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Comparing the Morphological Accuracy of Two Modified Seal Methods Assisted Resin (Occlusal) Veneer Restoration of Posterior Teeth

Haimei Zhao
Nanjing Wanshou Hospital, Nanjing 210000, Jiangsu, China

Abstract: *Objective:* To compare the morphological accuracy of the modified silicone seal method and the modified resin seal method in assisted resin (occlusal) veneer restoration of posterior teeth. *Methods:* 80 patients who were admitted to our hospital from January 2023 to June 2025 and required posterior teeth resin (occlusal) veneer repair were selected and divided into a silicone seal group and a resin seal group using a random number table method, with 40 cases in each group. The silicone seal group used the modified silicone seal method to assist repair, and the resin seal group used the improved resin seal method to assist repair. The indicators related to the accuracy of the restoration shape and the treatment effect were compared between the two groups. *Results:* The edge suitability, occlusal contact accuracy and morphological matching scores of the restorations in the silicone seal group were all higher than those in the resin seal group, while the restoration detachment rate and edge microleakage incidence were lower than those in the resin seal group ($p < 0.05$). *Conclusion:* The improved silicone seal method has better morphological accuracy in assisting posterior tooth resin (occlusal) veneer repair, can reduce the risk of adverse events after repair, and has higher clinical application value.
Keywords: Improved seal method; Posterior resin (occlusal) veneers; Morphological accuracy; Silicone seal; Resin seal

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1. Introduction

Resin (occlusal) veneer repair of posterior teeth is a common clinical method for treating problems such as tooth defects and discoloration of posterior teeth. Its repair effect is closely related to the accuracy of the restoration shape. However, traditional repair methods rely on the doctor's experience and are prone to problems such as non-close edges and poor occlusal relationships [1]. The improved seal method can improve the accuracy of repair and reduce the foreign body sensation by preparing the tooth shape template in advance and assisting in the shaping of the resin veneer. However, the improved seals made of different materials have different effects in actual application. Based on this, this study compares the application effects of the improved silicone seal method and the improved resin seal method to provide a reference for clinical selection.

2. Materials and methods

2.1. General information

80 patients who were admitted to our hospital from January 2023 to June 2025 and required posterior tooth resin (occlusal) veneer repair were selected and divided into a silicone seal group and a resin seal group using a random number table method, with 40 cases in each group. In the silicone seal group, there were 21 males and 19 males, aged 25 to 60 (42.35 ± 5.28) years old; the restored teeth were: 18 first molars, 12 second molars, 6 first premolars, and 4 second premolars. The resin seal group consisted of 20 males and 20 males, aged 26 to 61 (42.80 ± 5.16) years old; the restored teeth were: 17 first molars, 13 second molars, 7 first premolars, and 3 second premolars. There was no significant difference in the general information of the two groups of patients ($p > 0.05$), indicating they were comparable.

2.1.1. Inclusion criteria

(1) The tooth defect area of the posterior teeth ≤ 1/3 of the occlusal surface area

(2) The teeth are not loose and the periodontal tissue is healthy

(3) The patients and their families are informed and cooperate with the research

2.1.2. Exclusion criteria

(1) Those with abnormal occlusal relationship

(2) Those with severe dental caries or uncured dental pulp lesions

(3) Those who are allergic to resin or silicone materials

2.2. Method

Before restoration, patients in both groups underwent routine oral examinations and x-rays to identify tooth defects, and then performed tooth preparation: carious tissue was removed, shallow concave edges were prepared, the occlusal surface preparation thickness was 0.5–1.0 mm, and the buccal and lingual surface preparation thickness was 0.3–0.5 mm. After the preparation was completed, the tooth surfaces were cleaned.

The silicone seal group uses an improved silicone seal method to assist in repair. Specific steps as follows.

(1) Seal preparation

Polyaddition silicone rubber (manufacturer: 3M China Co. Ltd., product model: ExpressXT) was used, the accurate proportion was then mix it in and covered the prepared teeth and adjacent teeth, and was pressed gently. To ensure that the material completely fits the shape of the teeth, press it. After the material was solidified, take it out and trim the excess edges to make a modified silicone seal.

(2) Resin shaping

Light-curing composite resin (manufacturer: Ivoclar Vivadent Company, product model: FiltekZ350XT) was selected, a matching color number according to the color of the patient's teeth was chosen, the resin was then filled into the modified silicone seal, and then accurately cover the seal on the prepared teeth, pressure was applied gentley to make the resin closely adhere to the tooth surface, and excess resin was removed at the same time.

(3) Light curing and trimming

Use a light curing lamp (wavelength 400–480nm, power 1200mW/cm^2), irradiate the resin for 20 seconds each time, irradiate the buccal, lingual and occlusal surfaces multiple times until the resin is completely solidified, remove the silicone seal, trim the edges and shape of the restoration with an emery needle, and finally polish it.

The resin seal group uses an improved resin seal method to assist in repair. Specific steps:

(1) Seal preparation

A self-setting resin (manufacturer: Shanghai Medical Equipment Co., Ltd. Dental Materials Factory, product model: self-setting dental tray water and dental tray powder) was used, and was mixed according to the powder-

liquid ratio of 3:1, then it was stirred evenly and cover the prepared teeth and adjacent teeth. After the resin has initially solidified (about 3 to 5 minutes), it was removed out and was transferred in hot water (60 ℃) to accelerate curing to complete hardening, and then grind and trim to make a modified resin seal.

(2) Resin shaping

The same type of light-curing composite resin as the silicone seal set was used, and the resin was filled into the modified resin seal, then, the prepared teeth was covered, pressurized and shaped, and the excess resin was removed

(3) Light curing and trimming

The operation was the same as the silicone seal set, complete the curing, trimming and polishing of the restoration.

2.3. Observation indicators

The morphological accuracy indicators of the two groups of restorations (edge suitability, occlusal contact accuracy, morphological matching was compared, and was all scored on a 10-point scale, the higher the score, the better the accuracy), and the incidence of adverse events within 6 months after repair (restoration loss, edge Leakage); the edge suitability is observed through scanning electron microscopy. The edge gap is ≤ 50 μm for 10 points, 51–100μm for 8 points, 101–150 μm for 6 points, and > 150 μm for less than 4 points; the bite contact accuracy is generally Through the bite paper inspection, the score of occlusal contact points was uniform distributed and moderate strength, 8 points, slightly less contact points or uneven strength, 8 points, obviously insufficient contact points or abnormal strength, 6 points, and no effective occlusal contact, 4 points or less. The shape matching was evaluated through visual observation and the patient's subjective feelings. The shape was coordinated with the adjacent teeth and the patient has no discomfort, which is 10 points. The shape is basically coordinated and the patient has no discomfort.

2.4. Statistical methods

Use SPSS24.0 to analyze data, measure data with *t*-test, count data with χ^2 test. $p < 0.05$ represents significant difference.

3. Results

3.1. Comparison of morphological accuracy indicators of restorations between the two groups

The edge suitability, occlusal contact accuracy and morphological matching scores of the silicone seal group were all higher than those of the resin seal group ($p < 0.05$), see **Table 1**.

Table 1. Comparison of morphological accuracy indicators of the two groups of restorations ($\bar{x} \pm s$, points)

Group	Marginal fitness	Occlusal contact accuracy	Morphological matching
Resin stamp set (40)	7.25 ± 1.03	7.18 ± 1.15	7.32 ± 1.08
Silicone stamp set (40)	8.96 ± 0.85	8.82 ± 0.96	9.05 ± 0.72
t	8.098	6.924	8.430
p	0.000	0.000	0.000

3.2. Comparison of the incidence of adverse events between the two groups after repair

The restoration shedding rate and marginal leakage rate in the silicone seal group were lower than those in the resin seal group ($p < 0.05$), see **Table 2**.

Table 2. Comparison of the incidence of adverse events between the two groups after repair [n (%)]

Group	Restoration falls off	Edge leakage	Overall incidence
Resin stamp set (40)	5 (12.50)	6 (15.00)	11 (27.50)
Silicone stamp set (40)	1 (2.50)	2 (5.00)	3 (7.50)
χ^2			5.541
p			0.019

3.3. Comparison of repair satisfaction between the two groups of patients

Patients in the silicone seal group had higher repair satisfaction than the resin seal group ($p < 0.05$), see **Table 3**.

Table 3. Comparison of repair satisfaction between the two groups of patients [n (%)]

Group	Very satisfied	Satisfy	Not satisfied	Overall satisfaction
Resin stamp set (40)	15 (37.50)	14 (35.00)	11 (27.50)	29 (72.50)
Silicone stamp set (40)	25 (62.50)	13 (32.50)	2 (5.00)	38 (95.00)
χ^2				7.440
p				0.006

4. Discussion

The core requirement for resin (occlusal) veneer repair of posterior teeth is to ensure that the shape of the restoration is highly consistent with the natural teeth, while meeting the requirements of occlusal function and aesthetics. However, in traditional repair methods, doctors need to manually shape the resin based on experience, which can easily lead to problems such as non-adhesive edges of the restoration and poor occlusal contact due to visual deviations and operational errors, affecting the repair effect and service life [2]. The improved seal method prepares tooth shape templates in advance to provide an accurate reference for resin shaping, which can effectively reduce operational errors. However, the choice of seal material will directly affect the accuracy and practicality of the template, so comparing the effects of different improved seal methods has important clinical significance.

The results of this study show that the marginal suitability, occlusal contact accuracy and morphological matching scores of the silicone seal group are higher than those of the resin seal group, which shows that the modified silicone seal method has better morphological accuracy when assisting in the restoration of posterior teeth with resin (occlusal) veneers. Analyzing the reasons, the improved silicone seal uses addition-polymerized silicone rubber material. This material has good elasticity and fluidity. When making the seal, it can more fully fit the fine structure of the tooth surface and accurately replicate the morphological characteristics of the tooth, especially in key parts such as occlusal pits and grooves, edge lines, etc., and can form more precise The self-setting resin material used in the improved resin seal is prone to slight shrinkage during the curing process, and the material has poor fluidity, making it difficult to fully fit the fine structure of the teeth, resulting in a certain deviation between the shape of the seal and the real teeth, which in turn affects the accuracy of subsequent resin shaping [3]. For example, in terms of edge suitability, silicone seals can accurately replicate the shallow concave edges of prepared teeth, making the edge gaps smaller after resin filling. However, resin seals are prone to excessive edge gaps due to morphological deviations, which is consistent with the results of scanning electron microscopy observations.

In terms of the incidence of adverse events after repair, the rate of restoration detachment and edge leakage in

the silicone seal group was significantly lower than that in the resin seal group, which is directly related to the higher morphological accuracy of the silicone seal method. The good edge adhesion of the restoration can reduce the entry of bacteria and food residues into the gap between the restoration and the tooth, reducing the risk of edge leakage. At the same time, the tight fit can also improve the retention force of the restoration and reduce the possibility of the restoration falling off [4]. However, the resin seal group has poor edge suitability, increases the risk of edge leakage, and can easily cause secondary caries in long-term use. At the same time, insufficient retention force will also increase the probability of the restoration falling off. In clinical practice, marginal leakage will not only affect the restoration effect, but may also damage the health of the dental pulp. If the restoration falls off, it will require re-restoration treatment, which will increase the patient's pain and economic burden. Therefore, the advantage of the silicone seal method in reducing the incidence of adverse events is of great significance in improving treatment safety and patient experience. The difference in patient satisfaction with repair further reflects the difference in the effects of the two modified seal methods. The total patient satisfaction in the silicone seal group reached 95.00%, which was much higher than the 72.50% in the resin seal group. Patient satisfaction is mainly related to the aesthetics, occlusal comfort and stability of use of the restoration. The shape of the restoration made by the silicone seal method is coordinated with the adjacent teeth, the occlusal contact is even, the patient does not feel discomfort during chewing, and the color of the restoration is highly matched with the natural teeth, and the aesthetic effect is good. However, the resin seal group restoration may cause occlusal discomfort due to shape deviation, or food impaction due to non-adhesive edges, which affects the patient's experience and thus reduces satisfaction [5,6]. In addition, the silicone seal material is soft, causing less irritation to the teeth and gums during the preparation process, and the patient is more comfortable, which is also one of the important factors in improving satisfaction.

From the perspective of clinical operation, although the material cost of the improved silicone seal method is slightly higher than that of the improved resin seal method, the operation process is simple, the seal preparation time is short (the curing time of addition polymerized silicone rubber is about 5 to 8 minutes), and the seal can be reused (it can be used in the same process after disinfection) Follow-up adjustments for one patient) can improve clinical work efficiency; the improved resin seal method requires waiting for the self-setting resin to be completely cured, and the material after curing is hard and difficult to trim. If the seal shape does not meet the requirements, it needs to be remade, which may increase the operation time and cost. At the same time, the silicone seal has good elasticity and can better adapt to subtle changes in the tooth surface during the resin shaping process, reducing uneven resin distribution caused by uneven operating strength and further ensuring the accuracy of the restoration shape. It should be noted that when using the improved silicone seal method, the operational details during the seal production process should be strictly controlled. For example, the mixing ratio of the silicone rubber material must be accurate to avoid improper proportions affecting the curing effect and elasticity of the material; when the seal covers the teeth, it must be ensured that there are no bubbles to prevent the bubbles from causing the seal form to be lost and affecting subsequent resin shaping; after the resin is filled into the seal, the prepared teeth must be covered and pressurized in time to avoid displacement before the resin solidifies [7]. In addition, after the repair is completed, the edges and occlusion of the restoration should be carefully inspected. If slight deviations are found, they can be adjusted through local trimming to ensure the best repair effect. As for the modified resin seal method, although its morphological accuracy is slightly inferior to the silicone seal method, it still has application value in some special cases. For example, when the patient is allergic to silicone material, or when the space for the repaired tooth is small and the silicone seal is difficult to accurately place, the modified resin seal method can be considered. At this time, the operating process needs to be optimized, such as using a gradual solidification method during the resin curing process to reduce material shrinkage; using fine grinding tools during the seal trimming stage to improve the accuracy of the seal shape and try to make up for the shortcomings of the material itself [8]. At the same time, by adding occlusal inspection and adjustment steps, the occlusal deviation can be corrected in time after the repair is completed to improve patient comfort.

In summary, the modified silicone seal method assisted posterior tooth resin (occlusal) veneer repair is better than the modified resin seal method in terms of morphological accuracy, reducing the incidence of adverse events, and improving patient satisfaction. Although the material cost is slightly higher, considering the comprehensive treatment effect and

safety, it is more worthy of clinical promotion and application.

Disclosure statement

The author declares no conflict of interest.

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