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Three years clinical follow-up of four different periodontal splint materials: An *In vivo* study

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Abstract
Background: Clinical follow-up of four different periodontal splint materials was carried out.
Methods: Fourty-nine subjects were randomly divided into four splint methods. Four different splint materials were evaluated in this study: (1) RB: Polyethylene FRC Ribbond Thm (2) Kerr: Polyethylene FRC Construct (3) MFL: Multifilament Fishing Line (4) Non Fiber Reinforced Composite as a control group. The control group consisted of 10 subjects, while 13 subjects were in RB, Kerr and MFL. After splinting procedures, the subjects were recalled three years later. Clinical periodontal parameters including plaque index (PI), gingival index (GI), clinical attachment level (CAL) and periodontal pocket depth (PPD) were performed at baseline and after three years.
Results: The survival rate was significantly affected by the splint type (RB:93.5%, Kerr:92.3%, MFL:85.8%, Control:68.4%). Periodontal parameters including PI, GI, CAL and PPD were decreased but similar between the four groups during the follow-up period.
Conclusions: Only resin composite application seems to be inadequate for periodontal splinting during 3 years. MFL splints are also economic and quite resistant, and they might be used as an alternative to fiber-reinforced composites.

Keywords: Periodontal splint, clinical follow-up, shear bond strength, fracture

Introduction
The purpose of the periodontal splint is to immobilize and stabilize mobile teeth. However, the etiology of mobility must be defined and removed before considering periodontal splint for patients. Tooth mobility can occur as a result of trauma, inflammation, periodontitis, heavy functional loads, endodontic lesions leading to secondary bone loss, and orthodontic tooth movement. After the etiologies are eliminated, some teeth may continue to show mobility due to decreased alveolar bone height. The most common example involves mobility due to decreased periodontal attachment that is present after the tooth is treated properly for severe periodontitis [1, 2]. Primary occlusal trauma, secondary occlusal trauma, progressive mobility, and pain during migration or function constitute the three main indications for splinting periodontally affected teeth. Splint is a common practice for stabilizing periodontally affected teeth. Splinting the teeth together takes support from the stronger teeth, allowing the distribution of force from the moving teeth to their immobile neighbors. This prolongs the life of mobile teeth, provides stabilization for reattachment of the periodontium, improves comfort, function and aesthetics [3, 4].
Since minimally invasive dentistry has replaced the traditional mechanical cavity preparation techniques for restorative materials and patients mostly prefer tooth-colored aesthetic materials, the use of composites has increased. Present conventional composite resin materials cause failure in restorations due to their low fracture strength. As a result of failure, undesirable complications such as discoloration, secondary caries, sensitivity, and microleakage may develop due to marginal incompatibility [5-7]. Studies to improve the mechanical properties of conventional composite resins aim to develop resin matrix or inorganic fillers. However, since no significant progress could be achieved with the studies carried out to improve the resin matrix structure, researchers mostly focused on filler technology. For this purpose, the aim is to increase the mechanical properties of the materials by adding fibers such as carbon, glass, polyethylene in different sizes into a composite material [8, 9]. Resin composite materials are strengthened by adding particles (randomly oriented), whiskers (single or multi-layered filaments) and fibers (short and long with different orientations) to existing inorganic fillers. The effect of fiber reinforcement is based on factors such as fiber amount, length, form, orientation, adhesion to the polymer matrix, and pre-saturation with the composite resin. However, for reinforcement, the force that the composite structure is exposed to must be effectively transmitted to the fibers by the resin matrix surrounding the fibers [8-11].
Fiber-reinforced composites are a special combination of ceramic filler and advanced polymer chemistry that provides greater function and aesthetics. Fiber connection materials are materials that contain fiber in the resin matrix and have a very wide usage area. Fiber technologies are now used in all disciplines in dentistry as direct restorative material, periodontal splint, trauma splint, endodontic post, lingual retainer, placeholder, temporary and fixed partial denture, and denture base material. The first attempts at reinforcement with fiber in dentistry date back to the 1960s. In the 1960s and 1970s, researchers tried to strengthen polymethyl methacrylate prostheses with glass and carbon fibers. Similar initiatives continued in the 1980s. These attempts were directed towards fiber reinforcement of implants, fixed prosthetic restorations, orthodontic retainers and splints. While these techniques improve mechanical properties, their general clinical acceptability has been

limited due to inappropriate clinical manipulation procedures of the materials and insufficient applicability [10-12].

In the late 1980s, dental researchers discovered the importance of effective bonding and full saturation of the fibers with resin and began to develop methods suitable for dentistry. Two approaches were developed during this time. The first involved the dentist or technician manually applying low-viscosity resin fiber bundles. While this process provides complete wetting, it also increases the technical precision. The other approach involved controlled presaturation of fiber bundles during manufacture [13-16]. Although there are many different production methods, it is generally applied by pulling fiber bundles through a helical path that pushes the resin into the fiber bundles. As one might expect, numerous manufacturing parameters such as the viscosity of the resin, the speed of the process, the tension on the fiber bundles affect the final fiber dimensions and content. These complex process parameters allow for high fiber content, complete wetting, minimal void presence, and control of cross-sectional dimensions in pre-saturated FRCs [17-19].

A case report published in 1995 by Miller and colleagues included "immediate and indirect periodontal, prosthetic splint placement", and it is the first study that presented the use of gas plasma-treated, knitted polyethylene fabric to reinforce composite resins that are used for periodontal splints. In this way, woven polyethylene lattice fibers treated with gas plasma; an attempt to place a thin but strong composite resin-based splint was introduced to dentistry as a high-strength, bondable, biocompatible, aesthetic, easily manipulated, neutral-colored fiber embedded in a resin structure [20]. Although there are different splint materials that allow conservative stabilization of hyper-mobile teeth, *In vitro* studies investigating these materials have been found to be quite limited. When the relevant literature is examined, although there are a limited number of retrospective studies examining splinting processes in the recent period, we have not found any study in which different fiber materials were investigated clinically [21-22]. Therefore, in this study, we investigated the 3-year clinical success of 2 different fiber reinforced composite materials, a fishing line and a resin composite material. The null hypotheses were that the clinical survival rate of four different splinting methods would not be different from each other.

Material and Methods

Clinical follow-up of four different periodontal splint materials was carried out. Ethical approval for this study was obtained from the University Research Ethics Committee (2015/006), and informed written consent was obtained from all the study participants. This project was carried out at the Faculty of Dentistry, Necmettin Erbakan University, Konya, Turkey. The study was conducted in full accordance with ethical principles, including the World Medical Association Declaration of Helsinki. Seventy patients with periodontal disease were incorporated for this research. The following exclusion criteria were performed: (1) subjetcs who do not have permanent oral care habits, (2) systemic disease, (3) incomplete periodontal treatment, (4) smoking habits, (5) regular medicine usage, (6) those who do not request to attent to follow-up, (7) missing teeth in the splinting area, (8) history of endodontic therapy and/or any restoration on the teeth to be evaluated, and (9) large diastema in the anterior region as outlined by the researcher.

In the selected group of patients, splinting was indicated due to severe mobility and lack of chewing comfort reported by the patients at the Periodontology Department. Only patients with vital teeth, presenting mobility of grade 3 and having at least one canine with no mobility on both sides of the dental arch were assigned for splint therapy. After the exclusion criteria, 70 patients (40 females, 30 males, age range: 41-68 years old), who had undergone periodontal therapy with root planning and scaling procedures followed by clinical follow-up controls on a periodic basis and reached a stable hygiene phase, have been included in the study for randomization [3]. The patients were randomized using an Internet-based computer program. Four different splint materials were evaluated in this study: (1) RB: Polyethylene FRC Ribbond Thm (Ribbond Inc., Seattle, WA, USA), (2) Kerr: Polyethylene FRC Construct (Kerr, Orange, California, USA), (3) MFL: Multifilament Fishing Line (Caperlan, France), (4) Non-Fiber Reinforced Composite (Clearfil Majesty Esthetic, Kuraray, Japan) as a control group.

Periodontal treatment

The periodontal treatment protocol of the authors institution is standardized as described and was not changed since the year 2014. No pocket elimination surgery or osseous resection were performed in any patients. The non-surgical periodontal treatment attempt consisted of motivation, teaching daily plaque control methods, tooth surface cleaning, and root surface straightening when necessary. Daily plaque control methods training was given by showing patients the use of toothbrush and interface cleaning tools on jaw models. In addition, the plaque control methods shown in the jaw models were seen in practice in the patients' own mouths. If necessary, further treatments like open flap debridement with or without subsequent systemic adjunct antibiotic therapy were performed.

Splinting Procedure

All periodontal splint applications were made directly by one operator. The teeth were isolated for the clinical procedure with a rubber dam. With small amounts of resin composite (Clearfil Majesty Esthetic, Kuraray, Japan) all mobile teeth were temporarily attached to each other at their labial surfaces and photo-polymerized for 10 s (Optilux 501, Kerr/Demetron, Danbury, CT, USA). The purpose of this step was to stabilize the mobile teeth and to avoid any displacement during splinting. For this process, the enamel surfaces were not etched and no surface preparations were made. It was decided that the splint would extend from the mandibular left canine to the mandibular right canine. Since the importance of the composite resin reinforcement is at the interproximal areas, the splint was to extend from the midlingual surface to the midlingual surface of each canine. A piece of dental floss was laid onto the lingual surface at the level of the proximal contacts and cut to length. Next, the lingual surfaces of the teeth were prepared with a reverse tapered diamond burs (Revelation, #805-014, SS White Burs, Inc., Lakewood, NJ, USA). When cavity preparation was completed (depth: 1 mm, width: 2 mm) cavity surfaces on the lingual side were then etched with 37% orthophosphoric acid for 60 s. After rinsing with water and air-drying, the two-step adhesive resin (Clearfil SE Bond, Kuraray, Japan) was applied to the surfaces using a microbrush, gently air-dried and photo-polymerized for 20 s. The splint material was impregnated with adhesive resin. After flowable composite resin (Filtek Ultimate, 3M ESPE St. Paul, MN, USA) was applied, a previously measured length of splint material was placed in the bed of the flowable resin. The splint material and the flowable composite were photo-polymerized for 40 s per tooth surface. All splint surfaces were completely covered with composite resin (Clearfil Majesty Esthetic, Kuraray, Japan) and each layer was again photo-polymerized for 40 s from all aspects. Finally, after occlusal and esthetic adjustments, all splints were finished using fine diamond burs to remove the excess composite resin. Subsequently, the composite surfaces were polished with coarse, medium, fine, and ultrafine finishing disks (Sof-Lex, 3M ESPE) in sequence using a hand-piece at 3000 r.p.m. in order not to expose fibers. Final polishing was accomplished with a composite resin polishing paste. For the control group, only non fiber reinforced composite was used for splinting.

All patients received the usual home-care oral hygiene instructions and a packet with nonprescription fluoride toothpaste, a manual toothbrush, interdental brushes and dental floss. Four weeks after the splinting procedures, subjects received consummate prophylaxis. All patients were called upon for follow-up controlsafter three years. The patients were awared regarding probable complications and they were catched up to recall occurrence of a deformity that emerged up to the appointment. The survival rates (caries, debonding or fracture) were determined clinically for all splint types during 3 years.

Clinical assessment

Silness and Löe's plaque index (PI) and Löe and Silness's gingival index (GI) were used to determine the periodontal status of each patient at baseline and after three years [23, 24]. In addition, clinical attachment level (CAL) and periodontal pocket depth (PPD) were measured. All measurements were recorded on prepared index forms. For the PI, GI, CAL and PPD averages, first the values obtained from the four surfaces of each tooth are summed and averaged, and the average of a tooth. Then, these values were summed up and averaged, and the individual's PI, GI, CAL and PPD averages were obtained. Clinical index scores were evaluated as follows. Plaque index: (Silness and Loe 1964); 0: No bacterial plaque in the adjacent area of the tooth surface with the free gingiva; 1: The presence of plaque, which cannot be noticed with the naked eye, but revealed by probing with the probe tip the gingival sulcus, 2: Presence of fine to moderate plaque in the gingival area and tooth surface, visibly; 3: Presence of dense soft accumulations in the gingival groove and tooth surface. Gingival index Scores: (Löe and Silness 1963); 0: Healthy gingiva. 1: The gingiva is characterized by mild inflammation, discoloration and edema, but no bleeding after probing. 2: The gingiva is moderately inflamed, bright, red, and edematous, but there is bleeding on probing. 3: "The gingiva is characterized by severe inflammation, marked redness and edema. There is a tendency of ulcerations and spontaneous bleeding. Periodontal pocket depth: With the aid of a Williams periodontal probe (PCPUNC 15% Hu-Friedy, Chicago II, USA), the distance between the free gingival margin and the sulcus/pocket base was measured from four points of the tooth: mesial, distal, buccal and palatal. During the measurement, care was taken that the probe was parallel to the long axis of the tooth and that the force that is applied is not excessive. Clinical attachment level: With the help of Williams periodontal probe, the distance between the enamel-cementum junction and the sulcus/pocket base was measured from four points of the tooth: mesial, distal, buccal and palatal.

Statistical Analysis

All statistical analyses were conducted with the Statistical Package for Social Sciences (SPSS 21.0 for Windows, SPSS Inc., Chicago, IL, USA). Statistical significance was set at a probability value of $p<0.05$. Descriptive statistics including the mean, standard deviation, minimum, and maximum values were calculated for the four splint groups. Since the results of the Kolmogorov-Smirnov and Shapiro-Wilk tests demonstrated that the data were normally distributed ($p>0.05$), parametric tests were used for statistical analysis. One-way analysis of variance (ANOVA) and Tukey's honestly significant difference (HSD) post hoc test were used to compare values between groups. Survival rate of splinted teeth and stability of splints was calculated applying the Kaplan-Meier estimator with 95% Cl.

Results

All splints were applied from canine to canine in the mandible, and 21 patients dropped out from the follow up. All patients had a permanent dentition with a mean of 20.1 ± 4.8 teeth and the total number of splinted teeth was 294. The control group consisted of 10 subjects (60 teeth), while 13 subjects (78 teeth) were in RB, Kerr and MFL (Table 1). Nineteen partial or complete composite fractures were detected in the control group during the study period; they were repaired with other splint materials and excluded from the study (Table 2). Life-tables calculated from the data and Kaplan–Meier curves showed survival rate for each group during the three years follow-up duration. The survival rate was significantly affected by the splint type (RB:93.5%, Kerr:92.3%, MFL:85.8%, Control:68.4%). Inter - and intra-group assessments of periodontal parameters including PI, GI, CAL and PPD were similar between the four groups during the follow-up period. At baseline, mean (SD) PPD of four groups was 3.46 (1.51) mm. Three years after splinting, mean PPD (SD) decreased to 2.76 (0.58) mm and remained stable over the following observation period. At baseline, mean CAL(SD) of all splinted teeth was 5.40 (1.73) mm. Three years after splinting mean (SD) CAL decreased to 5.01 (1.58) mm and did not change significantly over the study period. Mean PI (SD) at splinted teeth was 2.8 (0.9) at baseline and 2.7 (1.0) after three years. Mean GI (SD) at splinted teeth was 3,2 (0.3) at baseline and 2.9 (0.4) after three years. At baseline and 3 years after splinting 5 of the 294 splinted teeth showed endodontic treatment. After splinting, 11 caries lesions were diagnosed at the splinted teeth and restorations or fillings were applied. No splinted tooth was lost within the first 4 years after splinting. One splinted tooth was lost 3 years after baseline in control group. 40 splinted teeth required a repair during follow-up.

Table 1: Variables related the study subjects at baseline and after three years.

	Baseline	Three years
Number of patients (female/male)	70 (40/30)	49 (23/16)
Age (mean + SD)	46.5 (12.2)	-
Follow up time (month)	-	58.7
Number of study sample (teeth)	420	294
Number of teeth/patient	21.2 (5.3)	20.1 (4.8)
Location (Maxilla/Mandible)	9/61	7/42
Mean PPD mm (mean + SD)	3.46 (1.51)	2.76 (0.58)
Mean CAL mm (mean + SD)	5.40 (1.73)	5.01 (1.58)
Mean PI scores (mean + SD)	2.8 (0.9)	2.7 (1.0)
Mean GI scores (mean + SD)	3.2 (0.3)	2.9 (0.4)

Table 2: Clinical follow-up results

Groups	Partial or complete composite fractures (Patients)			Caries			Success rates (%)
	Baseline	2 years	Three years	Baseline	2 years	Three years	
Composite Resin (60 teeth)	None	15	19 (68.4)	None	1	2	68.4
Ribbond (78 teeth)	None	2	5 (93.5)	None	None	3	93.5
Kerr (78 teeth)	None	3	6 (92.3)	None	None	2	92.3
Fishing Line (78 teeth)	None	6	11 (85.8)	None	None	4	85.8

Discussion

This study investigated *In vivo* evaluation of four different splint materials. It is detected that the Non-fiber Reinforced Composite (the control group) exhibits unsuccessful results in the clinical follow-up period. The null hypothesis of this present study was rejected because the study found that Non-fiber Reinforced Composite is not suitable for long-term clinical splinting. On the other hand, Multifilament Fishing Line showed similar clinical success rate with the RB and Kerr groups.

The clinical prognosis of periodontally affected teeth is often dependent on the presence of tooth mobility. The main causes of mobility due to periodontal disease are alveolar bone loss, inflammatory changes in the periodontal ligament, and trauma from occlusion. While problems related to inflammation and occlusion can be corrected, it is unlikely to improve mobility due to alveolar bone loss. One study demonstrated that pockets in clinically mobile teeth did not respond to periodontal treatment as well as pockets in non-mobile teeth with the same initial disease severity. Therefore, splint treatment is an accepted method to reduce the mobility of periodontally affected teeth. It is generally accepted that even normal physiological functions such as chewing and swallowing contribute to tooth mobility. Although there is no definite information about its therapeutic effect, splinting of teeth during periodontal treatment is a useful method because it not only reduces mobility, but also improves the comfort of the patient and improves chewing function thanks to treatment. When the results of this study were examined, it was observed that after fiber reinforced resin splint, the functional and aesthetic problems of the patients were eliminated as a result of decreased mobility, and it was easier to apply oral hygiene procedures [25- 29].

Despite the fact that increased mobility is frequently observed for anterior teeth of the lower jaw, there are only few studies investigating the survival rate of different splinting materials and splinted teeth in patients with periodontitis. To our knowledge, this study is the first research in the literature of dentistry evaluating the clinical success and survival rate of different periodontal splint materials at clinically. Although highly evidence-based researchs are always preferred, it is known that the level of realizing long-term randomized clinical studies with participation of a large number of individuals is difficult. In this regard, it is known that the number of the patients followed is not at the desired level in our study.

One of the most important points in the selection of periodontal splint material is the mechanical interaction between splints and tooth surfaces. In splint applications made using only resin composite, the intended success cannot be achieved due to the strength differences between the teeth and the composite structure. According to our follow-up results, the survival rate of the control group was quite low (68.4%) compared to the other test groups. These results are important in terms of showing that long-term successful results cannot be obtained with a splinting process using only non-fiber reinforced composite.

In the past, splinting was performed with wires, pins or meshes placed directly into the restorative resin [30]. These materials can only be mechanically locked around the resin and cannot be chemically bonded within the splint. The interface formed between the composite resin and the wire, pins or mesh has the potential to create shear planes and stress concentrations that will lead to premature failure. As a result of the failure of the splint, clinical problems such as traumatic occlusion, periodontal disease progression and secondary caries may occur [31, 32]. The fiber has a cylindrical, thin and flexible structure that is 100 times longer than its diameter. Fiber-reinforced composites (FRC) used in dentistry basically have a similar structure to resin composites, and consist of an organic matrix and inorganic filler phase as in resin composites. Organic matrix exists in the structure of polymethyl methacrylate, epoxy or Bisphenol-A diglycidyl methacrylate, urethane dimethacrylate, triethylene glycol dimethacrylate. On the other hand, the inorganic filler phase consists of fibers placed in various lengths, diameters, structures and directions added to the organic matrix structure. The fiber in the composite matrix is bonded to the resin by an adhesive interface. The interface between the matrix and the fiber plays an important role in transferring the load from the composite to the fibers. While the reinforcing components provide strength and stiffness, the resin matrix surrounding the fibers fixes their geometric structure, protects them from the effects of moisture and keeps them in a predetermined position to provide optimal strength, support and applicability [10, 33, 34].

With the introduction of polyethylene woven fibers that can chemically bond with resin, many of the problems encountered in previous splinting approaches were solved. Advantages of FRC periodontal splints are ease of application with minimal tooth preparation, cost-effective compared to crown and bridge, easy removal of the splint when not needed, ease of repair in case of failure through rebonding and reapplication of new material, facilitating more aggressive treatment methods in teeth with questionable prognosis before long-term stabilization, high aesthetic value and ease of daily oral hygiene practices at home. RB and Kerr are the two fiber materials used in this clinical study. They are made of ultra-high molecular weight polyethylene fiber designed with lock stitching. Thus, it provides excellent bonding properties by effectively returning loads to the resin throughout the weaving without transferring the stress in a stress-free fashion [8, 13, 28].

Although fibers improve the mechanical properties of the material, they have not received much acceptance because they did not meet the initial clinically desired success. The reasons for this are that the connection between the fiber and the matrix, and the amount of fiber are insufficient. Therefore there is no improvement in mechanical properties. Moreover, the fiber ratio in the resin matrix is low in volume. In addition, a gap is formed between the fiber and the resin due to insufficient wetting of the fiber with the resin. As a matter of fact, while the ratio of fibers used in industrial products is 50-70% by volume, the fiber ratio in dental resins is less than 15%. This results in lower mechanical properties. In dentistry applications, it was stated that the fibers should be coated with an unfilled polymer or composite resin matrix, emphasizing the importance of effective bonding between fiber and matrix in order to achieve wear resistance and high mechanical properties. As a result of the studies, it was reported in the 1990s that sufficiently saturating (wetting/impregnating) the fiber with the resin could provide an effective bonding between the fiber and the matrix [34-36]. The resin treatment (wetting) of the fibers can be done in two ways; the first of these is the application of low viscosity resin to the previously dry fiber bundles by the dentist or the technician in the laboratory and ensuring that the fiber is wetted with the resin. This application is a very technical and very sensitive method, as it requires selection of the appropriate fiber and resin, and manual dexterity. The second technique consists of commercially available and pre-saturated (wetted) fiber bundles. In this type of fibers, the penetration of the resin into the fiber stack was obtained as fabrication [35, 36]. In the light of the above information, it was reported that the factors affecting the physical and mechanical properties of fiber reinforced composites are the structure and orientation of the fiber, the fiber concentration in the restoration, the resin matrix adhesion quality of the fiber, and the saturation of the fiber with the polymer matrix.

According to our study, the clinical follow-up results values were quite good and identical in the two groups comprising polyethylene fiber. Tokajuk *et al*. reported that ribbond reinforced with composite resin was a suitable material for treatment of hypermobile teeth, especially in cases where patient discomfort is a prominent factor, because of properties such as easy applicability, patient comfort, resistance to fracture, biocompatibility and esthetic acceptability [19]. In the literature of dentistry, the studies performed using FRC consist mainly of case reports; short-term follow-up studies are also available [18, 19, 26, 30]. Kumbuloglu *et al*. reported that E-glass FRC material is successful up to 4.5 years with a rate of 94.8% [26]. In their study, the findings such as periodontal pocket depth, clinical attachment level and plaque index of the patients for clinical follow-up were evaluated, and the applied splint materials was reported to contribute to periodontal healing [26].

MFL material, which we used in our study, was applied for periodontitis patients for the first time in the dental literature. This material has been used for the stabilization of the teeth with trauma, and was found quite useful due to allowing for physiological tooth mobility [37]. It has been reported that fishing line splint, which is also an inexpensive material, might be applied and removed more easily than a wire-composite splint [38]. According to the follow-up results of our study, MFL showed similar results to the FRC groups. In our study, unlike the research using this material for splinting after trauma, MFL was applied in a twofold manner: lower and upper. Thus it may be concluded that application of two layers contributed to the bond strength values. One of the most important results of this study was that MFL could be used for routine splint procedures in subjects with periodontal mobility.

Flowable composite resin application was performed prior to the placement of the splint materials in this study. It was reported and recommended by some researchers that the use of flowable composites under composite restorations reduces the flexural strength of the composite positively affects polymerization, and eliminates irregularities in the cavity floor. In some studies, it was found that the group in which the fiber reinforced composite resin was applied together with the flowable composite was higher than the fiber group that was not applied. In one study, the overall success rate was found to be 97.1% in the 18-month follow-up of restorations on which composite was applied and that placed fluid composite and fiber material at the base of the cavity in first molars with excessive crown destruction. The use of fiber reinforced composites in dentistry is gradually expanding and has potential for alternative applications. We can surmise that new areas of use will emerge when combined with the creativity of dentists. *In vivo* and *In vitro* studies on this subject are continuing [13, 39].

At baseline of the presented study, mean PPD (SD) of the splinted teeth was 3.46 (1.51) mm and mean CAL (SD) was 5.40 (1.73) mm. After 3 years, values decreased to 2.76 (0.58) mm and 5.01 (1.58) mm, respectively, and did not change significantly over the following observation period within groups. The decrease of 0,7 mm observed in mean PPD and CAL gain of 0.4 mm of the splinted teeth within the first 3 years can mainly be attributed to the success of oral health support, but an influence of different splint materials on these results can be discussed. While splinting of teeth without plaque-removal failed to prevent attachment loss in animals with experimental periodontitis, human studies showed higher CAL gain at splinted teeth than at non-splinted teeth in patients that were treated with regenerative periodontal therapy and in patients that did not receive any active periodontal therapy [20, 21, 40, 41]. Our results showed that splinting with different methods had positive effect on oral hygiene and increased clinical periodontal parameters including PI and GI.

Conclusions

Within the limitations of this presented study, it is concluded that non-fiber reinforced composite application was alone insufficient for periodontal splinting during three years, the MFL splints are also economic and quite resistant, and they might be used as an alternative to FRCs

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