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ORIGINAL ARTICLE

Maxillary rehabilitation of periodontally compromised patients with extensive one-piece fixed prostheses supported by natural teeth: a retrospective longitudinal study

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Abstract
Objectives This study aims to evaluate the long-term success and stability of periodontal tissue around extensive one-piece prostheses supported by natural teeth in periodontally compromised maxillae.
Materials and methods A total of 28 fixed dental prostheses (FDPs) fabricated by different technologies were inserted in 28 patients with a history of chronic periodontitis after successful periodontal treatment. Subsequently, a program of supportive periodontal therapy (SPT) was instituted. Clinical parameters were evaluated in each patient after insertion of the FDP and during a follow-up examination.
Results The reported follow-up examinations took place after a mean clinical service of 75.7 (9.9–232.7) months. Probing depths had remained essentially unchanged by that time (2.6±0.8 mm at baseline versus 2.7±0.6 mm at follow-up). Significant deteriorations were observed based on plaque index scores (from 24.8% to 33.2%) and bleeding on probing (from 8.5% to 26.2%). One case of framework fracture was noted.
Conclusions Restorative treatment with extensive one-piece FDPs resulted in long-term stability of the periodontal outcomes. Gingival conditions were shown to deteriorate mildly despite periodic recalls for SPT. An association between deterioration and compliance was observed, suggesting that periodic examinations are essential for maintaining oral hygiene and hence to the success of treatment.
Clinical relevance Given a favorable distribution of potential abutment teeth, treatment with tooth-supported extensive FDPs is desirable even in patients with a history of periodontitis. Removable dentures would involve a number of shortcomings, including functional problems and severe degradation of oral ecology. Tooth-supported FDPs are capable of restoring function, esthetics, phonation, and mastication.

Keywords Gingivitis · Extensive prostheses · Fixed dental prostheses · Maxilla · Periodontitis · Perioprosthetics

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Introduction

Loss of periodontal attachment due to advanced periodontitis will frequently require extraction of one or several teeth. Attachment loss at neighboring teeth and increased mobility will call for prosthetic restoration [1, 2]. Opinions differ, however, about the level of occlusal loading tolerated by a reduced but healthy periodontium and which prosthetic restorations should be regarded as ideal in these situations. Rather than having been conclusively answered, these questions are influenced by biomechanical paradigms [3].

Whether residual teeth characterized by attachment loss should be included as abutments in fixed dental prostheses (FDPs) remains controversial unless one subscribes to Ante's law [4–6].

Jepsen [7] determined average surface areas of dental roots, such that periodontally destroyed abutment teeth can be assessed based on residual bone height and can be compared to the "root surface" of pontics needed for replacement by the use of radiographs of the residual periodontal ligament surface. Increased tooth mobility in the presence of reduced but healthy periodontal tissue support and without expansion of the periodontal ligament should be considered a physiological response to altered function rather than a pathological event [8–14]. Other studies dealing with load transmission to extensive FDPs have shown that abutment teeth with a reduced but evenly distributed periodontium can tolerate occlusal forces without affecting masticatory patterns [15–18].

The method of choice to restore esthetics, phonation, and function (including a uniform distribution of masticatory forces) in the maxilla is to fabricate FDPs characterized by rigid splinting and no use of resin. Structures of this type should be preferred to removable dentures [19] because adhesion of microorganisms to resin surfaces may result in stomatitis [20].

Successful outcomes of such treatment were reported by Scandinavian authors several decades ago [19, 21]. Thorough subgingival scaling with sonic and ultrasonic instruments has been shown to reduce the microflora and to yield similar results to cleaning with hand instruments in terms of attachment gain and pocket depth reduction [22, 23]. Successful long-term outcomes have confirmed the adequacy of periodontal treatment without antibiosis or surgical procedures [24–28]. Nyman and Ericsson [29] reported that FDPs uneventfully survived for 8 to 11 years even in patients whose periodontal support function was greatly reduced.

Patient satisfaction with mastication, phonation, and esthetics has an important role in combined periodontal and restorative treatment regimens [30]. An investigation by Moser et al. [31] demonstrated that fixed prostheses did not jeopardize the condition of periodontal tissue. No statistically significant increases in bone resorption were demonstrated based on observation periods as long as 15 years [32].

In recent years, zirconia materials have become increasingly popular for prosthetic frameworks. These designs offer both high stability and, by eliminating metal margins, superior esthetics [33]. The aim with oxide-ceramic materials is to achieve a marginal discrepancy or bonding gap of <70 μm [34, 35]. Some advanced CAD/CAM systems are capable of yielding zirconia FDPs offering a fit at least as precise as conventional metal-ceramic FDPs [36, 37]. Both designs have revealed no difference in survival rates after an observation period of 3 years [38].

While implant dentistry offers excellent ways of closing edentulous areas, it often requires adjunctive procedures for bone grafting. Implants to be placed in maxillary posterior segments, for instance, frequently involve a need for sinus floor elevation due to pneumatization of the sinus [39]. Numerous patients also require other techniques of augmenting the alveolar crest to optimize the function and esthetics of prosthetic rehabilitation by restoring the interarch relation [40]. Another point of concern with implants is that patients with tooth loss causally linked to a history of periodontitis may frequently experience implant failure or peri-implantitis. According to Renvert and Persson [41], an increased risk of peri-implant infection does exist in patients with a history of periodontitis. Schou et al. [42] found that tooth loss associated with periodontitis correlated both with a significantly heightened incidence of peri-implantitis and with coronal bone resorption. Based on observation periods of up to 10 years, survival rates of 83% to 97% have been reported for implants in partially edentulous patients with a history of periodontitis [43–47]. Bisphosphonate treatment may also affect the success rate of implants [48, 49].

The present study was conducted against this background. It was designed to demonstrate that extensive one-piece FDPs supported by natural tooth abutments are a suitable concept for rehabilitation of partially edentulous maxillae whose residual dentition is affected by reduced periodontal support.

Materials and methods

Patient selection and study design The study was designed as a retrospective single-center trial. All patients gave their written informed consent prior to study entry. Institutional approval was obtained from the local ethics commission at Medical University Graz (Graz, Austria). Candidates for inclusion were 96 patients with a diagnosis of chronic periodontitis, defined as gingival inflammation with loss of clinical attachment due to periodontal ligament destruction and loss of adjacent supporting bone (AAP Parameters of Care 2000).

Diagnosis and periodontal treatment All patients underwent diagnosis, treatment, and reevaluation by a team of specialists in periodontology and fixed prosthodontics. After defining a preliminary treatment plan based on the initial periodontal diagnosis, all hopeless teeth were extracted, and the edentulous spaces closed with temporary restorations. Comprehensive instructions about oral hygiene were given. All patients underwent an initial course of supragingival and subgingival periodontal treatment, applying hand and/or ultrasonic instruments until smooth surfaces free of concrements were verified. The mean duration of this course was

10.6 (6–18) months. Upon completion of treatment, they were reevaluated and divided into two groups depending on whether or not they met the below inclusion criteria for treatment with maxillary FDPs.

General inclusion criteria The following inclusion criteria had to be met for patients to be treated with maxillary FDPs following reevaluation: age ≥18 years, partially edentulous maxilla, physical ability to tolerate conventional restorative treatment steps, and adequate motivation to comply with supportive periodontal therapy (SPT). Patients were excluded from the study if they smoked >20 cigarettes a day, exhibited signs of active infection or inflammation after initial periodontal therapy, were pregnant, or had TMJ disorders. Cases with a need for extended periodontal diagnostics, administration of antibiotics, or periodontal surgery were also excluded. Patients were included regardless of gender and ethnic background.

Tooth-related inclusion criteria Teeth that met the following criteria were included: (1) probing depths (PD) ≤6 mm, (2) grade I-III mobility according to Miller upon completion of initial periodontal treatment, and (3) no grade III furcation involvement.

Restorative treatment Abutment teeth were prepared in accordance with general guidelines, using a paramarginal chamfer of 0.5-mm wide and a uniform insertion path. Following centric bite registration, impression taking, and fabrication of the master cast, the intraoral situation was transferred to an articulator with the help of an arbitrary facebow. The metal-ceramic FDPs were based on a high-gold bonding alloy (Degudent H; DeguDent, Hanau, Germany) as framework material used in combination with a suitable veneering ceramic (Duceram or Duceram Plus, DeguDent). The first step of the zirconia FDPs fabrication process was to wax up the framework on the master cast. The resultant structure was then scanned, matched, and milled in zirconia using a Zenotec CAD/CAM system (Wieladent; Lenzing, Austria), and veneered with Cercon ceram kiss (DeguDent). Intraoral luting to the abutment teeth was accomplished with zinc phosphate cement (Harvard Cement; Harvard Dental International, Hoppegarten, Germany), resin-reinforced glass ionomer cement (GC Fuji Plus; GC Corporation, Tokyo, Japan), or self-adhesive composite cement (RelyX Unicem; 3 M, Neuss, Germany). A comprehensive baseline evaluation of clinical parameters was performed 2 weeks after cementation. Twenty-eight of these FDPs could be assessed for the study, including 234 abutment teeth, 118 pontics, and 10 cantilevers for a mean span of 12.7 (11–14) units per patient. These 28 FDPs included edentulous areas of not more than two pontics and not more than one distal cantilever of one-molar wide per side. All FDPs were designed as full-arch rigid structures (without stress breakers) offering convenient access to hygiene instruments for home care.

Clinical parameters A periodontal probe featuring 3-mm scaling (PCP 12; Hu-Friedy, Chicago, IL) was used to evaluate *probing depths* on the mesiobuccal, mesiopalatal, buccal, distobuccal, and distopalatal surfaces of each tooth. *Bleeding on probing* (BoP) in this context was also recorded and documented. An erythrosin detector dye was applied to all maxillary teeth to obtain *O'Leary plaque index* scores by evaluating the buccal, mesial, distal, and palatal surfaces for the presence (yes=1) or absence (no=0) of red coloring. *Furcation involvement* was recorded in millimeters using a Nabers probe (P2N6 12; Hu-Friedy, Chicago, IL). *Pulp vitality* was assessed by cold testing with carbon dioxide.

Supportive periodontal therapy A rigorous SPT program was instituted for all patients. Visits were scheduled in intervals of 4 to 8 months depending on the initial diagnosis. Attention was devoted to hygiene status, periodontal conditions, carious lesions, and complications. A total of 15 patients returned for the maintenance visits as scheduled. Another ten patients did not return for maintenance visits as scheduled, while three returned for none of these visits but were actively approached to have a follow-up examination performed specifically for this study. For simplicity, we shall refer to the first subset of 15 patients as "compliers" and to the second subset of 13 patients as "non-compliers." The median durations of follow-up among these two subgroups were compared but were not found to involve a statistically significant difference. The sensitivity analysis of follow-up durations revealed that the difference between short-term and long-term follow-ups was smaller than the difference between compliers and non-compliers.

Statistical analysis Continuous variables are reported as mean values and standard deviations, also including median and min/max values. Box plots are provided with influential points marked as circles. Paired *t* tests for continuous variables were performed to compare the values documented at baseline and follow-up. To assess the influence of in-between examinations, an ANOVA model with baseline and follow-up as repeated measurements was calculated with in-between examinations as covariable. Test results were confirmed by non-parametric tests. Two-sided tests with p values ≤0.05 were considered statistically significant. All calculations were performed with SPSS 17 (SPSS Inc., Chicago, IL) software and were based on patients (rather than individual abutment teeth) as statistical units to avoid bias and/or overly optimistic results.

Results

Patient sample Figure 1 gives an overview of the study design. Of the 96 initial candidates for inclusion, 68 patients were not treated with extensive one-piece FDPs. These decisions were based on single inclusion/exclusion criteria in 41 cases and on multiple criteria in 27. Tooth-related and general criteria were responsible for 59 and 9 of these cases, respectively. Thus, the sample of patients who were treated with extensive one-piece FDPs and could be included in our evaluation was reduced to 28 cases. These patients (20 women and 8 men) had a mean age of 50.3 (21–64) years at the time of initial diagnosis. They were all in good general health, required prosthetic rehabilitation, and expressed a desire to be treated with fixed restorations, which were provided as one-piece prostheses in the form of either metal-ceramic (n=24) or zirconia (n=4) FDPs between 10/1989 and 10/2010. Periodontal results obtained in the patients with zirconia FDPs at the baseline and follow-up examinations were compared to those obtained in the patients with metal-ceramic FDPs but did not exhibit any significant differences. Zirconia was not used before 2005. A total of 234 maxillary teeth were present in these 28 patients at baseline, 64 of which had been adequately managed by root canal treatment (as verified by radiography) and restored with custom-cast posts and cores. All 234 teeth were included as abutments in the 28 FDPs evaluated here, which also included 118 pontics and 10 cantilevers, totaling

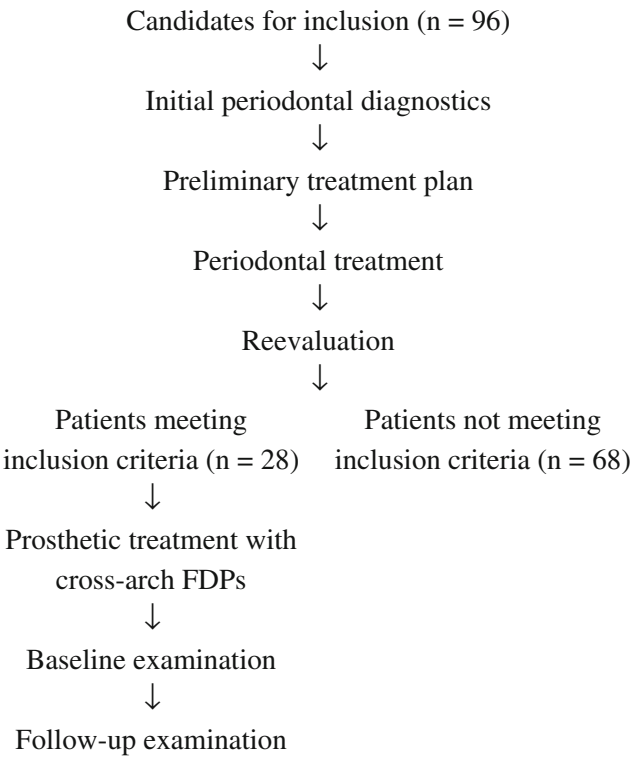

Fig. 1 Retrospective study design

up to a mean span of 12.7 (11–14) units per patient. The reported follow-up examinations took place after 75.7 (9.9–232.7) months of intraoral service. A sensitivity analysis revealed that the different follow-up periods did not affect the results.

Probing depths Pertinent data are summarized in tables (Table 1) and charts (Figs. 2 and 3). At baseline, a mean PD of 2.6±0.8 mm (median 2.34 mm) was obtained based on 234 teeth (1,404 tooth surfaces) and ranged from 1.7 to 4.8 mm per patient. The smallest/greatest PDs measured were 1.0/6 mm. Based on tooth surfaces, 80.1% of sites were <4-mm deep, 16.8% ranging from 4 to <6-mm deep, and 3.1% being exactly 6-mm deep. At follow-up, a mean PD of 2.7±0.6 mm was obtained based on 231 teeth (equaling 1,386 tooth surfaces, see "Complications" below for the 3 teeth missing from baseline) and ranged from 1.6 to 4.1 mm per patient. The smallest/greatest PDs measured were 1.0/11.0 mm. Based on tooth surfaces, 80.5% of sites were <4-mm deep, 16.5% ranging from 4 to <6-mm deep, and 3% being ≥6-mm deep (Fig. 3). A t test for paired differences did not reveal a significant difference between baseline and follow-up p=0.278). Non-compliers with SPT (i.e., those not returning for maintenance visits as scheduled) revealed a significant deterioration of PDs from baseline to follow-up (0.48±0.61 mm, median 0.57 mm, p=0.014), while the compliers exhibited a slight trend for improvement falling short of statistical significance (−0.13±0.73 mm, median: 0.14 mm, p=0.493). The difference between both subgroups (compliers versus non-compliers) at follow-up was statistically p=0.024.

Plaque index Pertinent data are summarized in tables (Table 1) and charts (Fig. 4). A mean plaque index (PI) score of 24.8±5.1% (median 26.5%) was obtained around the abutment teeth at baseline, compared to 33.2±12.2% (median 31.0%) at follow-up. This difference is statistically significant (p<0.001, Fig. 4). Deterioration over time was less pronounced among the compliers (2.8±5.6%, median 3.0%) than among the non-compliers (14.9±14.8%, median 13.0%) with SPT. This difference is statistically significant also p=0.014.

Bleeding on probing Pertinent data are summarized in tables (Table 1) and charts (Fig. 5). Mean BoP around the abutment teeth was 8.5±10.9% at baseline versus 26.2±10.0% at follow-up. Again, this difference is statistically significant (p<0.001, Fig. 5). Deterioration over time was less pronounced among the non-compliers (11.5±16.1%, median 9.0%) than among the compliers (23.1±14.5%, median 28.0%) with SPT. Although this difference fell short of statistical significance, it only did so by a very narrow margin p=0.059.

Table 1 Parameter changes from baseline to follow-up in compliers versus non-compliers with supportive periodontal therapy

	Examination	Number (*n*)	Mean	SD	Median	Min.	Max.	*p* value
PD	Baseline	28	2.58 mm	0.78 mm	2.34 mm	1.67 mm	4.83 mm	0.278
	Follow-up	28	2.74 mm	0.64 mm	2.62 mm	1.63 mm	4.13 mm	
Changes in PD	Total	28	0.15 mm	0.73 mm	0.24 mm	−1.45 mm	1.32 mm	0.024
	Non-compliers	13	0.48 mm	0.61 mm	0.57 mm	−0.96 mm	1.32 mm	
	Compliers	15	−0.13 mm	0.73 mm	0.14 mm	−1.45 mm	0.95 mm	
PI	Baseline	28	24.8%	5.1%	26.5%	10%	30%	0.001
	Follow-up	28	33.2%	12.2%	31.0%	12%	65%	
Changes in PI	Total	28	8.4%	12.3%	5.5%	−7%	50%	0.014
	Non-compliers	13	14.9%	14.8%	13.0%	−7%	50%	
	Compliers	15	2.8%	5.6%	3.0%	−4%	16%	
BoP	Baseline	28	8.5%	10.9%	0.0%	0%	28%	0.000
	Follow-up	28	26.2%	10.0%	28.0%	0%	42%	
Changes in BoP	Total	28	17.7%	16.1%	24.5%	−16%	42%	0.059
	Non-compliers	13	11.5%	16.1%	9.0%	−16%	34%	
	Compliers	15	23.1%	14.5%	28.0%	−6%	42%	
PBI	Baseline	28	0.6%	0.3%	0.6%	0.25%	1.40%	0.028
	Follow-up	28	0.8%	0.5%	0.7%	0.22%	2.10%	
Changes in PBI	Total	28	0.2%	0.5%	0.1%	−0.83%	1.56%	0.358
	Non-compliers	13	0.3%	0.4%	0.1%	−0.11%	1.27%	
	Compliers	15	0.1%	0.5%	0.1%	−0.83%	1.56%	

Non-compliers include patients who did not return for some or all of the scheduled maintenance visits

PD probing depth, *PI* plaque index, *BoP* bleeding on probing, *PBI* papillary bleeding index

Papillary bleeding index Pertinent data are summarized in tables (Table 1) and charts. The mean papillary bleeding index (PBI) score around the abutment teeth was 0.6±0.3% (median 0.6%) at baseline and increased to 0.8±0.5% (median 0.7%) around the same teeth by the time of the follow-up examination. This difference is statistically significant (p=0.028) and was more pronounced among non-compliers (0.3±0.4%, median 0.1%) than compliers (0.1±0.5%, median 0.1%) with SPT without reaching statistical significance in this regard p=0.358.

Recession and furcation involvement At baseline, all abutment teeth had their preparation margins on a paramarginal level. At follow-up, recessions of 0.51 mm were measured. No cases of clinical furcation involvement were clinically observable at baseline. At follow-up, one second molar

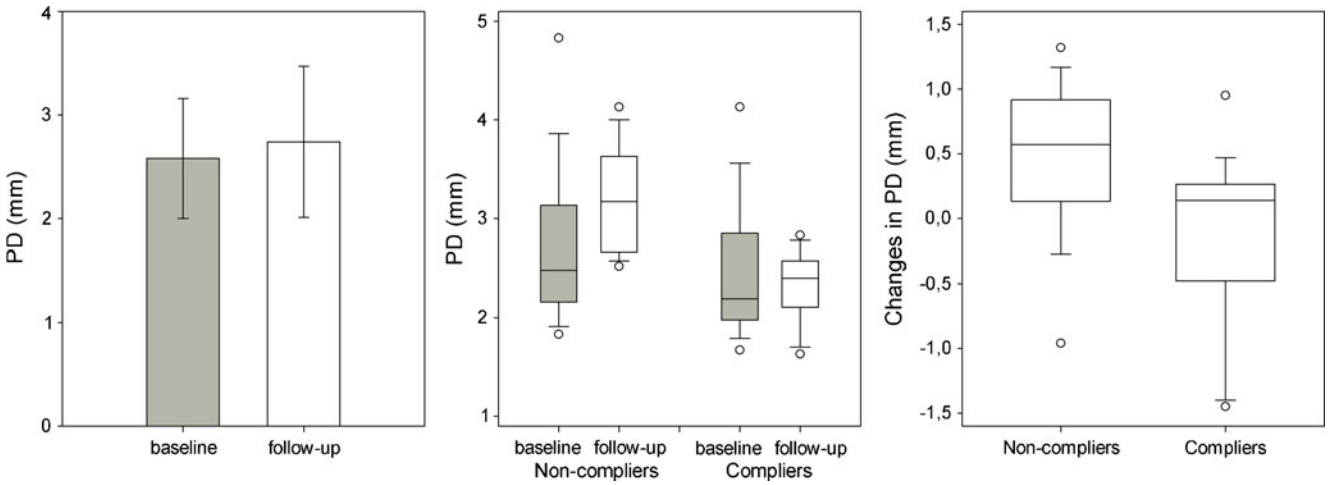

Fig. 2 Pocket depths at baseline and follow-up (mean±SD) (*left figure*). Pocket depths (mean±SD) at baseline and follow-up in non-compliers (*left*) versus compliers (*right*) with supportive periodontal therapy (*middle figure*). Changes in pocket depths (mean±SD) from baseline to follow-up in non-compliers (*left*) versus compliers (*right*) with supportive periodontal therapy (*right figure*)

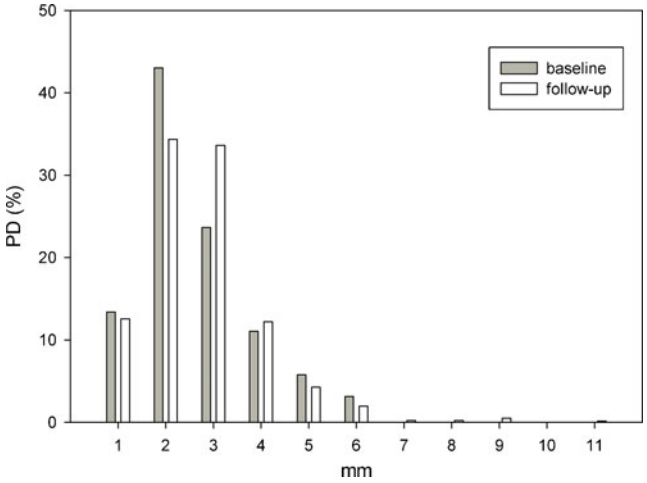

Fig. 3 Percentage distribution of probing depths at baseline and follow-up

exhibited grade I furcation; there was one case of grade II furcation, and one second molar developed grade III furcation.

Biological complications Two of the 234 abutment teeth were found to exhibit secondary caries at follow-up. These lesions were completely removed and restored with appropriate materials. Three of the 234 abutment teeth developed non-treatable apical periodontitis during the observation period and were extracted before the follow-up examination reported herein. This was accomplished by elevating a flap (including a vertical releasing incision) and reducing the alveolar bone down to the hopeless root, taking care to preserve as much tissue as possible. Subsequently, the crown coping was transformed to a pontic by retrograde closure with resin.

Technical complications One framework fracture was observed among the 28 FDPs, affecting one of the zirconia frameworks. The entire FDP was refabricated. Chipping of ceramic veneers was clinically observed in a total of four FDPs. All of them were intraorally mended with resin.

Discussion

Our investigation demonstrates that periodontal conditions remained stable after periodontal treatment and restoration of partially edentulous maxillae with extensive one-piece FDPs. This finding confirms the results obtained by other study groups [30]. We did observe a deterioration of home-care parameters in accordance with the degree to which the patients returned for periodic maintenance visits (compliers versus non-compliers with SPT). Probing depths remained stable between baseline and follow-up, although better scores were obtained among the compliers than the non-compliers. BoP scores increased significantly from 8.5% at baseline to 26.2% at follow-up, but there was no significant difference between compliers and non-compliers in this regard. PI scores deteriorated significantly from 24.8% to 33.2%, with the compliers doing markedly better than the non-compliers. These change can be attributed to an excellent hygiene status in all the patients at baseline (BoP being 0% in 16 and PI<30% in 24 of 28 patients) and to the fact that BoP scores increased to an acceptable 26% and PI scores to 33% despite periodic instructions. Furthermore, a minor non-significant improvement was observed among the compliers with SPT.

Moser et al. [31] similarly reported that suboptimal maintenance therapy did not jeopardize periodontal conditions associated with fixed prosthetic restorations. They covered a mean observation period of 11 years during which BoP

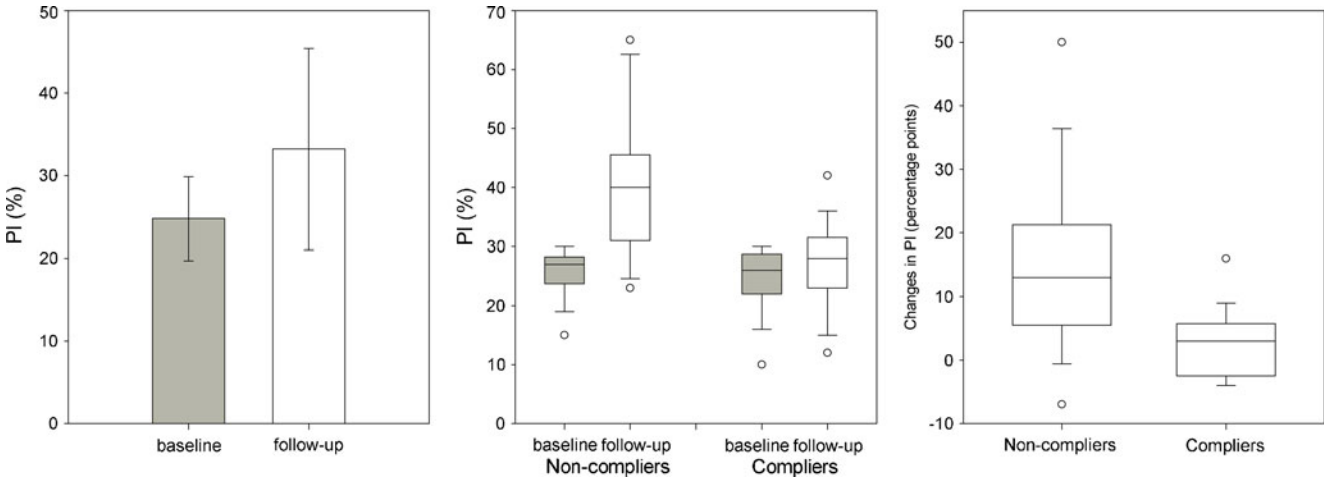

Fig. 4 Plaque index scores at baseline and follow-up (mean±SD) (*left figure*). Plaque index scores (mean±SD) at baseline and follow-up in non-compliers (*left*) versus compliers (*right*) with supportive periodontal therapy (*middle figure*). Changes in plaque index scores (mean±SD) from baseline to follow-up in non-compliers (*left*) versus compliers (*right*) with supportive periodontal therapy (*right figure*)

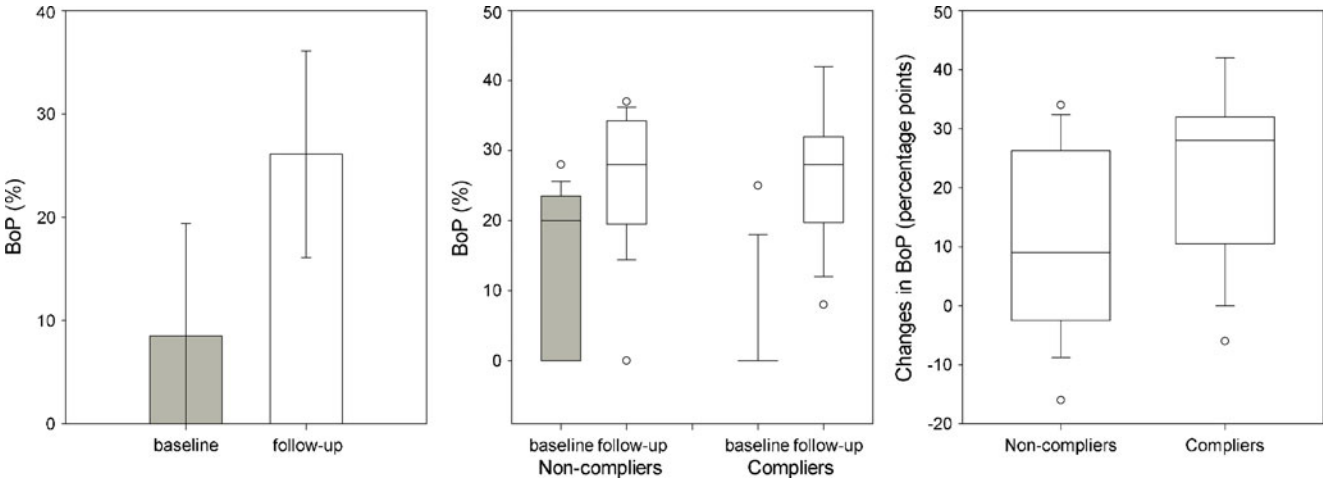

Fig. 5 Bleeding on probing at baseline and follow-up (mean±SD) (*left figure*). Bleeding on probing (mean±SD) at baseline and follow-up in non-compliers (*left*) versus compliers (*right*) with supportive periodontal therapy (*middle figure*). Changes in bleeding on probing (mean±SD) from baseline to follow-up in non-compliers (*left*) versus compliers (*right*) with supportive periodontal therapy (*right figure*)

remained stable (decreasing slightly from 31% to 28%), while PI scores increased from 42% to 48%. Probing depths in that study were 2.7±0.2 mm at baseline versus 2.8±0.07 mm at follow-up, compared to 2.62±1.2 mm versus 2.73±1.3 mm in our own study. Moser et al. [31] also reported grade I/II furcation involvement in 15.2/1.7% of molars at baseline, which increased to 38.4/2.2% at follow-up, whereas no cases of furcation involvement were clinically observed in our own study at baseline. Furthermore, they observed class III furcation involvement in 0.6% of molars at baseline. The follow-up results in our study included grade I furcation involvement in one second molar, one grade II furcation, and one second molar developing grade III furcation involvement.

It cannot be denied that complications are always possible with prosthetic rehabilitations like the ones reported in this communication. Biological complications may include secondary caries and apical lesions, and technical complications may include chipping of ceramic veneers [50]. Both complications reported by Hammerle [51, 52] and those observed by us did not necessitate fabrication of new prostheses. The only exception was an isolated case of framework fracture affecting one of the zirconia FDPs in the present study. That fracture occurred without excessive occlusal loading at the thinnest point of a connector between two abutment teeth. There may have been a design issue as studies have shown that the connector design between abutment teeth is critical to the long-term success of extensive one-piece FDPs [53–55]. Fardal and Linden [2] reported one framework fracture of a metal-ceramic FDP following 6 years of intraoral service.

Two of the 234 abutment teeth evaluated in our study exhibited secondary caries at follow-up and were managed by intraoral application of a restorative material. Chipping of veneers occurred in 4 of the 28 FDPs and was successfully managed by intraoral mending. Fardal and Linden [2] observed two cases of veneer fracture based on 94 FDPs (77 supported by teeth and 17 by teeth plus implants) in 80 patients during a mean observation period of 10.2±3.1 (7–2) years. Only three teeth were extracted in our study (because of non-treatable apical periodontitis) before the follow-up examination. Thanks to a favorable distribution of abutments; however, even this isolated case did not affect the superstructure. Fardal and Linden [2] reported eight cases of abutment teeth being lost due to caries and endodontic problems. Four teeth required endodontic treatment in that study, and caries was diagnosed in eight teeth.

Tooth-supported FDPs offer substantial advantages over solutions relying on implants. They allow treatment to be completed more expeditiously than after implant insertion preceded by augmentation procedures, which will both delay fabrication of the definitive prosthesis and require longer periods of temporization [39, 40]. All patients in our study had started out with a history of chronic periodontitis. Histories of this type have been associated with an increased risk of peri-implant infections [41]. Also, tooth-supported restorations involve less expensive materials than implant-supported restorations, thus reducing the cost of treatment for our patients.

Once periodontal and restorative treatment has been completed, it is essential to institute SPT for long-term success in periodontally compromised patients. An individual recall program must be scheduled, and meticulous instructions for home care given to each patient to maintain his or her periodontal health. Despite extensive motivation, only 54% of our patients complied with SPT as scheduled. Those who failed to comply were found to exhibit less favorable gingival conditions.

Combined periodontal and restorative treatment has been shown to result in good patient satisfaction with regard to function, phonation, and esthetics [30]. All patients evaluated in the present study expressed being satisfied with their functional and esthetic outcomes. Rigorous treatment concepts and careful laboratory procedures are essential to the success of such combined therapy, another prerequisite being periodic occlusal monitoring to prevent excessive loading [30].

Conclusions

The present study demonstrates that maxillary extensive FDPs were associated with long-term stability of periodontal tissue even in patients not undergoing SPT on a regular basis. The reported changes in gingival status remained within acceptable limits even though home care turned out to be less favorable than initially instructed and verified. Judging from the restorative success and survival rates, we conclude that tooth-supported extensive FDPs can be recommended irrespective of framework materials and fabrication technologies if patients are selected and all treatment and laboratory steps executed with appropriate care.

Conflicts of interest The authors report no conflicts of interest related to this study.

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