

Paired observation on light-cured composite resin and nano-composite resin in dental caries repair

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Abstract: To compare the value of light-cured composite resin with that of nano-composite resin in dental caries repair. 88 patients taking dental caries repair in our hospital from May 2014 to April 2015 were selected, and divided into observation group and control group by coin method with 44 patients in each group. Nano-composite resin was used in observation group, while light-cured composite resin in control group. Then, the occurrence rates of odontohyperesthesia, aesthetic satisfaction with dental caries repair and complications were compared between two groups by visual analogue scale (VAS). The occurrence rate of odontohyperesthesia in observation group is significantly lower than that in control group (9.09% (4/44) vs 31.82% (14/44), 6.82% (3/44) vs 22.73% (10/44), 2.27% (1/44) vs 13.64% (6/44)) with difference of statistical significance ($P < 0.05$) 1 week, 4 weeks, and 8 weeks after repair. VAS score of patients in observation is significantly lower than that in control group ((2.78 ± 0.56) scores vs (5.22 ± 0.76) scores, (2.02 ± 0.35) scores vs (4.32 ± 0.57) scores, (1.12 ± 0.14) scores vs (2.41 ± 0.43) scores) 1 week, 4 weeks, and 8 weeks after repair. Moreover, the difference in comparison of interactive effects between two groups, between different time points, and between groups at different time points has statistical significance ($P < 0.05$). Nano-composite resin can lower the occurrence rate of odontohyperesthesia in dental caries repair, reduce the pain of patients, and improve the satisfaction of patients with tooth appearance.

Keywords: Light-cured composite resin, nano-composite resin, dental caries repair.

INTRODUCTION

As a common oral problem in clinical, dental caries always affects the normal life and aesthetics of patients (Zhang *et al.*, 2013). At present, there are various materials for repair of dental caries which give patients quite different experiences for their different particle sizes and rigidities. Light-cured composite resin is typical traditional material, while new-type material, nano-composite resin, is developed with continuous improvement of medical technology in recent years (Zhang *et al.*, 2015). To provide reference to tooth cosmetic effects in repair of dental caries in clinical, this work made paired observation on light-cured composite resin and nano-composite resin in repair of dental caries. The report is as follows.

Data and methods

Clinical data

88 patients with 101 decayed teeth in total taking dental caries repair in our hospital from May 2014 to April 2015 were selected. All the documents about this study were reviewed and approved by the ethic committee of our hospital. Inclusion criteria: (1) patients and their family were all willing to participate in this work; (2) having clear consciousness for normal communication and exchange; (3) having no hepatic and renal functional disorder and other important organ diseases. Exclusion criteria: (1) having mental and nerve diseases hindering

normal communication; (2) in pregnancy or lactation; (3) participating other research projects. The whole work was completed with informed consent from patients and their family. 88 patients were divided into observation group and control group with 44 in each group by coin method. The difference in sex, age, height and other general data between two groups has no significance ($P > 0.05$) with strong comparability.

Method

Nano-composite resin was used in observation group for repair of dental caries, while light-cured composite resin used in control group. The specific operation steps are as follows: Completely clear the dental face to remove detritus; remove surrounding necrotic tissues and impaired tooth and form proper joint face and angle between prosthesis and lesion face. In order to fix the restoration, several undercut spots were formed with tapered bur on dental face. For patients with decayed tooth, healthy tooth should be restored as much as possible. Therefore, manufacturing and fixation were conducted according to defective cavity. After early preparation, acid etching was conducted for 30s with self-etching adhesive and light-curing for 20s. After color comparison, 3M-Z350 nano-composite resin was used for cutting and filling in observation, while 3M-Z100 composite resin used in control group. Curing was conducted for 40s for each cutting. Polishing series of 3M composite resin was used for polishing before grinding adjacent face.

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Table 1: Comparison in general data between two groups

Group	Patients	Sex		Age (years)	Height (cm)	Weight (kg)	BMI (kg/m ²)	Education degree			
		Male	Female					Junior high school	Senior high school	Junior college	Junior college or above
Observation group	44	26 (59.09)	18 (40.91)	45.32 ±2.32	164.45 ±2.01	67.34 ±3.22	24.31 ±1.23	7 (15.91)	9 (20.45)	13 (29.55)	15 (34.09)
Control group	44	23 (52.27)	21 (47.73)	46.03 ±2.31	165.03 ±2.08	68.21 ±3.29	24.02 ±1.25	10 (22.73)	10 (22.73)	11 (25.00)	13 (29.54)
t/ χ^2 value	-	$\chi^2=0.4144$		t=1.4385	t=1.3301	t=1.2536	t=1.0969	$\chi^2=0.8916$			
P value	-	P=0.5197		P=0.1539	P=0.1870	P=0.2134	P=0.2757	P=0.8275			

Table 2: Comparison of odontohypersthesia at different time points between two groups [n (%)]

Group	Patients	1 week	4 weeks	8 weeks
Observation group	44	4 (9.09)	3 (6.82)	1(2.27)
Control group	44	14 (31.82)	10 (22.73)	6(13.64)
χ^2 value		6.9841	4.4226	3.8801
P value		0.0082	0.0355	0.0489

Table 3: Comparison of VAS score at different time points between groups ($\bar{x} \pm s$, score)

Group	Patients	1 week	4 weeks	8 weeks
Observation group	44	2.78±0.56	2.02±0.35	1.12±0.14
Control group	44	5.22±0.76	4.32±0.57	2.41±0.43
Between groups		F=1.8418,P=0.0482		
Between different time points		F=16.0000,P=0.0000		
Between groups at different time points		F=16.5765,P=0.0000		

Table 4: Comparison of aesthetic satisfaction after dental caries repair between two groups [n (%)]

Groups	Patients	Satisfied	General	Bad
Observation group	44	38 (86.36)	5 (11.36)	1 (2.27)
Control group	44	26 (59.09)	12 (27.27)	6 (13.64)
u value		2.9226		
P value		0.0035		

Observation index

Occurrence of odontohypersthesia of patients in different groups was observed 1 week, 4 weeks and 8 weeks after dental caries repair. Visual analogue scale (VAS) (Huskisson, 1982) was used to compare the aching feeling of patients in two groups 1 week, 4 weeks, and 8 weeks after dental caries repair with different materials. The score was 0~10 points with 10 points representing acute pain, while 0 painless. Then, the satisfactions with tooth aesthetics of patients in two groups were compared by evaluating if patients had discomfort and foreign body sensation with the color, shape and repair residue and if the repaired tooth was consistent with the healthy teeth. The evaluation dimension includes satisfied, general and bad. In addition, relevant complications, including periodontitis, prosthesis loose, prosthesis fall and pulpitis were observed after repair.

STATISTICAL ANALYSIS

Data processing in this work was conducted with SPSS 11.5 software package. VAS score and other measurement

data were represented with ($\bar{x} \pm s$) and tested by t test. The occurrence rate of complications and other enumeration data were represented by (n (%)) and tested by χ^2 test. P<0.05 refers to difference with statistical significance.

RESULTS

Comparison of odontohypersthesia at different time points between two groups

The occurrence rate of odontohypersthesia for patients in observation group is significantly lower than that in control group 1 week, 4 weeks, and 8 weeks after repair with difference of statistical significance (P<0.05) (table 2).

Comparison of VAS scores at different time points between two groups

VAS score of patients in observation group is significantly lower than that in control group 1 week, 4 weeks and 8 weeks after repair. The difference of interactive effects between two groups, different time

Table 5: Comparison of complications after repair between two groups [n (%)]

Group	Patients	Restoration fall	Restoration loose	Periodontitis	Pulpitis	General complication
Observation group	44	0(0.00)	2(4.55)	1(2.27)	0(0.00)	3(6.82)
Control group	44	5(11.36)	8(18.18)	6(13.64)	5(11.36)	24(54.55)
χ^2 value		5.3012	4.0615	3.8801	5.3012	23.5628
P value		0.0213	0.0439	0.0489	0.0213	0.0000

points and two groups at different time points has statistical significance ($P < 0.05$) (table 3).

Comparison of aesthetic satisfactions after dental caries repair between two groups

The aesthetic satisfaction of patients in observation group is significantly higher than that in control group ($P < 0.05$). See table 4

Comparison of complications after repair between two groups

The occurrence rate of complications, including restoration fall, restoration loose, periodontitis and pulpitis in observation group is significantly lower than that in control group with difference of statistical significance ($P < 0.05$) (table 5).

DISCUSSION

Also called decayed tooth and scolecodont, dental caries is a bacteriosis which can cause secondary diseases, including periapical periodontitis and pulpitis. Severe dental caries may even cause inflammation of jawbone and alveolar bone. Without timely treatment by appropriate measures, the lesion may develop continuously to form tooth cavity making dental crown completely disappear and damage to cause tooth loss (Tham *et al.*, 2015; Rebia, 2012). With high morbidity and wide distribution, dental caries is a common oral disease which always causes tooth damage and abnormality and destruction in structure and appearance of hard dental tissues. Finally, the tooth will lose normal anatomical shape to damage normal tooth morphology and its joint and occlusal relationship (Wang *et al.*, 2013; Shokouhinejad *et al.*, 2016; Puckett *et al.*, 2007). Tooth damage may affect patients' periodontal and pulp tissues, and further affect patients' auxiliary function in phonation and chewing, as well as their appearance. In recent years, patients with dental caries ask for higher requirements on phonation, chewing, appearance in treatment of tooth damage with continuous improvement of living standard. Therefore, more consideration of aesthetic requirements in dental caries repair is taken into clinical tests.

There are many physical materials for aesthetic repair for dental caries, including traditional light-cured composite resin and nano-composite resin which is newly developed in recent years. All of these materials have great influence on the development of oral aesthetic science (Lv *et al.*,

2015). Light-cured composite resin is easy to be accurately shaped by convenient and simple operation. With high abrasive resistance, proper mobility and viscosity, and good mechanical property, it has bright and natural color after being polished (Ren, 2012; Manolea *et al.*, 2009; Emine *et al.*, 2013). However, the main material of light-cured composite resin is submicron, so the moisture, bacteria, etc. in oral may flow into microleakage to damage dental pulp with large-scale filler and tiny gap which cannot be observed with naked eye in tooth repair (Yang *et al.*, 2016). In recent years, with the continuous improvement of medical technology, a new-type material, nano-composite resin, is developed. It has characteristics of accurate margin, polishability and good compressive strength, etc. (Gonçalves *et al.*, 2015; Loreto *et al.*, 2015; Aftab *et al.*, 2015; Ogle and Byles, 2014). With particle diameter shorter than visible wavelength, nano-composite resin can enter into polymeric chains to avoid cohesion cluster to some extent. Therefore, this material has little stimulation on dental pulp and small possibility of micro leakage. Moreover, after repair, this material also reserves relatively low occurrence rate of sensitivity. However, the expensive price of nano-composite resin brings large economic pressure to patients and limits its clinical application (Zhang and Zhou, 2014; Dong *et al.*, 2013; Wang *et al.*, 2015). The fitness of light-cured composite resin and nano-composite to clinical patients requires more clinical practice.

This work made a paired observation between two materials to obtain the difference between light-cured composite resin and nano-composite resin in repair of dental caries. The results show that the occurrence rate of tooth sensitivity among patients taking dental caries repair with nano-composite resin is significantly lower than that with light-cured composite resin. It is mainly because the fine particle of nanometer materials has little stimulation on gingiva without leakage. In addition, the pain score of nano-composite resin is also relatively low, showing its stimulation on gingiva is little to reduce the pain of patients. Moreover, compared with composite materials, nanometer materials have better histocompatibility and strength. Therefore, after dental caries repair with nano-composite resin, the occurrence rates of complications, including periodontitis, pulpitis, restoration fall, and restoration loose are relatively low, while aesthetic degree is high. The results about the aesthetic satisfaction with dental caries repair show that nano-composite resin is more acceptable among patients.

In conclusion, it has positive clinical significance to use nano-composite resin in dental caries repair in decreasing the occurrence rate of odontohyperesthesia, reducing patients' pain and improving the aesthetic satisfaction of patients.

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