

THE INFLUENCE OF HIGHLY VISCOUS FLOWABLE COMPOSITE RESINS ON THE SURVIVAL RATE OF PERIODONTAL SPLINTS

Ionut LUCHIAN¹, Stefana NANU^{2*}, Ioana MARTU³, Cornelia TEODORESCU¹, Liliana PASARIN¹, Sorina SOLOMON¹, Maria-Alexandra MARTU¹, Monica TATARCIUC³, Silvia MARTU¹

¹“Grigore T. Popa” University of Medicine and Pharmacy, Iași, Romania, Faculty of Dental Medicine, Department of Periodontology;

²“Grigore T. Popa” University of Medicine and Pharmacy, Iași, Romania, Faculty of Dental Medicine, Resident;

³“Grigore T. Popa” University of Medicine and Pharmacy, Iași, Romania, Faculty of Dental Medicine, Department of Dental Technology;

Corresponding author: Stefana NANU e-mail: stefana.nanu@hotmail.com

ABSTRACT

Introduction. An immobilisation system is defined as a device made in order to stabilise mobile teeth. **Aim.** This study aims to perform a clinical assessment of the efficiency of applying dental immobilisation in the case of periodontal patients with pronounced dental mobility in the lower frontal group. **Material and Methods.** In order to carry out this study, we have selected a group of 30 patients aged 50 to 70, with an average age of 57, who have visited the “Grigore T. Popa” University of Medicine and Pharmacy, Iasi, Periodontology Clinic in the interval March 2016 - June 2017. The patients received splinting treatment through using three different composites. **Results and Discussion.** Overall, we have found a success rate of 55% of the 30 patients, individuals in which the immobilisation system was intact. For the remaining 45%, 20% had 2 disaggregated elements, 15% had one disaggregated element, 7 % had 3 disaggregated elements and 3% had a fractured immobilisation system. **Conclusions.** 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.

Keywords: *periodontal splint, fiber glass, heavy flow, tooth mobility*

Introduction

An immobilisation system is defined as a device made in order to stabilise mobile teeth [1-3]. Increased tooth mobility, clinically ascertained, is expressed in terms of amplitude of movement of the tooth's crown. It may be associated to chronic marginal periodontitis, due to which the bone support is diminished, with periodontal pockets present, to deficient oral hygiene or to occlusion trauma.

Contemporary, complex prosthodontic restorations are used in combination with periodontal splints in order to increase the predictability of the treatment and reduce the periodontal risk. [4-6]

Recent studies have shown that immobilisation systems that involve fibreglass pre-impregnated with resins have a better elasticity modulus than metal wires, are aesthetically superior, follow perfectly the contour of the teeth and bond chemically both with the teeth and with the composite material [1,7,8].

Aim This study aims to perform a clinical assessment of the efficiency of applying dental immobilisation in the case of periodontal patients with pronounced dental mobility in the lower frontal group. The method is very efficient, as underlined by numerous journal articles, which show a

high success rate as late as 4.5 years after the immobilisation was applied. Thus, extractions are postponed, together with possible costly follow-up treatments and even with the disruption of functions if treatment is delayed.

Material and methods. In order to carry out this study, we have selected a group of 30 patients aged 50 to 70, with an average age of 57, who have visited the Grigore T. Popa University of Medicine and Pharmacy Iasi Periodontology Clinic in the interval March 2016 - June 2017.

The patients were selected based on the following inclusion criteria:

- diagnosed with severe chronic marginal periodontitis
- 2nd or 3rd degree dental mobility in central and/or lateral incisors
- therapeutic compliance
- presence of a favourable occlusion
- at least two sites with a probing depth of more than 4 mm in the 5th sextant
- general favourable status.

The exclusion criteria were as follows:

- age below 18;
- refusal to sign the informed consent form;
- general diseases;
- smokers;
- non-favourable occlusion;
- absence of lower anterior teeth;
- mobility of lower canines;
- precarious hygiene;

The work algorithm for every patient was the following:

1. For the first session:

- extraoral and intraoral clinical examination,
- complete medical history,
- calculation of bacterial plaque index
- teaching correct brushing technique and encouraging its use at least twice per day,

- indicating the use of mouth rinses with targeted action,
- orthopantomography;
- ultrasonic scaling, above and below the gum using inserts of a specific design (Satelec)
- root planing;
- professional brushing;
- supragingival Air-flow;
- subgingival Air-flow using soluble glycine powders;

After scaling, we proceeded to a periodontal examination, consisting of:

- measuring the probing depth (the distance between the gum edge to the location of the tip of the periodontal probe inserted in the sulcus using a moderate probing pressure),
- measuring attachment loss (the distance from the cement-enamel joint to the base of the sulcus), bleeding during probing,
- mobility of teeth based on Miller's mobility index.

Dental mobility was assessed manually and categorised into 4 classes:

- 0 - physiological mobility;
- 1 - minimal mobility;
- 2 - mobility in the vestibular-oral direction ≤ 1 mm;
- 3 - additional mobility on the horizontal > 1 mm.

The probing depth, loss of attachment and bleeding during probing were recorded in six sites for the teeth in 5th sextant. Medium chronic periodontitis was considered present when having a loss of attachment of between 3 and 4 mm, noticed in at least 30% of the probed surfaces, in each patient. Severe periodontitis involved a loss of attachment of more than 5 mm in at least 30% of the probed surfaces.

2. For the second session:

- carrying out dental immobilisation using the Angelus Interlig system using three different types of composite materials.

Depending on the type of composite material used, the 30 patients were divided, in a randomised manner, into 3 groups:

- Group A: 10 patients for whom we used the Interlig splinting system (Angelus), together with a Heavy Flow composite, GrandioSO (VOCO), shade A2-A3.
- Group B: 10 patients for whom we used the Interlig splinting system (Angelus), together with a composite Flow, GrandioSO Flow manufactured by Voco, shade A2-A3.
- Group C: 10 patients for whom we used the Interlig splinting system (Angelus), together with a GrandioSO solid composite (Voco), shades P-A2 and P-A3.

The aim of the study was to assess the rate of survival of the immobilisation system after 12 months, checking its integrity and the need for retouching or re-application.

The study included fibreglass immobilisation systems anchored at lower frontal level and including the teeth from 3.3 to 4.3. In order to assess survival rate, we devised an integrity index for original-design immobilisation systems.

The codes used in this assessment index are the following:

- 0 – restoration intact
- 1 – one disaggregated element
- 2 – 2 disaggregated elements
- 3 – 3 disaggregated elements
- 4 – 4 disaggregated elements
- 5 – 5 disaggregated elements
- 6 – 6 disaggregated elements
- 7 – fracture of the fibreglass

Results and discussions

From the 12-month assessment we obtained the following results in the studied group, systematised according to the value of the integrity index of the splinting system (IIS). (Table 1)

Patient	A (HEAVY FLOW)	B (FLOW)	C (SOLID)
1	0	1	0
2	0	2	0
3	0	0	0
4	0	0	0
5	0	2	1
6	0	2	2
7	1	1	2
8	0	3	2
9	0	3	1
10	0	7	0

TABLE 1 – The integrity index of the immobilisation system

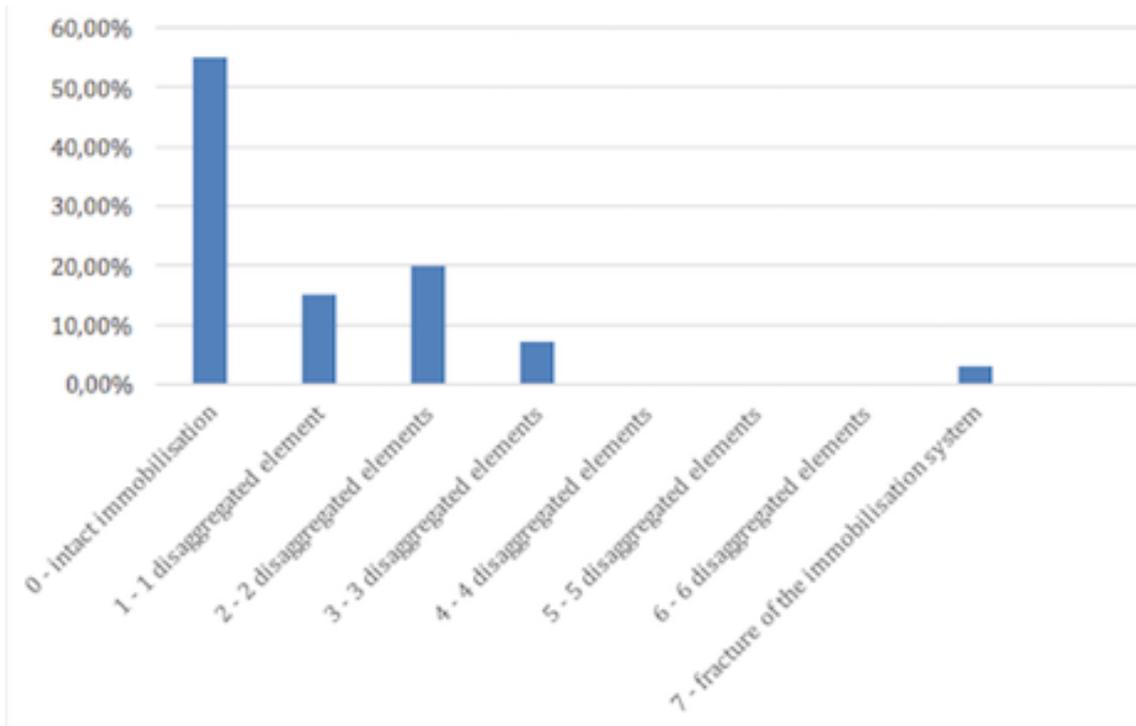


TABLE 2 - Percentage representation

Overall, we have found a success rate of 55% of the 30 patients, individuals in which the immobilisation system was intact. For the remaining 45%, 20% had 2 disaggregated

elements, 15% had one disaggregated element, 7 % had 3 disaggregated elements and 3% had a fractured immobilisation system. (Table 2)

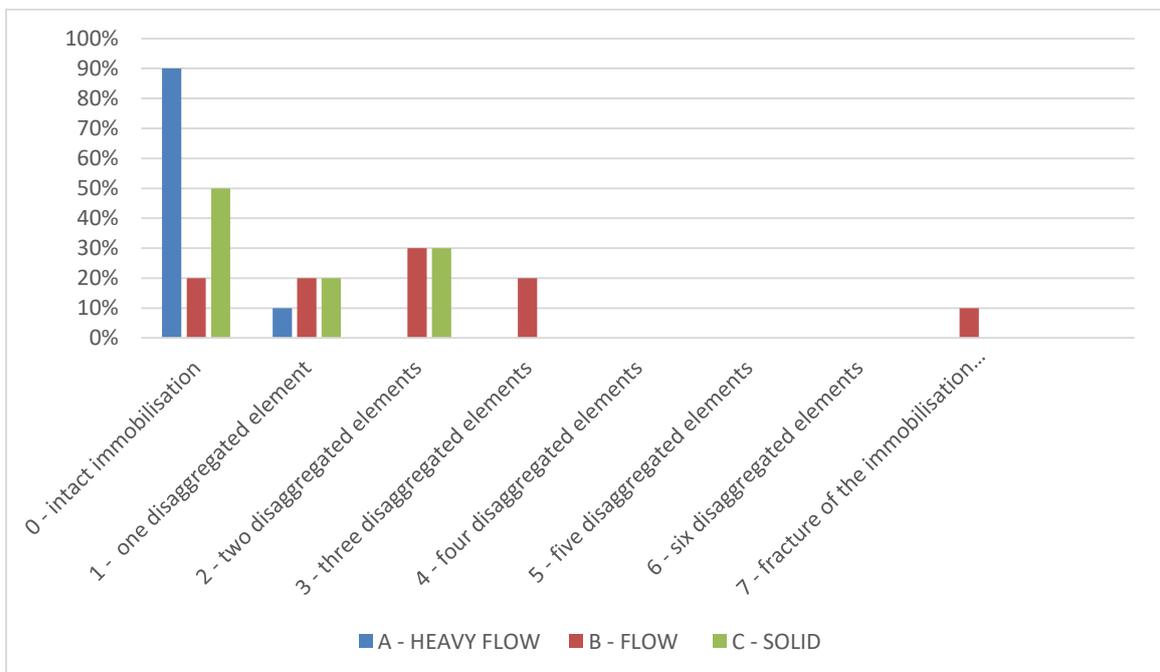


TABLE 3 – Percentage representation of each individual group

According to this table, in the case of 9 patients in group A, in which we used the composite material GrandioSO Heavy Flow, the integrity index had the value 0, meaning an immobilisation that is still intact after 12 months; in one patient, the integrity index had the value 1, meaning one disaggregated element.

In the case of group B, for which we used the composite material GrandioSO Flow, 2 patients had index 0, therefore we had a success rate of 20%, 2 patients had index 1, meaning 20%, 3 patients had index 2, meaning 30%, 2 patients had index 3,



Fig. 1 – Clinical aspect during the splinting procedure

The failure of immobilisation may be partial or total. Partial failure is defined as the loss of attachment in one or several teeth, while total failure is defined as the complete detachment of the device from the teeth. From a clinical perspective, complete disaggregation is preferable to partial failure, as the latter may go unnoticed by the patient and may result in clinical failure.

The partial failure rate is significantly higher when the Flow GrandioSO composite is used, 7 patients out of 10 undergoing partial failure of one, two or three elements significantly higher than in the case of the patients in group C, in which only 5 patients had partial failure of one or two elements.

The complete fracture of the fibreglass occurred in just one case out of 30, in the case of a patient in group B. This phenomenon

meaning 20% and in just one patient we found the fibreglass had been fractured.

In the case of group C, for which we used the GrandioSO solid composite material, the success rate was 50%, meaning 5 immobilisations still intact after 12 months, and 2 patients had one disaggregated element, while the remaining 3 had 2 disaggregated elements. (Table 3)

The highest success rate was achieved in this case in the patients in group A, for which we used the composite material Heavy Flow GrandioSO, followed by the solid composite GrandioSO. (Fig. 1-2)



Fig. 2 – Clinical aspect post splinting procedure

occurred, most likely, due to occlusion instability. The required occlusion adjustments were carried out, the patient was instructed again on the required hygiene procedures, and the immobilisation system was reattached under the protection of a dental dam.

Tokajuk et al. reported that fibreglass reinforced with composite resin is an appropriate means for treating mobile teeth, particularly in those cases in which the patient's discomfort is a dominant factor, due to its features: easy handling, patient comfort, resistance to fracture, biocompatibility and aesthetic acceptability. [9,10] In dentistry literature, the studies carried out using FRC consist mainly of case reports. [11] Kumbuloglu et al. report that fibreglass has a success of up to 4.5 years, at a rate of 94.8%. [1] This study has also evaluated other parameters, such as the depth of periodontal

pockets, epithelial attachment and the patient's plaque index. Concerning clinical follow-up, it was concluded that the splint materials contributed to periodontal healing.[2]

Since the objective of our study was to assess the strength of only three materials, data such as the level of bone, mobility or gingival index were not assessed in it.

The success of the periodontal therapy was assessed by other others using the identification of inflammatory markers and bacteria associated with periodontal disease. [12-16] Although advanced therapies are available in association with splinting, it is mandatory to be ethical regarding the periodontal prognosis of the teeth we want to treat. [17-19]

As in closed flap surgery of the impacted teeth, the clinician should give particular care to the bonding procedure as well in order to reduce the risk of debonding due to a technical error. [20]

Wu et. al. reported that placing the composite under the material in the achievement improved the resistance of the fibres. One of the important aspects that have to be considered is the fact that the resin surface is prone to wear over time. In particular, the low amount of inorganic resins in the composite resin would result in a material that is abrasion resistant. Our study used three different composites, but the same bonding agent and the same type of fibreglass. [2, 3, 21]

Since the fracture has always occurred

in the attaching device rather than in the composite-support interface, FRC materials should always be covered entirely in composite material. These results have shown that neither the composite, nor the fibreglass, but instead the silanization of fibreglass is the critical component for the failure of the FRC structure.

Nevertheless, selecting the type of immobilisation and of fibre appropriate for each procedure is done based on advantages, disadvantages and knowledge about each of them. An ideal immobilisation system must be designed in such a manner as to attract the least possible amount of bacterial plaque and tartar, to be able to remain in place in the long term, to be able to fulfil its functions, and not to interfere with either healing or aesthetics.

Conclusions

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.

The tested solid composites have had an acceptable survival rate, the failures occurring in the study being, most likely, the consequence of a more difficult handling in the lingual area and excessive polishing.

It appears that the use of classic flowable composites for direct periodontal splintings with fibreglass fibres is recommended to be avoided, since their mechanical strength is insufficient for the stress they are subjected to.

REFERENCES

1. Kumbuloglu O, Saracoglu A, Mutlu O. Pilot study of unidirectional E-glass fibre-reinforced composite resin splints: Up to 4.5-year clinical follow-up. *J of Dentistry* 2011; 4(11):134-78.
2. Vieriu RM, Tanculescu O, Mocanu F, Doloca A., Martu S.A Comparative Study of Mechanical Properties of Different Types of Fiber Reinforced Composites Used in Periodontal Therapy. *Materiale Plastice*, 2015; 52 (2): 266-271
3. Tanculescu, Oana; Doloca, Adrian; Vieriu, Raluca-Maria; et al. Physical and Mechanical Characterization of Different Fiberreinforced Composite Systems Used in Fixed Prosthesis. *Rev. Chim. (Bucharest)*, 2016; 67(1): 96-102
4. Martu I, Luchian I, Diaconu-Popa D, Doscas AR, Bosanceanu DG, Vitalariu A, Luca O, Tatarciuc M. Clinical and technological particularities regarding unidental restoration using ceramic crowns with a zirconia infrastructure. *Rom J Oral Rehab* 2017; 9(1):27-31.

5. Bosinceanu DG, Bosinceanu DN, Luchian I, Baciu R, Tatarciuc M, Martu I, Complete dentures - Clinical behavior and patients complaints. Rom. J. Oral Rehab., 2017; 9(2):5-8.
6. Solomon SM, Iovan G, Pasarin L, Sufaru IG, Martu I, Luchian I, Martu MA, Martu S. Risk Predictors in Periodontal Disease. Rom J Oral Rehab 2017; 9(3):89-96.
7. Antohe ME, Forna DA, Andronache M, Feier R, Forna NC. Aspects of the therapy of partially extended edentation using modern methods - attachments as maintenance, support and stabilization. Rom. J. Oral Rehab., 2016; 8(2):16-25.
8. Diaconu D, Tatarciuc M, Vitalariu Anca, Stamatin O, Foia L, Checherita L. Researches on the Influence of the Resin Cements Micro-leakage to the Resistance of the Composite Inlays. Materiale Plastice 2014; 51(3): 271-274.
9. Tokajuk G, Pawińska M, Stokowska W. The clinical assessment of mobile teeth stabilization with Fibre-Kor. Advanced Medical Sciences 2006; 51(1): 225-226.
10. Barlean L, Coman M, Bobu L, Aungurencei O, Baciu D, Balcos C, Scutariu MM, Leata R, Comparative Evaluation of a Glassionomer Cement and a Resin Composite Used as Dental Sealants. Materiale Plastice 2015; 52(4): 542-545.
11. Puri MS, Singh Grover H, Gupta A, Puri N, Luthra S. Splinting – A Healing Touch for an Ailing Periodontium. J Oral Health Comm Dent 2012; 6(3)145-148.
12. Martu I, Goriuc A, Martu MA, Vata I, Baciu R, Mocanu R, Surdu AE, Popa C, Luchian I. Identification of Bacteria Involved in Periodontal Disease Using Molecular Biology Techniques. Rev Chim (Bucharest) 2017; 68(10):2407-12.
13. Luchian I, Martu I, Martu C, Goriuc A, Beldiman A, Martu S. Changes in Biochemical Parameters Associated with Periodontal Disease. Rev. Chimie, 2016; 67(6): 1073-1075.
14. Luchian, I., Martu, I., Ioanid, N., Goriuc, A., Vata, I., Hurjui, L., Martu-Stefanache, A., Tatarciuc, M., Matei, M.N., Martu, S. Salivary IL-1 β : A Biochemical Marker that Predicts Periodontal Disease in Orthodontic Treatment. Rev. Chimie, 2016; 67(12): 2479-2483.
15. Sufaru IG, Solomon SM, Pasarin L, Martu-Stefanache MA, Oanta AC, Martu I, Ciocan-Pendefunda A, Martu S, Study regarding the quantification of RANKL levels in patients with chronic periodontitis and osteoporosis. Rom. J. Oral Rehab.; 2016; 8(4):42-46.
16. Ursarescu IG, Martu-Stefanache MA, Solomon SM, Pasarin L, Boatca RM, Caruntu ID, Martu S. The Assessment of IL-6 and Rankl in the Association Between Chronic Periodontitis and Osteoporosis Rev. Chimie, 2016; 67(2): 386-389.
17. Solomon S, Pasarin L, Ursarescu I, Martu I., Bogdan M., Nicolaiciuc O., Ioanid N., Martu S. The effect of non-surgical therapy on C reactive protein and IL-6 serum levels in patients with periodontal disease and atherosclerosis. Int. J. Clin. Exp. Med., 2016; 9(2):4411-4417.
18. Nicolae V, Chiscop I, Cioranu Ibric VS, Martu MA, Luchian AI, Martu S, Solomon SM, The Use of Photoactivated Blue-O Toluidine for Periimplantitis Treatment in Patients with Periodontal Disease. Rev Chim (Bucharest) 2015; 66(12):2121-2123.
19. Luchian I, Vata I, Martu I, Tatarciuc M, Pendefunda V, Martu S. Challenges in Ortho-Perio and General Dentistry Interrelationship. Limits and Perspectives. Rom J of Oral Rehab, 2016; 8(1):80-83.
20. Becker A, Zogakis I, Luchian I, Chaushu S. Surgical exposure of impacted canines: Open or closed surgery?. Semin Orthod 2016; 22(1):27-33.
21. Wu XY, Zhong Q. Evaluation of fiber reinforcement composites in restoring lower dentition defect and fixing loose teeth for chronic periodontitis. Shanghai Kou Qiang Yi Xue 2014; 23(2): 204-208.