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Survival Rates of CSC Telescopic Abutments of Severe Advanced Periodontis with Secondary Occlusal Traumatism using Periodontal and Prosthetic Therapies. A Long-Term Study of Case Series for 5.1- 19.3 Years

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Abstract

Objective: The purpose of present study was present the survival rates of telescopic abutments a retrospective analysis from 26 patients affected SAP and SOT using periodontal treatment and CSC telescopic denture.

Materials and Methods: Teeth consisted of both maxillary group (123 abutments) and mandibular group (127 abutments). The present study was to focus on the survival rates of CSC telescopic abutments via routine periodontal therapy procedures including TPP, NSPT, and CSCTD procedures. The mean age of the samples was 54.4 ± 9.1). Record reviews confirmed that the total samples received TPP, NSPT, and CSCTD presented from 5.1years to 19.3 years with a mean 10.2±3.9 years(median 10.2 years) and 8.8±3.9 years (median 7.1 years) in maxillary and mandibular teeth, respectively. The clinical examination of periodontal parameters conducted on the molars included gingival index GI), plaque index (PlI), periodontal probing depth, horizontal and vertical clinical attachment levels (CAL: the distance in mm between the CEJ and apical end of the probing depth) and root mobility recorded for six sites on each tooth surface, at the baseline, 6 months, 1 year, and follow-up throughout the end of study.

Results:

Means of ranges of initial radiographic alveolar bone loss from 36.3±12.8 % to 64.3±13.9 % (ranged from 18.0% to 90.4 %) versus from 34.2±6.6 % to 64.3±3.8 % (from 18.0 % to 72.9 %) for maxilla and mandible, respectively (Tables 1 & 2).

Among 123 maxillary abutments, treated by the combined procedures of TPP, NPT, and CSCTD examined, 7 abutments red color marks were lost, giving a survival rate of 94.3% after the end of study with a means elapsed time of 10.2±3.9 years (Tables 1 & 3).

A total of mandibular 127 abutments) were evaluated, giving a survival rate of 94.5% with 56 (anterior = 96.6%) and 64 (posterior=92.8%) abutments were retained, giving a survival rate of 96.6% (56/58) and 92.8% (64/69), respectively (Tables 2 & 4).

Conclusion: We concluded that clinical assessments of periodontal parameters using TPP, NSPT, and CSCTD restoration design revealed a remarkable soft and hard periodontal healing in both anterior and posterior abutments. Additionally, periapical radiographs presented complete repair of bony defects by bone fills, and reappearance of the lamina dura surrounding periodontal areas.

Clinical Relevance: The present study indicated that a technique using TPP, NSPT, and CSCTD restoration design revealed not only a prominent improvement of both soft and hard periodontal healing, but also bone fills of bony defects and repair of lamina dura. It is an exciting and encouraging finding and may be as a valuable method to treat severe advanced periodontitis.

Abbreviations: GI: Gingival Index; PI: Plaque Index; SAP: Severe advanced periodontitis; SOT: Secondary occlusal trauma; SRP: Scaling and root planning; NSPT: Non-surgical periodontal therapy; TPP: Therapeutic periodontal prosthesis; FI: Furcation Involvement

Introduction

The published data addressed that non-surgical periodontal therapy may not only dramatically improves clinical and microbiological para- meters, but also resolves inflammation and arrests adult periodontitis [1-4]. There still exist some problematic areas, such as, FED, furcal concavity, osseous defects, usually correlated with deep pockets that may adversely respond

to non-surgical periodontal therapy because of these sites limited access to debride bacterial deposits. In addition, clinical studies, reported from some investigators [5,6] indicated that deep pockets within the molar FIs have prone to more attachment loss and higher mortality rate when observed over many years [5-8]. There exists conflicting data regarding the bone fills of angular defects following surgical and non-surgical periodontal therapy. Renvert et al. [9] indicated that limited repair in treating intra-osseous defects using flap operation and there was virtually no bone fill after root planning. Isidor et al. found periodontal flap operation resulted in 0.5 mm bone fill in angular defects and no changes following root planning. In conclusion, the finding of minimal bone fills after scaling and root planning was in contrast to the findings of bone fills, which reported by Rosling et al. [10] and Polson & Heij [l,11] that abundant bone repair, post-surgically. It can be argued that the lose rate of periodontal attachment levels is influenced by some deteriorative factors such as type of plaque infection, host susceptibility, and the local environment of chronically inflamed tissue, pathologically deepened pockets resulted from foods impaction, ill-fitting restorations, crowding of teeth, morphology of alveolar bone, trauma from occlusion etc.

Effect of Tooth Mobility on the Periodontal Compromised Tooth Mortality Rate

The clinical and radiographic symptoms of periodontal compromised teeth with severely advanced periodontitis were characterized as severe advanced periodontitis (SAP) with secondary occlusal trauma (SOT). Lindhe & Nyman [12] and Rosling et al. [10] reported that an effect of following proper periodontal therapy (teeth which exhibit severely reduced but healthy periodontium still exhibit a permanently increased mobility), does not diminish the increased mobility of the tooth, splinting of the teeth may be considered. This type of treatment is only in cases , however, during the recall phase or even during the pre-surgical period it becomes obvious that the reduced periodontal support around the teeth either in the entire dentition or in several parts of the individual's arches with SAP may be insufficient to withstand force resulted from torque, occlusal, lateral directions. The clinical data, reported from Nyman et al. [13] showed that permanent periodontal prosthesis can be hypermobility of isolated abutment teeth, especially even the prosthesis with a cross-arch design.

The Biological Rationale for Therapeutic Provisional Prosthesis (TPP) affected SAP with SOT

In cases of individuals with SAP were most common affected by SOT. Once not only characterized by severely periodontal attachment loss and reduced height of the alveolar bone but frequently also of a remarkably increased mobility of teeth. SOT of the jigging type with concomitant increased hypermobility of teeth induced a series of periodontal tissue alterations associated with clinical and radiographic symptoms such as teeth hypermobility, pathological migration, angular bone defects, dis- appearance of lamina dura, widening of periodontal ligament. In order to present a gradual mechanical extraction of teeth with SAP, splinting using the periodontal prosthetic therapy for full mouth rehabilitation should be carried out as a prevention of therapeutic purposes of masticatory function, the patient's comfort, elimination of SOT, and esthetic dentistry. The results revealed that

i. In the absence of periodontal therapy, sites with more advanced attachment loss are more likely to undergo further breakdown than sites which have less attachment loss.

ii. There was a significant (p=0.012) of 0.15 mm mean attachment level gains in the teeth with bridge splinting (mean attachment gain = 0.10±0.19 mm/yr.) as compared to the teeth without bridge splinting (mean attachment loss =0.05±0.13 mm/yr.);

iii. Teeth with SOT showed a significantly higher loss rate than teeth without SOT.

iv. Patients with a periodic recall (3-4 times/yr.) showed a significantly lower loss rate than patients without periodic recalls

The longitudinal observations of the various studies have evaluated the different treatment modalities of molars with advanced furcation involvement using scaling and root planning (SRP), traditional flap operation with and/or without bone grafts, root resection techniques, regeneration therapy with and without GTR, obturation therapy with bio-adhesive materials, and growth factor's therapy. However, each of their reports exhibits some great discrepancies for the long-term evaluation of subsequent complications, which are susceptible to failure and eventually requiring extraction. Although, the treatment of angular defects in molars with using guided tissue regeneration has been reported and has exhibited significant and predictable results at the mandibular molars with Class II FI [14-16]; it has, however, afforded very limited and less predictable results in the treatment of Class II and III maxillary furcation defects. [17-19] Fleischer et al. also documented that even a more experienced operator with an open approach obtained a calculus-free surface in only 68% of cases [20]. The purpose of this report was, retrospectively and longitudinally, to present SAP with SOT using non-surgical periodontal therapy (NSPT) and CSC telescopic prosthetic procedures. In addition, evidenced-based clinical trials options as TPP, NSPT, and CSCTD were also prescribed here.

Material and Methods

The present article is one of extension of our serial study on the field of periodontal prosthetic therapy for the treatment of individuals with SAP (SAP, alveolar bone loss > 60 %). The present study was based on a retrospective analysis from 26 patients affected SAP and SOT. Proper informed consent was obtained from the patients and control individuals. A total 450 teeth as the abutments of CSCTD were selected from Kaohsiung Medical University, School of Dental Medicine, Graduate Institute of Dental Sciences during 1980 and 2016. Teeth consisted of both maxillary

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group (123 abutments) and mandibular group (127 abutments). All patients were in good health with no contraindications to dental treatment. The teeth with SAP and SOT treated using TPP, NSPT, and CSCTD was signed as the test group, while the teeth involving SAP and SOT, treated using NSPT only was signed as the control group. The present study was to focus on the survival rates of CSC telescopic abutments via routine periodontal therapy procedures including TPP, NSPT, and CSCTD procedures. The present study was to focus on the survival rates of CSC telescopic abutments via routine periodontal therapy procedures including TPP, NSPT, and CSCTD procedures. The mean age of the samples was 54.4 ± 9.1). Record reviews confirmed that the total samples received TPP, NSPT, and CSCTD presented from 5.1years to 19.3 years with a mean 10.2±3.9 years(median 10.2 years) and 8.8±3.9 years (median 7.1 years) in maxillary and mandibular teeth, respectively.

The clinical examination of periodontal parameters conducted on the molars included gingival index GI), plaque index (PlI), periodontal probing depth, horizontal and vertical clinical attachment levels (CAL: the distance in mm between the CEJ and apical end of the probing depth) and root mobility recorded for six sites on each tooth surface, at the baseline, 6 months, 1 year, and follow-up throughout the end of study. The removable TPP were fabricated not only for splinting the mobile teeth, but also for stabilizing the teeth with SOT. This removable TPP design is prepared as the precursor of permanent periodontal prosthesis of CSC retainer 21, or CSCTD16. Other additional advantages of CSCTD included easier cleaning at complete open space of abutments for personal plaque control by patient at home, as well as for professional plaque control by clinician. All treatment was performed by the same clinician. Supportive periodontal treatment recalled for reinforced OHI at two to three month's appointments for personal plaque control by patient, as well as professional plaque control by clinician. The percentages of RABL at the alveolar bone crest for each abutment was determined by measuring the medial and distal alveolar crest with most apical defect to the root apex from standardized parallel periapical and /or vertical bite-wing radiographs at baseline, margin of TPP, and inner crown margin.22 The superimposed and unclear radiographs could not be used to determine the levels of RABL in the mesial and distal osseous defects.

Results

Twenty-six subjects with 123 maxillary and 127 mandibular teeth were polled in this study. The age ranged from 29 to 78 years (mean age, 54.4±9.1). Both the arches were similar in their demographic characteristics: 1) means of treatment periods 10.0± 3.7 years (ranged from 5.1 yrs to 18.3 yrs) versus 8.8±3.9 years (from 5.2 years to 19.3 years) for maxilla and mandible, respectively; 2) means of ranges of initial radiographic alveolar bone loss from 36.3±12.8 % to 64.3±13.9 % (ranged from 18.0% to 90.4 %) versus from 34.2±6.6 % to 64.3±3.8 % (from 18.0 % to 72.9 %) for maxilla and mandible, respectively (Tables 1 & 2). Tables 2 & 3 documented the treatment procedures, periods, ranges of radiographic alveolar bone loss and location of abutments, and number of abutments before and after treatment in the mandibular teeth. Out of 127 abutments, treated by the combined procedures of TPP, NPT, and CSCTD evaluated, 7 abutments (2 in anterior tooth ad 5 in posterior teeth) were lost, giving a survival rate of 94.5% and loss rate of 5.5%, respectively, after the end of study with a mean elapsed time of 8.8±3.9 years. Both of the 58 anterior and 69 posterior abutments (a total of 127 abutments) were evaluated, 56 (anterior) and 64 (posterior) abutments were retained, giving a survival rate of 96.6% (56/58) and 92.8%(64/69), respectively (Table 2).

Table 1: Survival rates of maxillary abutments of CSCTD treatment procedures using three in one technique at baseline data (5.1-18.3 years; median= 10.2 years).

S No.	Abutments CSCTD	RABL (%) Range	Abutments lost	Treatment procedures	Periods (yrs)
1	x	x	x	x	x
2	13,12,22,23,17,16,15,24,27,28	18.0 - 42.2	3	TPP/NSPT/CSC	12
3	23,16,14,24,25	40.1 - 52.4	0	TPP/NSPT/CSC	8.6
4	18,15,14,24,25,28	28.4 - 56.8	0	TPP/NSPT/CSC	7.2
5	x	x	x	x	x
6	16,15,24,26,27,28	35.6 - 64.1	0	TPP/NSPT/CSC	6.4
7	23,17,15,14,24,27	30.2 - 61.8	0	TPP/NSPT/CSC	7.1
8	12,21,16,14,25,27	30.3-73.4	1	TPP/NSPT/CSC	7.0
9	12,11,17,15,14,24,25,27	46.4-73.6	1	TPP/NSPT/CSC	5.8
10	13,12,11,21,23,24,26,27	26.3-50.9	0	TPP/NSPT/CSC	5.2
11	13,12,22,23,24	21.9-66.3	0	TPP/NSPT/CSC	7.5
12	13,17,15,26	43.8-76.2	0	TPP/NSPT/CSC	9.3

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13	13,12,11,21,23,26	38.0-54.9	0	TPP/NSPT/CSC	18.3
14	21,22,15,14,24,26	22.4-45.5	0	TPP/NSPT/CSC	10.4
15	13,12,11,22,16.24	41.0-76.7	0	TPP/NSPT/CSC	13.5
16	13,12,23,25	34.5-76.2	2	TPP/NSPT/CSC	10.8
17	x	x	x	x	x
18	x	x	x	x	x
19	12,11,21,22,17,15,14,27	32.1-79.6	0	TPP/NSPT/CSC	12.6
20	16,14,24	61.6-79.2	0	TPP/NSPT/CSC	11.9
21	x	x	x	x	x
22	17,16,26,27	70.5-90.4	0	TPP/NSPT/CSC	12.0
23	21,17,15,25,27	28.1-54.6	0	TPP/NSPT/CSC	10.2
24	17,24,26,28	49.7-78.6	0	TPP/NSPT/CSC	5.1
25	22,18,17,15,25,27,28	30.8-50.5	0	TPP/NSPT/CSC	13.0
26	13,11,21,23,25,26	32.9-46.9	0	TPP/NSPT/CSC	17.1
	Total SR: 116/123(94.3%) Range: RABL (%):18.0-90.4 Mean (SD):36.2(12.8)-64.3(13.9)	18.0 - 90.4	7/123(5.7%)	TPP/NSPT/CSC	10.2(3.9)

A= SR: survival rates: 93.2% (40/43).

P=SR: survival rates: 95% (76/80).

Follow-up: 5.1-18.3 years; 10.2(3.9) years.

Table 2: Survival rates of mandibular abutments of CSCTD treatment procedures at baseline data.

S No.	Abutments CSCTD	RABL (%) Range	Abut loss	Treatment Procedures	Periods (yrs)
1	47,43, 34,35	37.2 - 72.8	1	TPP/NSPT/CSCTD	6.5
2	47,45,44,43,42, 33,35,36,38	29.5 - 59.5	1	TPP/NSPT/CSCTD	12.6
3	44,43,42,41, 31,32,33,37	31.7 - 62.5	0	TPP/NSPT/CSCTD	8.6
4	45,44,43,33,34,38	35.4 - 62.4	0	TPP/NSPT/CSCTD	7.2
5	44,43, 35,36	42.8 - 61.7	1	TPP/NSPT/CSCTD	10.0
6	48,47,45, 33,34	38.9 - 63.4	0	TPP/NSPT/CSCTD	6.4
7	47,45, 33,35,37	33.1 - 66.3	0	TPP/NSPT/CSCTD	7.1
8	48,45,44,34,38	39.4 - 65.3	0	TPP/NSPT/CSCTD	7.0
9	x	x	x	x	x
10	43,42,41,31,32,33,36	31.6 - 60.4	0	TPP/NSPT/CSCTD	5.2
11	43,42,33,36	39.1 - 63.7	0	TPP/NSPT/CSCTD	7.5
12	x	x	x	x	x
13	46,43,42, 31,32,33,34,37	18.6 - 69.2	0	TPP/NSPT/CSCTD	18.3
14	47,43, 34,36	37.2 - 72.9	1	TPP/NSPT/CSCTD	6.7
15	47,45,44,43,42, 33,35,36	29.5 - 59.6	1	TPP/NSPT/CSCTD	6.4
16	44,43,42,41, 31,32,33,38	31.7 - 62.6	0	TPP/NSPT/CSCTD	6.0
17	45,44,43, 33,34	35.3 - 62.5	0	TPP/NSPT/CSCTD	5.7
18	44,43, 35,37	42.8 - 61.8	1	TPP/NSPT/CSCTD	5.4

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19	48,47,45, 33,35	38.9 - 63.5	0	TPP/NSPT/CSCTD	12.6
20	47,45, 33,35,38	33.1 -66.4	0	TPP/NSPT/CSCTD	6.7
21	48,45,44,34	39.4 - 65.4	0	TPP/NSPT/CSCTD	6.4
22	x	x	x	x	x
23	43,42,41, 31,32,33,37	31.6 - 60.5	0	TPP/NSPT/CSCTD	9.8
24	43,42, 33,37	39.1 - 63.8	0	TPP/NSPT/CSCTD	12.1
25	x	x	x	x	x
26	46,43,42,31,32,33,34,38	18.0 - 69.3	1	TPP/NSPT/CSCTD	19.3
	Total SR: 120/127 (94.5%)	18.0 - 72.9	7 (5.3%)		5.2-19.3
	RABL: Mean (SD)	34.2(6.6)- 64.3(3.8)			8.8(3.9)

A=SR: 56/58(96.6%)

P=SR: 64/69(92.8%)

Demographic data including treatment procedures, periods, ranges of initial radiographic alveolar bone loss and location of abutments, and number of abutments before and after treatment in the maxillary arch is showed in Tables 2 & 3. Among 123 maxillary abutments, treated by the combined procedures of TPP, NPT, and CSCTD examined, 7 abutments red color marks) were lost, giving a survival rate of 94.3% after the end of study with a means elapsed time of 10.2±3.9 years (Table 4). Of the 123 abutments examined, 3 abutments (anterior) were lost, giving a loss rate of 2.4% in maxillary anterior abutments, while 4 abutments (red color marks) were lost, giving a loss rate of 3.3% in posterior abutments (Table 4). Table 4 indicates the outcome of survival rate of 94.3 % and 94.5 % in both the maxillary and mandibular arches, respectively. A Mean and ranges of RABL(%), and follow up periods in maxillary abutments of 10.2± 3.9 years and in mandibular abutments of 8.8± 3.9 years) (ranges, 5.1 to 18.3 years in maxilla and 5.2 to 19.3 years in mandible, respectively) using combined procedures of TPP, NSPT, and CSCTD in a longitudinal clinical trials.

Table 3: Long-term outcome of CSC telescopic abutments with radiographic alveolar bone loss (RABL) by tooth type.

Tooth type	UA	UP	LA	LP
Success Rate	93.2%	95.0%	96.6%	92.8%
RABL (%)	46.4 (16.5)	48.9 (16.1)	45.1 (14.7)	49.3 (11.9)
Range (%)	21.9 - 76.2	22.4 - 90.4	18.0 - 72.8	29.6 - 79.8
Follow-up period (yrs)	10.6 (3.8)	10.1 (3.7)	9.4 (4.3)	8.9 (4.2)
Range (yrs)	5.1 - 18.3	5.1 - 18.3	5.2 - 19.3	5.2 - 19.3

UA: upper anterior teeth (incisors and canines)

UP: upper posterior teeth (premolars and molars)

LA: lower anterior teeth (incisors and canines)

LP: lower posterior teeth (premolars and molars)

Table 4: Distribution of study samples, number of abutments, ranges of RABL and treatment periods in 26 patie

Tooth type	Maxilla	Mandible	Total
Anterior abutment loss n (%)	3/123 (2.4)	2/127(1.6)	5/250(2.0%)
Posterior abutment loss n (%)	4/123 (3.3)	5/127(3.9)	9/250(3.6%)
Total Survival Rate n (%)	116/123 (94.3)	120/127(94.5)	
RABL (%) (maxi.) M (SD)	64.3(13.9)	64.3(3.8)	59.5-90.4
RABL (%) (mini.) M (SD)	36.3(12.8)	34.2(6.6)	18.0-70.5
Ranges (%)	18.0- 90.4	18.0-72.9	18.0-90.4
FU (years)	10.0(3.7)	8.8(3.9)	5.1-19.3
Ranges (years)	5.1-18.3	5.2-19.3	5.1-19.3

FU: follow up periods(years) (mean ± SD).

abut.: abutment(s); RABL: radiographic bone loss.nts.

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Discussion

Provisional crown has been recommended as a final approach of a therapeutic periodontal prosthesis (TPP) in the treatment of severely advanced periodontitis (SAP) with guarded prognosis [16,19,21-23]. The prosthetic design provides some advantages, including stabilizing hypermobile abutmants, easy plaque control, decrease torque force, and reduce leveling force on the weak abutments affected SAP with SOT [16,19,21,23]. The majority of the discrepanciey focused on the high prevalence of complications, such as root morphology, root fracture, recurrent invasion of furcation involvement (FI), incomplete plaque control over the residual root concavity, and treatment modalities. In addition, some studies reported that factors such as anatomy and bony defects size between the bone and tooth, and amount and dimension of remaining periodontal tissues close to the defect are also important [1,16,18,24-26]. However, these has more literatures related to the treatment of the abutments affected SAP with SOT using surgical periodontal therapy (SPT) and combined SPT with GTR. Although, there still have many literatures associated with treatment of less periodontal bony support using the CSC retainers, but most of the published data related to the successful treatment are limited on the case reports [21,24].

More recent literatures indicated a remarkable improvement in the periodontal parameters in advanced Class II and Class III molar FIs with root separation and /or resection (RSR) as compared to those without RSR [16]. Little or no report associated with the longitudinal study on the survival rate of teeth as the abutments of CSCTD restoration in patient affected SAP with SOT [26]. Present study seems to be the first report to explore and, retrospective to evaluate the survival rate of a treatment option using a conservative periodontal therapy, combined with the CSCTD restoration. The present study showed that clinical assessments of periodontal parameters using TPP, NSPT, and CSCTD restoration design revealed a remarkable soft and hard periodontal healing in both anterior and posterior abutments. Additionally, periapical radiographs presented complete repair of bony defects by bone fills (Figures 1a, 1b, 1c), (Figure 2a & 2b) and reappearance of the lamina dura surrounding periodontal areas.

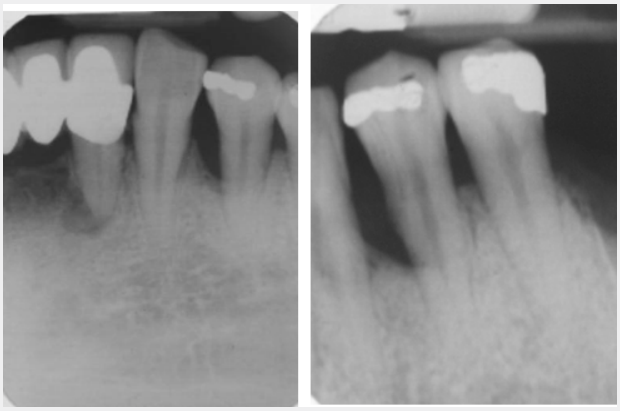

Figure 1a: Indicate severe angular bony defect on the mesial surface of left first premolar and moderate bone loss on the second premolar (2005/4/18) at the baseine.

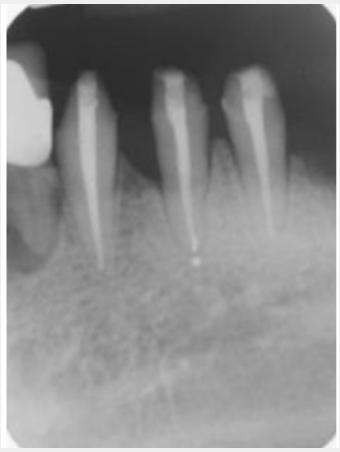

Figure 1b: Moderate bone repair occurred after conservative periodontal therapy (2006/2/10).

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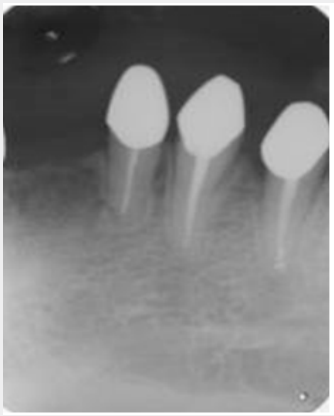

Figure 1c: Complete bone fill was found on the mesial surface of left first premolar after CSCTD periodontal prosthesis application 6 years later (2011/4/24).

Figure 2a: Indicate severe angular bony defects and bone loss on the full mouth (2011/2/20) at the baseline.

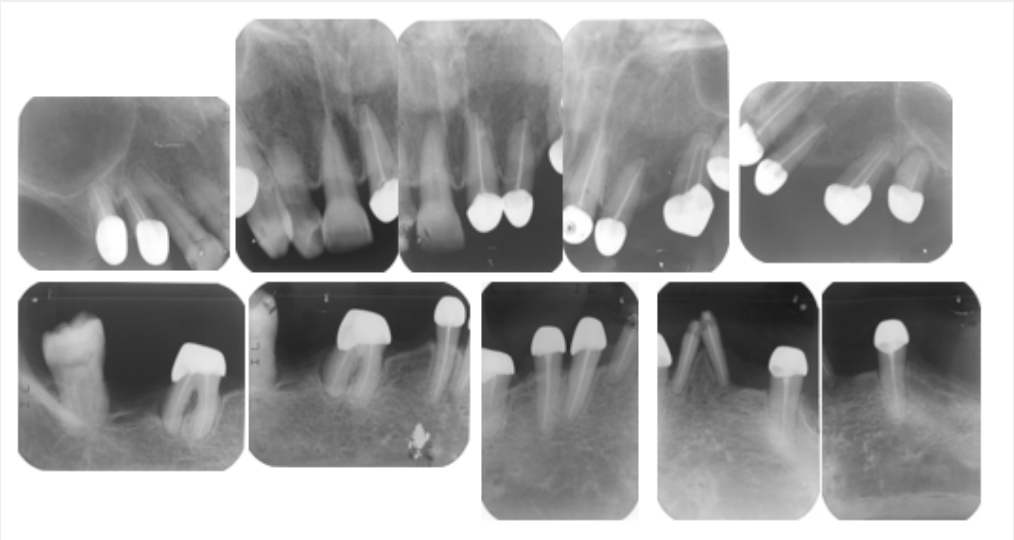

Figure 2b: Complete bone fills were found on the upper and lower alveolar bone after CSCTD periodontal prosthesis application 5 years and 3 months later (2016/5/21).

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