

## CLINICAL STUDY ON FIBER REINFORCED COMPOSITE AND WIRE-COMPOSITE PERIODONTAL SPLINTING AND THEIR INFLUENCE ON PERIODONTAL PROGRESS STATUS

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### ABSTRACT

**Aim of the study** The purpose was to determine the progress of periodontal status of splinted mandibular frontal teeth and the clinical performance of three types of materials used for obtaining extracoronary periodontal splints. **Material and methods** Patients were randomly distributed into three groups, depending on the type of splint applied: glass fiber reinforced composite (FRC-S), polyethylene FRC (FRC-P), and wire-composite (SRC). 90 teeth were evaluated, 30 in each group. **Results** Significant reduction of dental mobility in all three groups was noticed between initial evaluation (Ti) and immediately after splinting (T0). No significant differences were observed between T0-T6-T12. Lower values were observed in FRC-S group, which suggests the more rigid behaviour of material compared to the other two groups. In terms of the integrity of periodontal splints, three cases needed repair: two in SRC group (adhesive defect occurred between the wire-composite and dental surface), and one in FRC-S group (composite fracture without clinical exposure of the fibre). **Conclusions** For the entire study group, the clinical success rate was 80% and functional success rate was 100 % after 12 months. Under the terms of regular re-evaluation in maintenance phase, periodontal splinting allows a reduction in plaque index and the gingival index at 6 months after splinting, without interfering with the means of oral hygiene. A decrease in PD and CAL at 6 and 12 months was noticed after the completion of periodontal splinting. The wire - composite splints can promote the retention of plaque compared with FRC splints. It is necessary to consider that the teeth showing tooth mobility above 45 Periotest value may interfere with the clinical success of splinting. In these situations, other therapeutic options need to be considered.

**Key words:** periodontal splint, glass fiber reinforced composite, polyethylene fibre reinforced composite, wire – composite, dental mobility.

## INTRODUCTION

The main objective of periodontal splint is to achieve a favourable environment for periodontal healing, to reduce dental mobility, to obtain a masticatory comfort for the patient and to ensure optimal occlusion and functionality [1]. Periodontal immobilizations that redistribute functional and parafunctional forces favour stability after periodontal treatment [2]. Many splinting systems were describe in the literature: composite resin, wire, wire-composite, fiber reinforced composite [3], but there are few clinical studies on the use of FRC as a conservative method recommended as dental bridges [4] but also for treatment of teeth with increased mobility [5-8].

## AIM

The objectives were to evaluate:

- the effect of applying periodontal splints by quantifying and comparing hygiene and periodontal parameters;
- clinical behaviour of periodontal splints in terms of their integrity.

## MATERIALS AND METHODS

### *Defining the study group, inclusion and exclusion criteria*

15 patients with marginal chronic periodontitis were selected. They came for treatment to the Department of Periodontology, Dental Medicine Faculty, University of Medicine and Pharmacy "Grigore T. Popa" Iasi. The study was conducted with the agreement of the ethics committee no 8670.

Inclusion criteria were: patient with periodontal disease (medium or severe marginal chronic periodontitis), tooth mobility of II/III degree (lower frontal teeth), absence of marked dental anomalies, absence of systemic pathologies or medication with impact on periodontal status.

Exclusion criteria were: systemic

pathology or medication with impact on periodontal status, patient with an undergoing orthodontic treatment, patients who have missing teeth in the frontal mandibular area, uncooperative patients, patients who can't give informed consent.

Patients were randomly distributed into three groups, depending on the type of applied splint: glass fiber reinforced composite splint (FRC-S), polyethylene fiber reinforced composite splint (FRC-P), wire-composite splint (SRC).

90 teeth were evaluated, 30 in each group. After being informed about the purpose and methodology of the study, patients signed informed consent form. Working algorithm was conducted in several stages, as follows.

### *1. Clinical evaluation*

In the first stage, clinical examination was performed and observation form was completed for each patient. Following the initial clinical periodontal evaluation, the next five parameters were quantified: plaque index Silness and Loe (PI), gingival index Silness and Loe (GI), periodontal pocket depth (PD), attachment loss (CAL), and dental mobility (MD).

### *2. Etiological treatment*

Education was made for individualizing plaque removal techniques followed by scaling, root planning and professional cleaning.

### *3. Re-evaluation I*

After one-month (Ti), indices of plaque, gingival indices and dental mobility degree were reassessed. The patients included in the study were those who experienced discomfort during mastication, a reduction of PI, GI, dental mobility degree of anterior teeth greater than 30 for at least one incisor and at least one canine had no pathological mobility.

### *4. Applying periodontal splinting*

Extracoronary periodontal splints were made of fiber glass reinforced composite, polyethylene fiber reinforced composite and

wire -composite.

**5. Re-evaluation II**

- At T0 (immediately after splinting), dental mobility evaluation was performed.

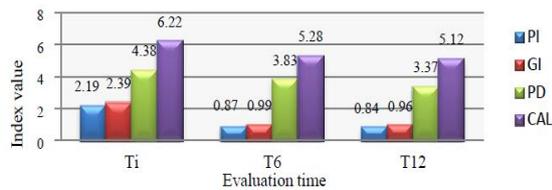
- At T6 (after 6 months) and T12 (after 12 months), the integrity of the splints and the five parameters were evaluated.

**RESULTS AND DISCUSSIONS**

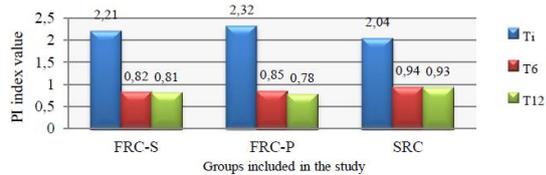
The values of evaluated periodontal parameters are presented in figure 1.

A reduction of PI and GI can be noticed from the initial situation to 6 months, followed by a stability period up to 12 months. Regarding PD and CAL, it was observed the same trend of values decline at 6 and 12 months from dental splinting.

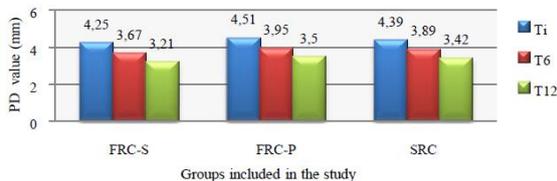
In figures 2 and 3 the values of plaque and



**Figure 1. PI, GI, PD, CAL values for the whole lot of study according to the time of evaluation**



**Figure 2. Plaque index values (PI) for groups included in the study depending on the time of evaluation**



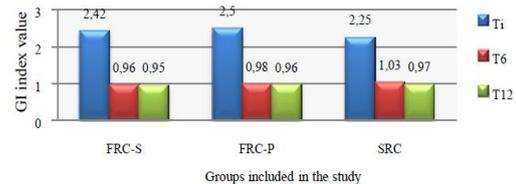
**Figure 4. PD values for groups included in the study depending on the time of evaluation**

hygiene indices for each group are presented and compared, reported to evaluation time. Higher values are observed in SRC group compared to the FRC-S, FRC-P groups at T6 and T12.

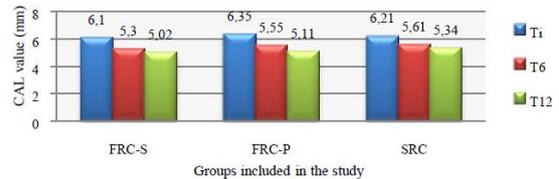
In figures 4 and 5 the values of probe depth and of total attachment loss are comparatively presented. It can be noticed a decrease of values between T0-T6, followed by a slight reduction between T6-T12.

Analysing the value of dental mobility on groups, there is a significant reduction in all three groups between T0 and T6. Between T6-T12 there are no significant differences, the values being approximately equal. There were observed lower values in FRC-S group, which suggests the more rigid character of material compared to the other two groups (Fig. 6).

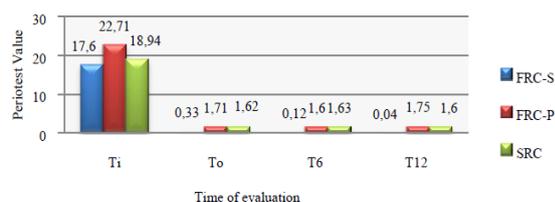
In figure 7 Periotest values of the entire study group are comparatively presented, depending on the type of teeth included in the splint. At T0 the central incisor presented the highest mobility followed by lateral incisor and then by canine. After applying periodontal splints, the values were balanced, without recording significant differences.



**Figure 3. Gingival index values (GI) for groups included in the study depending on the time of evaluation**



**Figure 5. CAL values for groups included in the study depending on the time of evaluation**

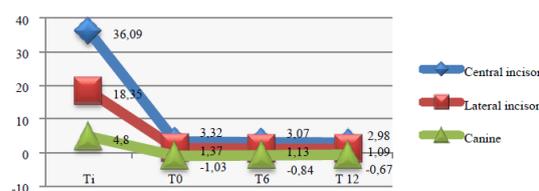


**Figure 6. Average values of dental mobility depending on splint type and the time of evaluation**

In terms of the integrity of periodontal splints, three cases that needed repair interventions were observed: two in SRC group (adhesive defect occurred between the wire-composite and dental surface), one in group FRC-S (composite fracture without clinical exposure of the fibre).

The recordings of the periodontal clinical parameters underline the severity and extension of periodontal damage. Analysing the influence of splinting on the hygiene and periodontal indices, a significant reduction of PI (from 2.19 to 0.97) and GI (from 2.39 to 0.99) between the initial moment and the six months evaluation after splint application was noticed. During the 6 - 12 months period there has been a stabilization of these parameters. There were observed higher values of GI and PI in the SRC group, at 6 and 12 months, although initial values of these indices were lower, the differences were not significant between the three groups. Xu et al. reviewed periodontal indices on 104 teeth for 6 months, on two groups of patients: with wire-composite splint and with FRC splint. They indicated values of SBI and PI indices greater in the group with wire splint compared to FRC splint [9]. So, we can formulate the hypothesis that wire and composite splint could favour more plaque retention compared with FRC splint.

Tokajuk et al., in a study made on 56 patients with chronic periodontitis, reviewed the dental-periodontal status in case of intracoronal glass fibre composite reinforced splints (Fibre-Kor and Flow-It), both anterior



**Figure 7. Average values of Periosteal dental mobility depending on the tooth and the time of evaluation, for all three groups**

and posterior, being included in the splint teeth with II-III mobility degree. Following for 10 months after periodontal splinting, the authors noticed a decrease by half of plaque indices, from 2.62 to 1.61 and a decrease of GI from 2.93 to 0.98 [6]. In another study is reported the same decrease of PI value between initial situation and the 6-month evaluation and a stabilization at 12 months [10]. Valya et al. in a study on 18 patients evaluated periodontal parameters of the mobile teeth with periodontal splinting compared to mobile teeth without periodontal splinting. The authors observed no statistically significant differences in terms of plaque index and of gingival index at 1 year and 2 years after completion of periodontal treatment. It was concluded that intracoronal splinting did not interfere with the means of individual and professional oral hygiene [11].

In this study, the PD and CAL values decreased at 6 and 12 months, resulting a lower average with 0.73 mm for PD and with 0.93 mm for CAL. These results are consistent with those reported by other authors. Tokajuk et al. registered a decrease in the depth of periodontal pockets with 0.58 mm after 10 months from the periodontal splinting [6]. Xu et al. reviewed periodontal indices on 104 teeth for 6 months, on two groups of patients: with wire splinting and with FRC splinting. The authors observed in both groups a statistically significant decrease of PD and CAL [9]. Condor compared the effects of different types of splinting on treatment outcomes on 150 single root teeth

with chronic periodontitis. Teeth splinting was performed by using three methods: acrylic fixed partial dentures, composite splints reinforced with fiber glass or polyethylene, or brackets. The study revealed a correlation between the depth of periodontal pocket and the stage of inflammation, both before and after treatment. For the three groups of study it was observed an improvement of epithelial reattachment with an average of 0.9-1.03 mm. For all three groups were obtained final averages probing depths that can qualify for the monitoring and maintenance phases [12]. Akcali et al. observed no significant differences regarding GR, PD, and CAL between the FRC groups and wire-composite groups, at different period of time [10]. A study by Wu, Zhong quantified PI, GI and PD in patients who present absence of 2 frontal inferior teeth and who received periodontal FRC splint associated with replacing missing teeth. The evaluation was made at 1, 6, 12 and 24 months after treatment. The authors concluded that there were no statistically significant differences for PI and GI at different time intervals. PD decreased significantly after 6 months. Patient's satisfaction regarding aesthetics, functionality and comfort was greater than 80% [13]. One study by Kumbuloglu et al., evaluated the performances of composite reinforced with unidirectional glass fibre splints over a period of 4.5 years. The study included 19 patients who received periodontal splinting on sextant 5. Between 6 and 18 months was observed a reduction of probing depth of 1.2 mm. At the end of evaluation time was noticed a reduction of 3.6 mm of probing depth and of 2.6 mm of attachment loss [7]. In terms of the clinical behaviour of periodontal splints can specify that appeared fractures and delamination occurred in three patients, in total at 4 teeth: in composite/wire group at two teeth and in FRC-S group observed

composite fracture, without clinical exposure, to the same patient, at 2 teeth. Since these incidents were observed in early stages, it was possible the optimization of intraoral splints, which ensured maintaining their functionality until the end of evaluation period. In all cases the teeth in which appeared the defect had greater Periotest mobility than 45. Akcali et al. in a study conducted on 14 patients that received FRC glass and wire and composite extracoronal splints, were noted six situations with fibre defects, four in FRC application and two in wire and composite case. All splints allowed intraorally repair, but for four of them it was necessary the later removal. At the teeth with mobility greater than 40 the splints presented defects [10]. For the whole lot of the study, the clinical success rate was 80 % and functional success rate was 100 % after 12 months.

In a study by Varrela et al. on five centres were evaluated periodontal splints made of unidirectional and woven glass fibre. The study included 72 patients who had bone resorption more than 50% and required permanent immobilization. Were made intracoronal and extracoronal splints, both in anterior and posterior region of the dental arch. At 6 months from restoration, there have been one debonding and two delamination in unidirectional fiber group and at 1-year reassessment authors recorded one debonding in the same group. In the woven fiber group there was no defect. All the defects have been repaired intraoral, so the overall success rate was 94.5% and a functional success rate was 100% after one year [14]. Kumbuloglu et al. reported a clinical success rate of 94.8% and a functional success rate of 100% after 4.5 years, after completing the periodontal splinting in the mandible anterior area. The authors do not provide details on the mobility Periotest values of the teeth included in the study and uses one type of unidirectional E-

glass fibre and two types of composite [7]. Tooth mobility was evaluated using Periotest device in four stages: initial (Ti), immediately after splinting (T0), after 6 months (T6), and after 12 months (T12) after applying periodontal splints. Between Periotest values at Ti and T0 there were significant differences in each group. Subsequently, at the T6 has been a growing trend and then a stabilization at T12. There was no diagnose of decalcification or caries and no tooth required extraction. Evaluation and periodontal treatment at 6 months are key factors to achieve satisfactory results in patients with periodontal splinting [13]. Due to the low number of failures reported in the small number of patients it cannot be made a clear indication of the superiority of a particular splinting system, but could be pointed out the following observation: the elasticity of polyethylene fibers allows better tolerance of severe dental mobility compared to other systems investigated. Another aspect that needs to be analysed is the type of composite used. According to Luchian et al., highly viscous flowable composites have shown the best survival rate after 12 months, being therefore a good candidate for a first-choice material for performing direct immobilisations in periodontal treatment [15]. In this context, the junction between the composite and the dental enamel needs to be subjected to finishing and polishing techniques that allows a perfect smooth cervical surface [16, 17].

Limitations of research are related to: lack of systematization of clinical situations, restricted comparisons between different types of materials, presentation in the form of case-series, relatively short interval of monitoring.

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## CONCLUSIONS

1. Periodontal splint is a feasible therapeutic option that reduces tooth mobility, distributes the occlusal forces and ensures mastication comfort for patients with advanced periodontal disease.
2. For all three groups, there were significant differences of tooth mobility before and after periodontal splinting.
3. For the entire study group, the clinical success rate was 80% and functional success rate was 100 % after 12 months.
4. Under the terms of regular re-evaluation in maintenance phase, periodontal splinting allows a reduction in plaque index and the gingival index at 6 months after splinting, not interfering with the means of oral hygiene. It was also noticed a decrease in PD and CAL at 6 and 12 months after of the completion of periodontal splinting. The splints made of wire - composite can promote the retention of plaque compared with splints of FRC.
5. The decision to make a periodontal splint must be taken in the context of a reassessment of dental mobility after etiologic treatment. It is necessary to consider that the teeth showing tooth mobility above 45 Periotest value may interfere with the clinical success of splinting. In these situations, other therapeutic options need to be considered from the beginning.
6. Due to higher stiffness of glass compared to polyethylene fibres, their use is not indicated when there are mobility values close to the maximum limit. In the context of minor crowding, polyethylene fiber application is indicated because allows intimate adaptation to the tooth surface.

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