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Treatment of Severe Advanced Periodontitis Molar Furcation Involvement using Root Separation/Resection and Crown and Sleeve-coping Telescopic Denture - A Longitudinal Study of 5-13 Years

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Abstract

Because periodontal and prosthetic treatment outcomes are not consistent, dentists may choose to use root separation and/or root resection for the treatment of molars with poor root morphology. In addition, when the remaining roots after RSR are also poor root morphology, it is still a high-risk factor in terms of long-term periodontal and prosthetic success rates. In 25 cases affected severe advanced periodontitis (SAP), there were a total of 85 molars (47 maxillary molars, 38 mandibular molars), 33 abutments that had not undergone root separation or resection (RSR), and 52 that did not accept RSR. There were 43 crowns and sleeve-coping telescopic dentures (CSCTD) design. Both of 23 CSCTDs in the maxilla and 20 in the mandible, with a mean observation time of 6.7±1.9 years (study period: 5 -13 years). Periodontal parameters of plaque index (PLI), gingival index (GI), probing pocket depth (PPD), clinical attachment level (CAL) and radiographic alveolar bone change (RABL) were recorded. In addition, the molars affected with severe furcation involvements were evaluated for periodontal and periopro- thetic treatment before and after root separation/resection (RSR). The results showed that in cases of SAP affected Classes II & III molar FI with RSR, there was a significant ($p<0.01$) improvement in periodontal parameters as compared with cases affected SAP with Classes II & III molar FI without RSR. The conclusions revealed that the SAP affected with molars FI using both of RSR of periodontal treatment and CSCTD prosthetic designs, had remarkable improvement in perioprosthetic therapy.

Keywords: SAP; Molar FI; RSR; CSCTD

Abbreviations: SAP: Severe advanced periodontitis; RSR: Root separation or resection, CSCTD: Crown and sleeve-coping telescopic dentures; PLI: Plaque index; GI: Gingival index; PPD: Probing pocket depth; CAL: Clinical attachment level; RABL: Radiographic alveolar bone change; PRIA: Projected radiographic image analysis

Introduction

Using retrospective and radiological methods to observe the long-term results of periodontal treatment of multiple root molars with FI lesions, the results of periodontal treatment are more likely to be prone to periodontal attachment loss and tooth loss, [1-3] several studies have shown that the results of molar furcation involvement, with or without surgical treatment, tend to be more likely to be at high risk and treatment failure. [4-8] Predictable and effective treatment of severe molar FI is characterized by molar furcationplasty, molar root separation, and root amputation. The way in which these techniques assess subsequent complications and success rates remains controversial. [9-15] Because of these unpredictable outcomes, many dentists use root resection in the treatment of poor root shape of the maxillary molar affected furcation involvement, however, when the remaining root is still poor morphology, it is a risk factor for periodontal and long-term success of the perioprosthesis, so when the fixed prosthesis is

used for long-term maintenance and restoration of the tooth, the root resection produces risk factors for periodontal prosthesis [16,17].

Root resection, root separation and furcation tunneling are basically designed to provide an easy-to-clean molar with furcation involvement area, but these steps are associated with a number of complications, such as the original root concave, poor plaque control, difficulty in the odontoplasty after root amputation, and it is easy to cause root caries. [11,16,17] Therefore, it is important to solve the above postoperative problems and make periodontal prosthesis. In the treatment of severe periodontal lesions, CSCTD can provide periodontal prosthesis, and this design has the following advantages: maintenance of abutments, easy plaque control, reduced destructive torque force, on abutments [18-20]. In order to solve the problem of residual poor anatomical shape of the molar root after molar using RSR because of molar affected with Classes II and Class III FI. We have developed an improved philosophy to use CSCTD in the treatment for molar affected with Classes II and Class III FI. The purpose of this study was retrospective to investigate the difference in the clinical periodontal parameters between the Classes II and Class III molar FI after the molar root separation and the final perioprosthesis.

Materials and Methods

In this study, the 25 patients had a total of 85 molars (47 maxillary and 38 mandibular molars) with severe periodontitis, 33 abutment teeth that did not undergo root separation (as the control group), and 52 molar with root separation (as the experiment group) that were used as abutments of CSC telescopic denture (CSCTD), all treatments were performed by Dr. Hou from 1980 to 1997, and all study subjects agreed and were informed that there were a total of 43 sets of CSCTD (23 sets of maxilla and 20 sets of mandible), The mean observation time (mean±SD) was 6.7±1.9 years (ranges 5-13 years), patients returned regularly every 1-3 months, and the mean age was 51.4±9.1 years (range 26-67 years). All patients had no other diseases and contraindications to dental treatment, and the original data on the amount of alveolar bone loss in the 18th case of the study of teeth, age, number of molars, abutments, treatment period, and mesial and distal surfaces alveolar bone loss were illustrated in Table 1.

The clinical evaluation was recorded in three stages: the original data at the time of initial diagnosis (stage A); the edge as the reference point at the time of internal crown margin (stage B); and the data evaluated at the end of this study (stage C), including the gingival index [21] plaque index [22] of the buccal and lingual root furcation of the mandibular molars and the mesiodistal and buccal root furcation area of the maxillary molars. Detection of probing pocket depth (PPD), clinical attachment loss (CAL) and root caries is examined by clinical probing and dental radiographs. The percentage of loss on radiographs of alveolar bone in each distal branch molars in stages A, B, and C was obtained by measuring the distance between the closest apical area and the root apex in the mesial and distal furcation FI lesions by standard parallel method and vertical bite-wing method, including the alveolar bone level in the mesial and distal surface of the adjacent face.

To evaluate the differences in periodontal parameters between the experimental group and the control group in stages A, B, and C, the molars size was calculated by projected radiographic image analysis (PRIA) (Lin et al. 1996) [23], because the image overlap and ambiguity could not be obtained, and the radiographic image analysis values of the adjacent surfaces of the mesial and distal bone defects in the furcal bone defect area could not be obtained, so they were excluded from the samples of this study. The mean gingival index, plaque index, probed pocket depth, and clinical periodontal attachment level and their mean and standard deviation were calculated for each clinical parameter.

Table 2 compared the mean plaque index (PLI) of the maxillary and mandibular molars with or without root separation in the Class II and III molar FI lesions of stage A, B and C, and the results showed that the average plaque index was significantly reduced in the cases that underwent root separation. The average gingival index (GI) of this experiment was shown to have a similar trend with the plaque index, and the molars that had received tooth root separation were reduced more.

The results of Table 4 showed that 29.4% and 35.4% of the maxillary and mandibular molar teeth had bone fills that had undergone root separation, respectively. It was better than those without root separation (15.7% and 28.3%), respectively. In addition, 18.5% of the maxillary molars and 17.2% of the mandibular molars were not subjected to root separation, respectively. The loss of alveolar bone was more severe than as compared to that of 14.9% of the maxillary molars and 12.2% mandibular molars with root separation and CSCTD.

Discussion

In this study, we found that the use of CSC telescopic dentures combined with root separation to treat Classes II and III molar FI root lesions was much better in many periodontal parameters than in the molars of the molar FI without root separation. The plaque index of the molars of the molar FI lesions undergoing root separation was more reduced in both the maxillary and mandibular molars, and the efficiency of plaque control was better in the mandibular molars (0.68:1.04) than in the maxillary molars (1.19:1.47). When using root separation and CSC telescopic dentures (CSCTD) for the treatment of Classes II and III molar FIs, the Class II molar FI lesions are easier to control with professional and individual plaque control than the Class III molar FI lesions, and the same findings are found in the gingival index, probe periodontal pocket depth, and the average of clinical periodontal attachment height (Tables 2-4).

Although root amputation and root separation are most commonly recommended for the treatment of molars FIs, particularly in the area of Class III furcation involvement of the maxillary molars, there is some controversy over long-

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term observations by many scholars using different treatment modalities. [9,11,12,15,23]. The main differences are still in the high incidence of complications like root caries, root fracture, recurrence of root concave area lesions, poor average shift control of the remaining root surface depression and root extraction. Müller et al. [9] pointed out that about 44% of Class III FI lesions are still extracted after periodontal surgery, and the plaque index at the furcation involvement openings of the buccal, mesial, distal, and lingual molar furcations is maintained at a high level, regardless of whether there is regular follow-up or not, and whether or not subgingival calculus removal is performed. It was concluded that the choice of treatment depends on the degree of molar FI lesions and tooth morphology [9].The use of guided tissue regeneration for the treatment of molars FI lesions has been shown in the literature to have significant and predictable outcomes, especially in the Class II FI of the mandibular molar [24-26], but unfortunately for the Classes II and III of the maxillary molar, the effect is limited and the outcome is less predictable, [27-29] some scholars have pointed out that the success rate of this treatment model depends on the degree of molar FI lesions, the anatomical shape of the root, rather than the operator's technique and the severity of periodontal disease, [9,10]summarizing the two studies, alveolar bone and tooth anatomical appearance and lesion size, and the amount of remaining periodontal supporting tissue in the lesion area are equally important.

Table 1: A total of maxillary and mandibular molar abutments with radiographic alveolar bone levels were treated using with and without root separation combined application of CSCTD in 25 cases affected Classes II and III furcation involvements for 5□13 years.

Cases	Maxillary abutment	RABL(%) Ranges	Mandibular Abutment	RABL(%) Ranges	Treatment Periods(yrs)	Age
1	3	50.13-76.15	0	X	7.5	26
2	3	52.16-64.31	0	X	6.5	39
3	2	53.70-72.19	2	55.83-64.27	8.5	45
4	2	56.36-62.31	2	58.45-69.74	5.5	47
5	2	61.03-94.72	0	X	5.3	52
6	2	51.68-77.31	2	37.79-66.36	6.0	57
7	0	X	2	39.41-54.56	6.0	51
8	0	X	2	42.28-62.21	5.0	58
9	2	44.83-56.98	2	24.32-76.68	5.0	41
10	1	47.21-51.32	2	37.51-67.48	5.5	62
11	2	49.65-54.28	2	46.12-61.21	5.5	50
12	2	29.95-84.40	2	28.25-58.48	6.0	43
13	2	36.54-62.13	1	32.54-53.43	6.5	45
14	2	46.23-71.56	2	42.21-54.40	6.0	56
15	2	39.26-62.28	2	40.25-66.57	6.5	67
16	2	42.45-53.61	2	43.42-54.61	6.0	55
17	2	41.90-58.65	2	52.23-65.41	5.5	64
18	2	49.85-100	0	X	9.0	53
19	2	56.61-63.90	2	24.40-57.31	5.6	47
20	2	46.67-61.16	0	X	5.8	58
21	2	53.35-69.31	2	30.16-46.25	6.0	59
22	2	52.23-82.14	1	45.48-62.21	7.5	63
23	1	55.10-68.82	2	39.73-45.10	5.5	52
24	3	73.26-86.43	2	63.17-81.34	13.0	50
25	2	65.34-69.21	2	67.41-72.76	11.0	49
Total	47	62.79(15.48)	38	51.98(15.79)	6.67(1.90)	51.4(9.1)

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Table 2: Sandwich Technique Therapy for Long-term PII and GI Changes in Class II and III molar FI Lesions of Molars. (5-13 yrs average 6.7 ±1.9 yrs; n = 85).

Periodontal parameters	RSR(n)	Non-RSR(n)	p-value
Maxilla PII	2.12(0.37)(29) 1.04(0.36)(27)	2.18(0.39)(18) 1.47(0.34)(15)	p<0.01
Mandible PII	2.14(0.34)(23) 0.68(0.42)(23)	2.32(0.53)(15) 1.19(0.46)(14)	p<0.01
Maxilla GI	2.15(0.41)(29) 1.06(0.31)(27)	2.07(0.53)(18) 1.52(0.42)(15)	p<0.01
Mandible GI	1.96(0.31)(23) 0.67(0.41)(23)	1.92(0.56)(15) 1.13(0.46)(14)	p<0.01

Table 3: Sandwich Technique Therapy for Long-term PPD & CAL Changes in Class II and III molar FI Lesions of Molars. (5-13 yrs average 6.7 ±1.9 yrs; n = 85)

Periodontal parameters	RSR(n)	Non-RSR(n)	p-value
Maxilla PPD	7.14(1.52)(29) 2.97(0.94)(27)	7.26(1.34)(18) 3.87(1.05)(15)	p<0.01
Mandible PPD	7.24(1.41)(23) 2.64(0.89)(23)	7.26(1.32)(15) 3.65(0.82)(14)	p<0.01
Maxilla CAL	8.07(1.48)(29) 3.35(1.04)(27)	8.22(1.37)(18) 4.43(1.26)(15)	p<0.01
Mandible CAL	9.13(1.52)(23) 3.27(0.94)(23)	9.08(1.67)(15) 3.86(1.14)(14)	p<0.01

Table 4: RABL changes on the maxillary and mandibular molars with and without root separation.

Location(N)	Molars (N)	RABL(s)	RABL(s)	RABL(s)
		No change	Bone loss	Bone fills
Maxilla (47)	w/o RS (18)	65.80%	18.50%	15.70%
	w/ RS (29)	55.70%	14.90%	29.40%
Mandible (38)	w/o RS (15)	54.50%	17.20%	28.30%
	w/ RS (23)	52.40%	12.20%	35.40%

RABL: radiographic alveolar bone level; w: with; w/o: without; RS: root separation In this study, along with previous reports, [19,20] it has been emphasized that the combined use of molars and CSC double crown dentures provides an effective solution in addressing the problems of poor molars root shape, tooth type, tooth anatomy, and the size of the remaining alveolar bone and interdental lesions in severe second and third grade root pronged lesions, while also increasing the accessibility of professional and personal plaque control. In recent studies, it was found that the periodontal parameters of severe second and third grade rhizopathy treated with molars and root split combined with CSC double crown dentures were significantly improved compared with those without root splitting, so it is strongly suggested that this can be a useful clinical treatment, and the results of this study also indicate that this new therapy is suitable for severe second and third grade root pronged lesions with anatomical problems such as narrow root fork openings, or large molars that are more prone to periodontal disease. The phenomenon of capsular epithelial ulceration and spontaneous bleeding in the experimental group was more significant and faster than in the non-root dissection (control group), especially in the large molars with three roots.

Most of the published data on the success of crown and sleeve-coping telescopic denture (CSCTD) are case reports. [18-20] Recent data show that Classes II and III FI of molars without root separation often result in a high proportion of radiographic alveolar bone loss (percentage of abutments) (18.5% in the maxillary molars with three FIs; 17.2% in the mandibular molar

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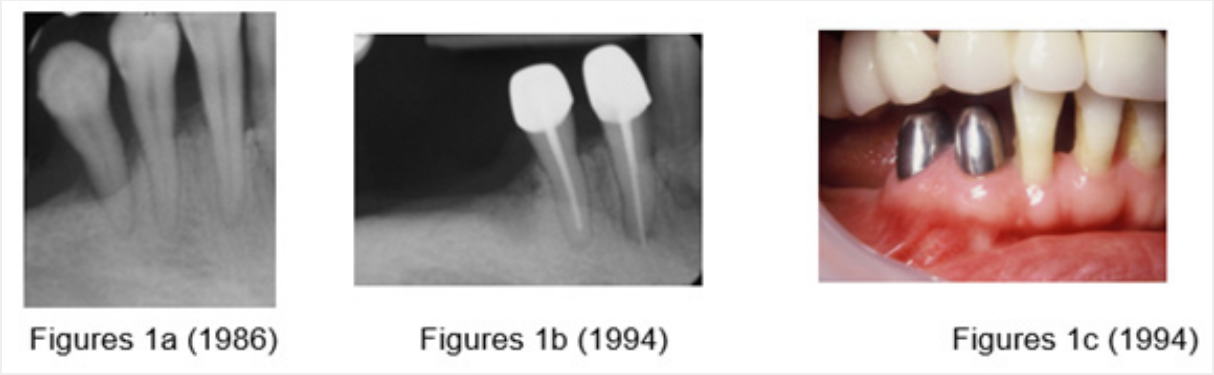
with two FIs), and low bone filling (15.7% in the maxillary molars with three FIs; 28.3% in the mandibular with two FIs), but the rate of alveolar bone loss of maxillary molars abutments after root separation (14.9% in the maxillary three FIs area; 12.2% for two FIs area) and bone filling (29.4% for three FIs area; 35.4% of the mandibular molar with two FIs (Table 4); if CSCTDs were used as a prosthesis, there were still residual molar furcations in the three FIs and two FI without root separation, which increased the chance of local periodontal destruction (Figure 1 & Figure 2).



Figures 1a: Periapical radiograph showed moderate bone loss on the right first and second premolars of mandible at the baseline in 1986.
1b. Periapical radiograph showed remarkable bone fills 13 years later (1994).
1c. Clinical picture revealed complete healing of bone and periodontal tissues.

Figures 2a: Periapical radiograph showed moderate bone loss on the left first premolar and Class III molar FI on the first molar mandible at the baseline in 1986.
2b. Inner crowns of left first premolar and Class III molar FI on the first molar with root separation (RS) after 13 years.
2c. Clinical picture indicated inner crown application on both of premolar and first molar with RS after 13 years later.

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