene education was given to the patient. At the follow-up a week later, preoperative photos were taken, then 13–23 teeth were prepared, impressions were taken, the models were filled, and colorimetric analysis was performed. The direct resin veneers were molded, the occlusion was adjusted, the veneers were polished, and pictures were taken after surgery. The patient was instructed not to use the prosthesis to bite hard objects and to return to the clinic after a year so that the color, edge, and completion of the prosthesis as well as the condition of the gums could be observed. No abnormality was found in the maxillary 3-3 abutment and prosthesis, and the patient was satisfied with the restoration effect (see Fig. 2).

Typical case of porcelain veneers

The patient was a 24-year-old male, who went to the doctor mainly because dental fluorosis was affecting his appearance.

Examination: uneven white spots on the labial and buccal surface of the whole mouth, yellow spots on the labial surface of the bilateral maxillary central incisors, normal oral hygiene, calculus (+), and slight bleeding during probing.

Diagnosis: dental fluorosis

Treatment: Complete mouth cleansing was performed, and oral-hygiene education was given to the patient. At the follow-up a week later, preoperative photos were taken, then 13–23 teeth were prepared, impressions were taken, the models were filled, and colorimetric photos were taken. The preoperative photos, colorimetric photos, and models were then sent to the technical processing center so that the porcelain veneers could be made. After making the prosthesis, it was fitted and bonded into the mouth, and pictures were then taken. The patient was instructed not to use the veneers to bite hard objects and to return to the clinic after

Table 4. Comparison of the aesthetic effect of the two restoration methods on the anterior teeth

| Group    | Number of cases | Complete surface [n (%)] | The probe was stuck, but there was no crack that could be probed [n (%)] | Visible cracks, broken porcelain, breaking or falling off [n (%)] | Total restoration rate (%) |
|----------|-----------------|--------------------------|-------------------------------------------------|-------------------------------------------------|-----------------------------|
| Resin    | 196             | 186 (94.90)              | 6 (3.06)                                        | 4 (2.04)                                        | 97.96                        |
| Porcelain| 132             | 130 (98.48)              | 2 (1.52)                                        | 0 (0)                                           | 100                          |
| X² value |                 |                          |                                                 |                                                 |                             |
| P value  |                 |                          |                                                 |                                                 | n.s.                         |

Table 5. Comparison of the edge suitability effects of the two restoration methods

| Group    | Number of cases | Good anastomosis, no sharp probe stuck [n (%)] | There were defects that did not affect the appearance [n (%)] | There were obvious cracks and dentin was detected by probe [n (%)] | Total restoration rate (%) |
|----------|-----------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|-----------------------------|
| Resin    | 196             | 187 (95.41)                                     | 7 (3.57)                                        | 2 (1.02)                                        | 98.98                        |
| Porcelain| 132             | 132 (100)                                      | 0 (0)                                           | 0 (0)                                           | 100                          |
| X² value |                 |                                                 |                                                 |                                                 |                             |
| P value  |                 |                                                 |                                                 |                                                 | n.s.                         |

Table 6. Comparison of the incidence of gum-related symptoms between the two restoration methods

| Group    | Number of cases | No inflammation, healthy [n(%)] | Mild inflammation, a small amount of bleeding on probing or mild receding gums [n (%)] | Obvious bleeding and swelling of the gums, periodontal pockets probed [n (%)] | Total incidence rate (%) |
|----------|-----------------|---------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|-------------------------|
| Resin    | 196             | 185 (94.39)                     | 9 (4.59)                                                                              | 2 (1.02)                                                                         | 5.61                    |
| Porcelain| 132             | 131 (99.24)                     | 1 (0.76)                                                                              | 0 (0)                                                                           | 0.76                    |
| X² value |                 |                                  |                                                                                        |                                                                                 | 5.274                   |
| P value  |                 |                                  |                                                                                        |                                                                                 | <0.05                   |

Figure 1. Patient satisfaction score after the repair was tested using the visual analogue scale (VAS), 100 points indicated being the most satisfied. Data was shown as mean ± SD, ***p<0.001, n=34 cases with direct resin veneers, n=30 cases with porcelain veneers.
one year so that the color, edge, and the completion of the restoration could be examined as well as the gum condition. No abnormality was found in the maxillary 3-3 abutment and restoration, and the patient was very satisfied with the restoration effect (see Fig. 3).

Discussion
White or yellow plaque on the labial surface of dental-fluorosis patients affects the patients’ appearance. Many patients, especially young patients, have higher expectations for the appearance of their front teeth. Many scholars believe that veneers, especially porcelain veneers, are the best choice for the esthetic restoration of dental fluorosis. A total of 328 teeth of 64 patients with dental fluorosis were selected for this study, including 34 cases with direct resin veneers (196 teeth) and 30 cases with porcelain veneers (132 teeth). The treatment achieved good clinical results and high patient satisfaction. In patients with dental fluorosis, the labial demineralized enamel is removed, and the base color is mostly the color of natural teeth. Veneer restoration has less molar tooth tissue, tooth preparation is mainly concentrated in the enamel layer, the postoperative sensitivity and the incidence of pulp inflammation is low, and the bonding strength is high. When using porcelain veneers for restoration, since the optical properties of porcelain materials are similar to those of natural teeth, the color of natural teeth can be reproduced well, and they are not prone to discoloration. The long-term success rate is high, but the cost is also relatively high. Direct resin veneers have the advantages of a low price and a reduced number of visits, but they have higher requirements for the operating techniques of doctors. In addition, because of the defects in the resin material itself, the esthetic effect after restoration is slightly worse than that of porcelain veneers, and the material is more prone to discoloration. It is for these reasons that the porcelain veneers performed better in the evaluation of the clinical effects and patient satisfaction. Therefore, when economic conditions permit, porcelain veneer restoration should be selected, when possible, to achieve better clinical results.

The research team found that, in the process of resin and porcelain veneer restoration for patients with dental fluorosis, direct resin veneers require doctors to have a high degree of mastery of tooth morphology. In addition, individual esthetic standards are different, resulting in a difference between the direct resin veneer form and the standard form. In the process of tooth preparation for porcelain veneers, the preparation of the shoulder is very important. The shoulder plays a termination role in the placement of the porcelain veneers, which can ensure their smooth and correct placement. In order to ensure effective bonding, the bonding process should be conducted strictly in accordance with the instructions of the Ivoclar double-curing resin bonding material. Direct resin veneers require a high level of technical ability, the operation is difficult, and the long-term effects need further study. Although porcelain veneers require two patient visits, the operation is relatively simple, and the appearance and morphological effect are better.
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The success of porcelain veneer restoration firstly depends on precise tooth preparation, especially the preparation of the shoulder and the tightness of the edge after the restoration is in place. Fan Cong et al. have shown that the main reasons for gingival inflammation after porcelain veneer restoration are improper operation by the surgeon and poor maintenance of the patient’s oral hygiene(13). In the cases of porcelain veneer restorations in this study, 1 case had slight inflammation of the gums at the follow-up visit 24 months after restoration. After oral examination, the edge tightness was good, no redundant adhesive was found, and a small amount of plaque was found on the surface of the prosthesis. Oral health education was given to the patient again, and the importance of maintaining oral health was told. Gingival inflammation disappeared after a week.

Secondly, the bonding of porcelain veneer plays a key role in the success of restoration. In vitro studies have shown that the strength of porcelain veneer after complete bonding can meet the clinical needs(14,15). Reliable bonding can also enhance the strength of abutment and porcelain veneer and reduce the occurrence of microleakage. In this experiment, the resin adhesive Variolink N was used to bond the porcelain veneer, and the clinical effect was good. It is worth noting that the bonding effect is also closely related to the quality of tooth enamel. Studies have shown that the ideal bonding interface for porcelain veneer is the enamel surface, and a satisfactory bonding effect can be obtained when more than 50% of the tooth surface is enamel(16).

The results of this study confirmed that the cosmetic restoration of anterior teeth with porcelain veneers for patients with anterior tooth defects can achieve a better restoration effect than direct resin veneers, and they can also reduce the incidence of gingival inflammation.

Competing Interests
The authors have declared that no COI exists.

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