



Extracoronar Splinting with Fiber-Reinforced Composites in Periodontitis Patient with Hypertension

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ABSTRACT

Background: One of the most common periodontal diseases is periodontitis. Periodontitis is a disease of periodontal tissue damage caused by the accumulation of microorganisms in the subgingival plaque that can cause periodontal pockets, loss of attachment, bleeding in the gingiva, and tooth mobility. Splinting can stabilize mobility teeth in periodontitis.

Objective: this case report aims to discuss the treatment of extracoronar splinting, with fiber-reinforced composites in patients with chronic periodontitis accompanied by tooth mobility.

Case: A 60-year-old man complained of dirty and rough teeth 1 year ago. Complaints are painless and never treated. The patient has a history of hypertension and daily smoking habits. After scaling and root planning treatment, grade 1 tooth mobility occurs in teeth 31, 41, and 42. One week later, an examination was carried out but showed no improvement, so splint treatment with fiber-reinforced composites was carried out on teeth 33 to 43. One week after the splinting treatment, an examination was carried out and the result was no tooth mobility in teeth 31, 41, and 42.

Discussion: Splinting with fiber-reinforced composites has been shown to improve tooth stability is non-corrosive, easy to apply, requires low to medium cost, and has high aesthetics. Composite fiber materials have advantageous physical properties as they increase the flexural strength of composite resins.

Conclusion: splint treatment with fiber-reinforced composites successfully stabilized tooth mobility in teeth 31, 41, and 42.

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INTRODUCTION

Periodontal disease is an inflammatory disease in the tissues around the teeth that begins with gingival inflammation and continues to damage to other dental support tissue structures such as cementum, periodontal tissue, and alveolar bones. Plaque, calculus accumulation, and bacteria are the main causes of periodontal disease.¹ Gingivitis and periodontitis are frequent periodontal diseases. Periodontitis is one of the public health problems globally that is estimated to affect 10%- 15% of the world's population. Based on data from the 2018 Basic Health Research (RISKESDAS), the percentage of periodontitis cases in Indonesia is 74,1%.²

Chronic periodontitis is damage to periodontal tissue with slow progressivity accompanied by inflammation of periodontal tissue caused by specific microorganisms.³ Chronic periodontitis can be caused by both local and systemic factors. Local factors can be in the form of plaque accumulation on the surface of the teeth that contain a collection of bacteria such as *Actinobacillus actinomycetemcomitans*, *Porphyromonas gingivalis*, *Tannarella forsythia*, *Prevotella intermedia* and *Fusobacterium nucleatum*. Systemic factors can be caused by hormonal changes, stress, and systemic diseases.⁴ Hypertension is one of the systemic diseases that can affect the occurrence of chronic periodontitis.⁵ Another factor that can aggravate the occurrence of chronic periodontitis is the habit of smoking.⁶

Hypertension is one of the most commonly encountered cardiovascular diseases which is a condition where systolic blood pressure is ≥ 140 mmHg and or diastolic blood pressure is ≥ 90 mmHg.⁷ Hypertension can cause microcirculatory dysfunction in periodontal tissue so that it can result in abnormalities in periodontal tissue.⁵ The manifestation of the oral cavity that often occurs in hypertensive patients is the presence of gingival swelling caused by consuming anti-hypertensive drugs, namely calcium channel blocker drugs.⁸

Smoking can worsen chronic periodontitis because exposure to smoke from tobacco can alter the oral microbiota which has an important role in protecting the oral cavity from disease development.⁹ Smoking habits cause changes vascularization and salivary secretion due to heat generated by cigarette smoke. Changes in vascularization due to smoking cause dilatation of capillary blood vessels and infiltration of inflammatory agents so that enlargement of the gingiva can occur. The tar contained in cigarettes can settle on the teeth and cause the surface of the teeth to become rough so that plaque and bacteria can easily adhere. Chronic invasion of plaque bacteria below the gingival margin can lead to the occurrence of periodontitis.¹⁰

Chronic periodontitis is characterized by damage to the periodontal ligaments, alveolar bones, and tooth mobility.³ Tooth mobility is a complaint that is often experienced by people with periodontal disease.¹¹ Tooth wobble can be caused by inflammation of periodontal tissue, loss of clinical attachment, dilation of the periodontal ligament due to dental parafunction, traumatic primary and secondary occlusion, and damage to the alveolar bones.³ The presence of inflammation caused by plaque accumulation and trauma due to occlusion is the most common factor that causes tooth mobility.¹¹ According to Miller, tooth mobility is classified into 3 degrees. Degree 1 is the mobility of the teeth slightly larger than normal. Degree 2 is a mobility of about 1 mm, and degree 3 is a mobility of more than 1 mm in all directions and/or the teeth can be pressed in the apical direction.¹² One of the treatments to control and stabilize tooth mobility is splinting.¹³

Splinting is a tool used to maintain or stabilize tooth mobility in their functional and physiological position. The main purpose of periodontal splinting are periodontal healing, reducing tooth mobility, repositioning teeth, obtaining the comfort of mastication for the patient, and to ensure optimal occlusion and functionality.¹⁴ The main indication of the use of splinting in controlling tooth mobility is the immobilization of the mobility that causes discomfort to the patient and stabilizes the tooth at an increasing level of mobility.¹¹ There are various types of splinting including composite resin, orthodontic wire, wire-composite, fiber-reinforced composite, nylon fishing line-composite, and polyethylene.³

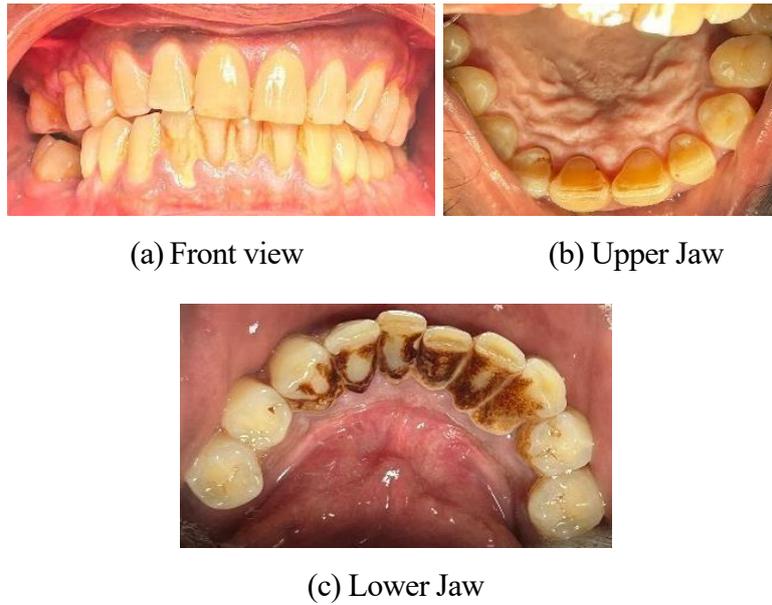
Splinting with fiber-reinforced composite resin can be done with 2 techniques, namely extracoronal and intracoronal. Technique extracoronal splinting is carried out by placing fiber-reinforced composite resin directly without dental preparation, while the intracoronal splinting technique requires a horizontal preparation with a width of 2-3 mm and a depth of 1-2 mm.¹¹ Fiber-reinforced composite is a mixture of polymer matrix and reinforced by fiber. The main purpose of using fiber-reinforced composite is to obtain high strength with a high modulus of elasticity. The composition of fiber-reinforced composite includes fiber and matrix resin which functions as reinforcement and provides stability and rigidity. Protective part matrix resin, producing strength and workability of the material.¹⁵ The advantages of splinting using fiber-reinforced composite resin are that it is easy to apply with minimal dental preparation, the cost required is relatively low to medium, it is easy to remove when it is no longer needed, it is easy to repair if there is a mistake, it has a high aesthetic value, and it is easy to clean by the patient at home.¹⁶ The use of fiber-reinforced composite can prevent plaque retention on the splinting material so can preventing recurrent periodontitis and

preventing delays in periodontal tissue healing because oral and dental hygiene can be maintained.¹⁷

Extracoronar splinting has long been used as a treatment for chronic periodontitis accompanied by tooth mobility to improve tooth stability. However, most previous studies have focused on the mechanical aspects of splinting, such as reducing tooth mobility and masticatory comfort, without comprehensively evaluating the influence of systemic risk factors on treatment success. The literature on extracoronar splinting in chronic periodontitis patients with systemic risk factors such as hypertension and smoking remains very limited. This gap indicates the need for further research to more comprehensively evaluate the effectiveness of extracoronar splinting in chronic periodontitis patients with systemic risks such as hypertension and smoking.

CASE REPORT

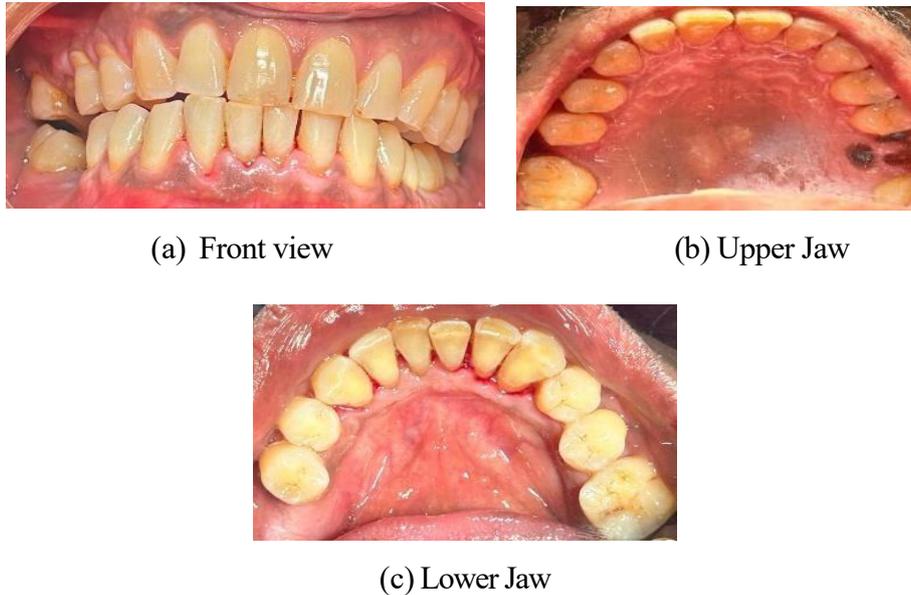
A 60-year-old male patient came to the Soelastrri Dental and Oral Hospital of the University of Muhammadiyah Surakarta with complaints of dirty and rough teeth, mobility teeth and difficulty eating. The patient felt these complaints since 1 year ago. The complaints are not accompanied by pain and the patient has never done treatment related to the complaints felt. The patient admitted that he had never been hospitalized, had no allergies to drugs, weather, temperature, and food and the patient admitted to having a history of hypertension and routinely consuming amlodipine 5 mg for 2 years. The patient admitted that he had come to the dentist for a tooth filling. The patient's father and mother had no history of systemic disease and had never been to the dentist. The patient admitted that he had a habit of brushing his teeth 2 times a day, smoking 10 cigarettes per day, and consuming tea every day. The general impression of patients when coming to Soelastrri Dental and Oral Hospital is physically healthy and mentally communicative and cooperative. Blood pressure checks of 140/89 mmHg and extra oral examinations found no abnormalities. Intraoral examination found plaque and calculus on the teeth of the upper jaw and lower jaw. The OHI score was 4 (moderate), plaque index was 63%, gingival index 0.38 (mild gingivitis), and BOP (bleeding on probing) was positive with the probing depth of mesial-midlabial-distal tooth 31 being 3 mm-2 mm- 2 mm, the probing depth of mesial-midlabial-distal tooth 41 was 3 mm-2 mm-3 mm, and the probing depth of mesial-midlabial-distal tooth 42 was 3 mm-5 mm- 2 mm.



Picture 1. The teeth before initial therapy.

Based on the results of the examination, the diagnosis was obtained, namely generalized chronic periodontitis stage 1 grade B et causa plaque and calculus accompanied by 1st degree mobility, class 1 miller recession, secondary traumatic occlusion aggravated by hypertension and smoking. During the first visit, the patient is given communication, information, and education to carry out initial therapy treatments, namely scaling and root planning with the aim of cleaning tartar on the surface of the patient's teeth. The communication conveyed about the diagnosis in the form of chronic periodontitis generalized stage 1 grade B et causa plaque and calculus accompanied by 1st degree mobility, class 1 miller recession, traumatic secondary occlusion aggravated by hypertension and smoking and conveyed the treatment that would be given, namely scaling and root planning with ultrasonic scaler. The information provided to the patient, namely scaling and root planning, can cause teeth to feel sluggish and bleeding in the oral cavity due to the process of taking calculus in the supragingival and subgingival. Secondary traumatic occlusion can be treated with occlusal adjustment which aims to eliminate premature contact, distribute mastication forces, reduce tooth mobility, and support the success of periodontal treatment. Education conveys to patients that calculus that is not cleaned can have a more severe impact and cause bad breath, so patients must maintain dental and oral hygiene by brushing their teeth with the modified Stillmann technique on teeth that are in recession and in other teeth using modified bass techniques, checking the health of teeth and mouth regularly, and reducing smoking. Scaling and root planning are carried out using an ultrasonic scaler. Post-action scaling and root

planning are polished on the surface of the teeth with a mixture of paste and pumice using a brush.



Picture 2. Clinical tooth after treatment scaling and root planning

The second visit was 1 week after the evaluation of scaling and root planning treatment. The results of the objective examination showed that there was a 1st degree mobility in teeth 31, 41, and 42. Based on the results of the evaluation, the patient was indicated to get treatment extra coronal splinting treatment using fiber-reinforced composite material applied to teeth 33 to 43.

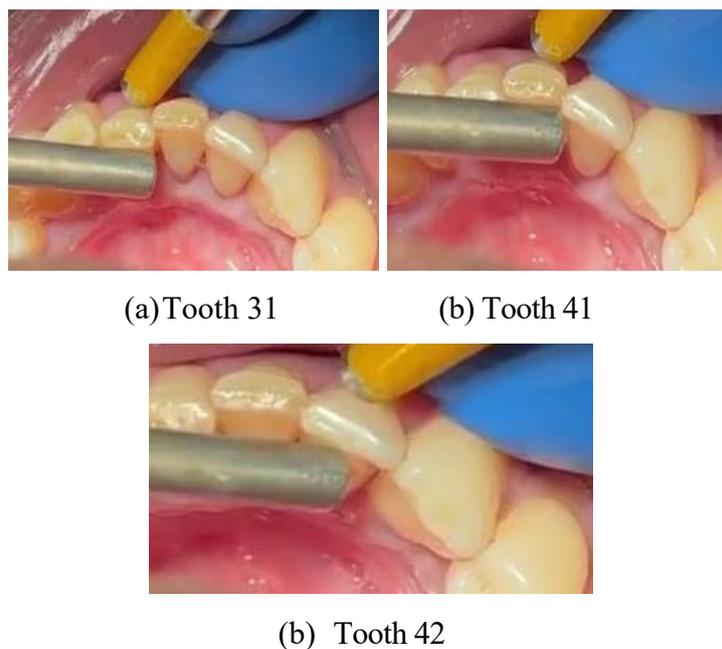


Figure 3. Dental mobility checks

Maintenance begins with preparing tools and materials in advance. Next, the length of work is measured using dental floss on teeth 33 to 43, then cut according to the length of work using scissors (Figure 4a). Adjust the length of the fiber-reinforced composite with dental floss, then apply the bonding to the fiber-reinforced composite on top of the glass plate (Figure 4b).

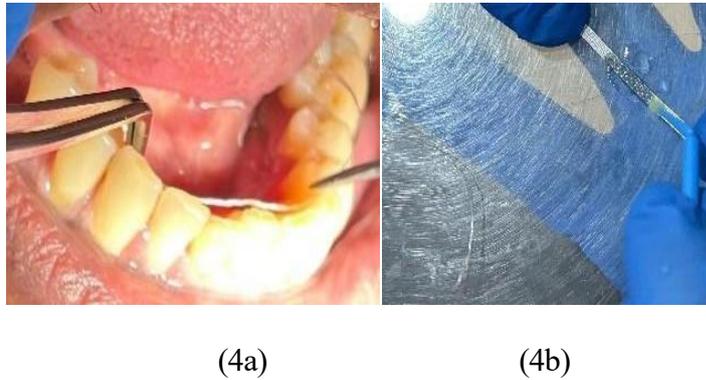


Figure 4. 4a) Measurement of working length using dental floss, 4b) Bonding application on fiber-reinforced composite

Next, phosphoric acid etching is applied to the lingual surface of teeth 33 to 43 (Figure 5a) then rinse and dry (Figure 5b). Apply bonding to the lingual surface of teeth 33 to 43 (Figure 5c) then irradiate with light cure for 20 seconds (Figure 5d).

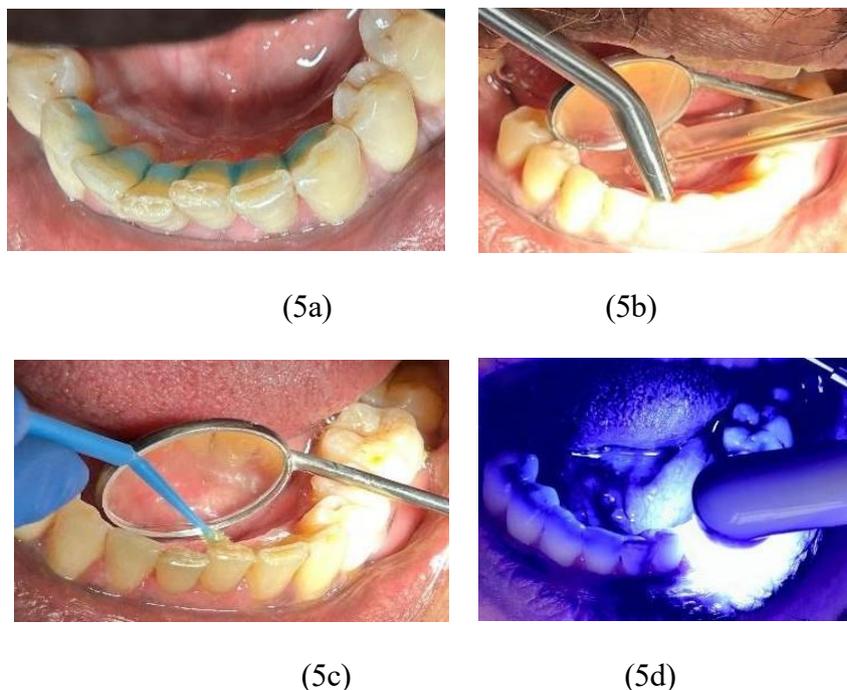


Figure 5. 5a) Etching application, 5b) Rinsing and drying after etching application, 5c) Bonding application, 5d) Irradiation for 20 seconds

Next, the application of flowable composite was carried out on the lingual teeth 33 to 43 (Figure 6a) followed by placing fiber-reinforced composite on it using a plastic instrument, then pressed until the fiber-reinforced composite was completely attached (Figure 6b). Irradiate with light cure for 20 seconds (Figure 6c).

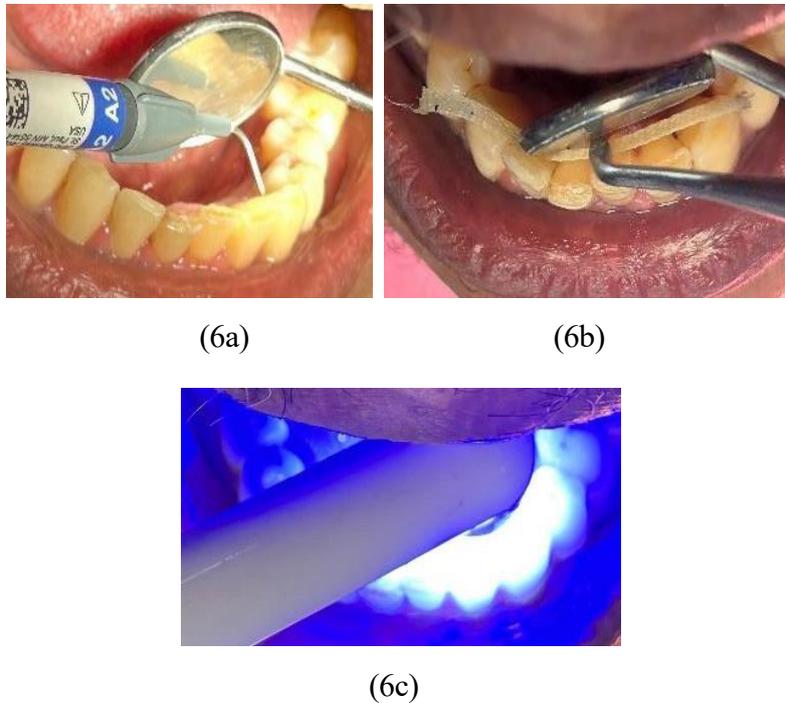


Figure 6. 6a) Flowable composite application, 6b) Fiber-reinforced composite application, 6c) Irradiation for 20 seconds

After the fiber-reinforced composite is properly installed on the lingual teeth 33 to 43, it is followed by finishing and polishing using enhance bur (Figure 7a) then occlusion check is carried out using articulating paper (Figure 7b).

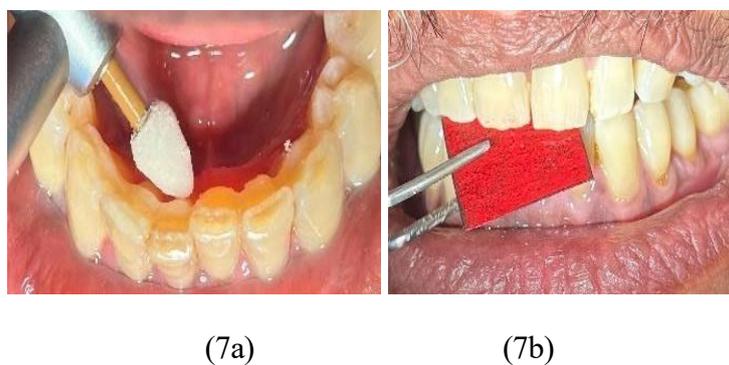


Figure 7. 7a) Finishing and polishing, 7b) Occlusion check

Furthermore, patients were instructed to maintain their teeth and mouth hygiene and instructed to come back 1 week after treatment to carry out control. One week after treatment,

from the results of the subjective examination, the patient felt comfortable and undisturbed. The results of the objective examination showed that there was no tooth mobility in teeth 31, 41, and 42 and the fiber-reinforced composite splinting was still perfectly attached to teeth 33 to 43 (Figure 8). This shows that the fiber-reinforced composite splinting treatment can be said to be successful in stabilizing tooth wobble in teeth 31, 41, and 42.



Figure 8. Clinical picture 1-week post-treatment extracoronal splinting *fiber-reinforced composite*

DISCUSSION

Periodontitis is one of the periodontal diseases that causes permanent periodontal tissue damage characterized by chronic inflammation, epithelial migration, loss of connective tissue, and loss of alveolar bones. Periodontitis is divided into two, namely chronic periodontitis and aggressive periodontitis. Chronic periodontitis is associated with the accumulation of plaque and calculus that generally develops slowly, periods of rapid destruction, and horizontal bone loss.¹⁸ Pathological migration that causes diastema, teeth mobility, and tooth loss is a common condition in people with periodontitis.¹⁹ Untreated periodontitis can lead to bacteremia that increases mortality from systemic diseases such as diabetes mellitus, cardiovascular disease, hypertension, lung disease, stroke, kidney disease, and stress.²⁰

The characteristics of the pathogenesis of periodontal disease are characterized by a complex relationship between immune responses Host and microorganisms in plaque. Plaque is a major etiological factor in the pathogenesis of periodontal disease.²¹ Plaque is a structured, yellow, soft substance that adheres to the surface of the tooth. Plaque contains many different types of microorganisms, especially bacteria. Plaques containing pathogenic microorganisms can worsen periodontal infections. Increased number of bacteria on plaque such as *Porphyromonas gingivalis*, *Tannerella forsythia*, *Treponema denticola*, and *Actinobacillus actinomycetemcomitans* can initiate periodontal infections. Risk factors for

periodontal disease include hormones, stress, smoking, and systemic diseases such as diabetes mellitus and hypertension.²

Hypertension is the most common chronic disease.⁵ Hypertension is a condition of chronic increased blood pressure which can increase the risk of cardiovascular disease, stroke, and other complications. According to WHO, blood pressure is considered high if it reaches $\geq 140/90$ mmHg.⁷ Hypertension can cause oral manifestations, namely periodontal disease. This condition is usually encountered in patients who are undergoing antihypertensive treatment with calcium channel blockers. This is in line with research conducted by Dewi et al (2023) which states that most hypertensive patients have manifestations of periodontitis.²² Research conducted by Fatimah et al (2025) also states that there is a significant relationship between hypertension and periodontal disease.²³ Hypertension can cause microcirculatory dysfunction in the periodontal tissue, which can lead to abnormalities in the periodontal tissue.⁵

Smoking has a great influence on the occurrence of periodontal disease. Smoking causes disorders. Periodontal health is achieved through three pathways, namely microcirculation and the immune system, connective tissue, and bone metabolism. Smoking can also affect the function of neutrophils which are the main source of the metalloproteinase-8 matrix (MMP-8). MMP-8 is a key biomarker in chronic periodontitis, the higher the amount, the higher the severity of periodontal inflammation.⁹ This is in line with research conducted by Fansurna (2023) which states that there is an influence between smoking behavior on the incidence of periodontal disease.²⁴ Another study conducted by Wulandari et al. (2017) also stated that there is a significant relationship between smoking habits and the severity of periodontitis.²⁵ The ingredients contained in cigarettes can affect the inflammatory response of gingiva. At the time of smoking, tar enters the oral cavity in the form of vapor which will then become solid and settle after cooling. Tar deposits on the tooth surface cause the tooth surface to become rough, making plaque accumulation more precise.²⁶ The nicotine found in cigarettes causes the release of adrenaline and noradrenalin. So it causes vasoconstriction that inhibits the delivery of nutrients to periodontal tissue, decreases antibody responses, and inhibits neutrophil function.²⁵

Chronic periodontitis is characterized by damage to the periodontal ligaments, alveolar bones, and teeth mobility.³ Tooth mobility is one of the periodontal diseases caused by damage to the bones that support the teeth, occlusion trauma, and expansion of inflammation from the gingiva to the deeper supporting tissues.¹¹ According to Miller, tooth mobility is classified

into three degrees. Degree 1 is the tooth yaw slightly larger than normal, degree 2 is the yaw of about 1 mm, and degree 3 is the tooth yaw of more than 1 mm in any direction and/or the tooth can be pressed in the apical direction. One way to control and stabilize tooth mobility is to perform splint treatment.¹³

According to the American Academic of Periodontology (AAP), splinting is a tool or device used to prevent movement or displacement of moving or injured parts to evenly distribute occlusal pressure.¹¹ The main indication of splint treatment in controlling mobility is the immobilization which causes the patient's discomfort and stabilizes the teeth.²⁷ Contraindications for splint treatment are moderate to severe mobility teeth with inflammation or trauma due to primary/secondary occlusion, insufficient number of healthy teeth supporting mobility teeth, patients not maintaining oral hygiene, and occlusal adjustments have not been made in teeth with previous occlusal disorders and trauma. The purpose of splinting is to provide rest (support) to the periodontal tissue, aid in repair from trauma, reduce mobility quickly, and prevent tooth migration.¹¹ In accordance with the treatment carried out in this case that splint treatment can stabilize the mobility teeth. This is in line with research conducted by Hardhani (2022) which states that splinting treatment succeeds in stabilizing teeth mobility.³ Another study conducted by Maizar and Suprianto (2018) states that splinting is a treatment that can be done to stabilize teeth that experience mobility due to periodontal problems.¹⁶ The treatment of chronic periodontitis in patients with medical compromises such as hypertension, requires special attention by prioritizing the treatment of hypertension conditions first before periodontal treatment so that patients can get periodontal treatment appropriately and safely.⁷

There are different types of splints including composite resins, orthodontic wires, wire composites, nylon fishing line composites, polyethylene, and fiber-reinforced composites.³ Fiber-reinforced composite is a type of splinting that combines composite materials and polyethylene fibers. Fibers can increase the performance of composites as a stress-bearing component that can withstand stress by improving the load-bearing effect on brittle composite matrices. Fibers also act as crack-stopping so that they can increase the hardness of the material.¹⁶ Composite fiber material has advantageous physical properties because it improves the flexural strength of composite resin.²⁸ Splinting treatment using fiber-reinforced composite in this case can be said to be successful in stabilizing tooth mobility because fiber-reinforced composite has high strength which can stabilize tooth mobility. This is in line with research conducted by Ambarawati (2019) which state that managing tooth mobility with

splinting fiber-reinforced composite successfully stabilizes tooth mobility because fiber-reinforced composite has strong physical and mechanical properties.²⁹ Fiber-reinforced composites have the advantages of being easy to apply with minimal tooth preparation, relatively low to moderate costs, easy to remove if no longer needed, easy to repair if a mistake occurs, can improve tooth retention, and have high aesthetic value.^{18 11}

CONCLUSION

Treatment of tooth mobility with extracoronary splints, with fiber-reinforced composites, can be said to be successful in stabilizing tooth mobility in teeth 31, 41, and 42. The success of splinting treatment in this case can be seen from the absence of tooth mobility at control 1 week after extracoronary splinting treatment, with fiber-reinforced composites.

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