PERIODONTAL SPLINTING – AN ADJUNCT TO PERIODONTAL THERAPY

Tsvetalina Gerova-Vatsova

Department of Periodontology and Dental Implantology, Faculty of Dental Medicine, Medical University of Varna

ABSTRACT

Progressive loss of clinical level of attachment and bone destruction, which often are result of spent periodontal disease, nevitably lead to increased mobility of the teeth. Other causes of tooth mobility are occlusion trauma, atypical root system, iatrogenic shortened roots after an apical osteotomy, excessive strain during orthodontic treatment and root resorption. Increased tooth mobility adversely affects the patient's function, aesthetics and comfort. Splints are used to overcome these problems.

Keywords: *splints, splinting, periodontal therapy*

INTRODUCTION

Damage and loss of the tooth retention structure - periodontium, after a periodontal disease, can lead to abnormal tooth mobility. Increased tooth mobility inevitably affects patients' function, aesthetics and mentality. In some cases, it is possible to give a "last chance" to the mobile teeth before thinking about extraction.Periodontal splinting would extend the life of the affected teeth by a long time. Splinting provides stability that can stimulate periodontal restoration processes during periodontal treatment.

Tooth splinting with damaged periodontal teeth was done many years ago, but there are still conflicting opinions on this topic. Critics of periodontal splinting consider the splint to have a negative effect on the health of the oral cavity, resulting in a deterioration of the patient's oral hygiene and adverse effects on the supporting teeth.

Address for correspondence:
Tsvetalina Gerova-Vatsova
Faculty of Dental Medicine
Medical University of Varna
84 Tzar Osvoboditel Blvd
9002 Varna
e-mail: cvetalina21@gmail.com

Received: May 19, 2020
Accepted: June 22, 2019

Today, a significant progress is being made in the materials used for splinting. The need to stabilize the mobile teeth has led to the development of many types of splints that allow the maximum restoration of the periodontium during and after periodontal treatment.

AIM

This review article aims to summarize up-to-date information on periodontal splinting - causes of increased tooth mobility, classification of periodontal splints, indications and contraindications, and principles.

MATERIALS AND METHODS

Articles related to the subject were searched in PubMed and Google Scholar databases. The included articles and textbooks were in English language only. The search was performed using a combination of different keywords such as: "splinting", "periodontal therapy", "periodontal splints", "periodontal stabilization splints".

RESULTS AND DISCUSSION

Splints and Splinting - Definitions

Splint - a rigid or flexible device that secures a displaced or movable part (1,2).

Periodontal splint - a device used to maintain or stabilize the mobile teeth in their functional position (1).

Dental splinting – connection of two or more teeth using a periodontal splint (2).

Historical Data

The splinting of periodontally compromised teeth has progressed to the use of a silver wire, followed later by tools of gold wire or ribbon to maintain the teeth.

Archaeological findings from 500 BC have been discovered, which are inevitable evidence of a person's desire to preserve his or her teeth. These archeological findings demonstrate how periodontally compromised anterior teeth are connected by means of a gold wire.

There are remains of ancient Egyptians who made dental bridges with the help of gold or silver wire that connected one or more lost teeth to the neighboring ones.

Teeth Mobility - Physiological and Pathological Mobility

All teeth have a slight degree of physiological mobility, which varies for the different groups of teeth and at different times of the day. Physiological mobility is movement up to 0.2 mm horizontally and 0.02 mm axially. Mobility outside the physiological range is termed abnormal or pathological (3,4,5).

Mobility is estimated as the amplitude of displacement of the crown as a result of the application of a certain force (6). The magnitude of this amplitude is used to distinguish the physiological and pathological mobility of the teeth. The two major factors determining the degree of tooth mobility are the height of the supporting tissues and the width of the periodontal ligament (5).

Teeth mobility occurs in two stages:

1. The initial or intra-alveolar stage occurs when the tooth moves within the periodontal ligament. This is related to highly elastic ligament distortions and redistribution of forces (7).
2. The second stage progresses gradually and leads to elastic deformation of the alveolar bone in response to increased horizontal forces (8).

Many attempts have been made to develop mechanical or electronic devices to accurately measure tooth mobility (9,10,11,12), although these devices are not widely used.

Miller Teeth Mobility Classification (1950)

Mobility is clinically classified by holding the tooth between the handles of two instruments or with one instrument and one finger. Tooth mobility is evaluated on a scale of 0 to 3 *(*6,13) as follows:

- 0 - no mobility is detected after a force, other than that considered to be physiological, is applied
- 1 - horizontal mobility up to 1 mm
- 2 - horizontal mobility exceeding 1 mm
- 3 - horizontal and vertical mobility

Etiology - Causes of Increased Tooth Mobility

Chronic periodontitis is a destructive periodontal disease that includes gingival inflammation, clinical attachment loss and bone destruction (14,15). Chronic periodontitis is the second most common oral disease in the population (16). Research has shown that periodontitis is a widespread disease among Americans. For the population over 30 years the prevalence of the disease is approximately 47.2%, and for adults over 65, the prevalence is 70.1% (17,18).

Although a number of risk factors can affect the onset, progression and prognosis of periodontitis (age, gender, smoking, hormonal changes, immune system disorders, systemic diseases, diabetes, stress) (14,15), the major etiological factor is represented by specific microorganisms (gram-negative bacteria) of the bacterial plaque (19,20). In this inflammatory disease, the number of major periodontal pathogens of the red complex - *P. gingivalis*, *T. forsythia* and *T. Dentícola* (21) is increasing. The organism's response leads to a cascade of reactions leading to connective tissue and bone destruction (22,23).

Progressive clinical attachment loss and bone destruction inevitably lead to increased tooth mobility (24).

When patients have periodontitis and mobile teeth are present, efforts should be directed first to periodontal treatment and subsequently to splinting of the mobile teeth, if they are to be preserved (25,26). Periodontitis is usually treated by mechanically removing all deposits of supra- and subgingival plaque and improving periodontal health by reducing the probing pocket depth, the bleeding on probing and

the mobility, and increasing the clinical attachment level (4,27). In addition to mechanical therapy, lasers of different wavelengths can be used (28,29,30,31).

In the absence of periodontitis, primary occlusal trauma is the most likely cause of tooth mobility (25,26).

Rare causes of increased tooth mobility may be atypical root system, iatrogenic shortened roots after an apical osteotomy, excessive stress during orthodontic treatment and root resorption (25, 26).

Splint Classification

- Depending on the duration of use, the splints are classified as (32,33,34):
  - Temporary splint - temporary splints that are worn for less than 6 months and cannot be followed by an additional splint therapy. Example - during active periodontal treatment.
  - Provisional splint - temporary splints used from months to several years with a definitive end to splint therapy. Example - for diagnostic purposes, they usually lead to more durable stabilization.

Permanent splint - a permanent splint maintains long-term stability

Depending on the removability (33,34):

- removable;
- unremovable.

Depending on whether the hard tissue structures in which the splintwill be inserted are affected or not (33,34):

- intra-crown splints;
- extra-crown splints.

INDICATIONS AND CONTRAINDICATIONS

In order to decide how the mobile teeth will be treated, the reason for their mobility must first be identified - periodontal disease, occlusion trauma, etc. The tooth mobility resulting from occlusal trauma can be reduced by occlusal therapy, without splinting (33). In cases where articulating occlusion will not reduce the mobility of the teeth *(periodontal disease), reduced mobility can be achieved only* by periodontal splinting. Splinting *in these situations is* indicated if the mobility of the teeth distorts the function, comfort, and aesthetics of the patient (35).

Tarnow and Fletcher (1986) describe the indications and contraindications for splinting of periodontally affected teeth. According to their study, the rationale for dental splinting should include the severity of periodontal disease, determined by the amount of bone loss radiographically and/or measured tooth mobility (26).

Indications for periodontal splinting (33,34,36,37):

- restoration of mimic function and patient comfort;
- stabilization of teeth with increased mobility, which did not respond to occlusal adjustment and periodontal treatment;
- to facilitate occlusal articulation and periodontal treatment in extremely mobile teeth;
- preventing teeth from tilting or teeth in supra-position;
- stabilization of the teeth after orthodontic treatment;
- tooth stabilization after acute trauma.

Contraindications for periodontal splinting (33,34,35):

- occlusal stability and optimal periodontal conditions of the teeth;
- poor oral hygiene;
- insufficient number of fixed teeth for adequate stabilization of the mobile teeth;
- high risk of developing dental caries;
- overall oral prognosis;
- clustered and misaligned teeth.

If the crown/root ratio of a periodontally compromised tooth is not favorable, then a decision must be made to extract that tooth. The crown of the extracted tooth can then be used for a natural "bridge body," which can be fixed by means of a splint for adjacent teeth (38).

ADVANTAGES AND DISADVANTAGES

Critics of periodontal splinting consider the splint to have a bad effect on the health of the oral cavity, resulting in a deterioration of the patient's own oral hygiene and adverse effects on the supporting teeth (33).

It is now accepted that dental mobility is an important clinical parameter for periodontal prognosis. Splinting of the mobile teeth helps to restore periodontal health and improves function, comfort and aesthetics (39).

Alkan et al. (2001) consider that splinting of the mobile teeth before debridement (SRP) and eliminating the possibility of potential trauma during the intervention of the mobile teeth has no additional effect on the treatment (40).

Some authors have argued that the bone level and the clinical attachment level of splinted and unsplinted teeth after bone surgery are similar (41, 42). *Other authors claim that regenerative procedures using membranes and bone grafts have greater predictability if tooth move*ment is eliminated in advance (43).

Splinting teeth with damaged periodontium was a standard procedure many years ago, but there are still conflicting opinions on this topic (33).

Today, splinting of mobile teeth is considered to be an adjunct to periodontal treatment. The choice of the right splint and the strict adhering to the indications and contraindications to its construction are crucial. It has been shown that combining the teeth with one another allows the masticatory forces to be distributed from the mobile teeth to their fixed neighbors, thereby gaining support from the "stronger" teeth. This extends the life of the mobile teeth, provides stability for eventual clinical attachment gain, and improves comfort, function and aesthetics (33,34,44).

Based on the available data, it can be noted that splinting can be considered as an essential part of periodontal treatment to increase the lifespan of periodontally compromised teeth with extended mobility (34).

Principles to Be Observed When Designing a Periodontal Splint (1,33,34,38, 5)

- All periodontal disease must be controlled before the periodontal splint is positioned.
- For each mobile tooth, at least two more teeth with a healthy periodontium are included, i.e. enough teeth with a healthy periodontium should be included in the periodontal splint.
- The splint should not irritate the tissues in the oral cavity.
- The splint should allow good oral hygiene to be maintained;
- The splint should be with a simple design without extensive preparation of the teeth.
- It must be stable and efficient and easy to adjust.
- It should not make it difficult to use periodontal instruments.
- There needs to be an aesthetically acceptable result.

CONCLUSION

The progressive clinical attachment loss and bone destruction in periodontal diseases inevitably leads to increased tooth mobility. Other causes of tooth mobility are trauma from occlusion, atypical root system, iatrogenic shortened roots after an apical osteotomy, orthodontic treatment and root resorption. Increased tooth mobility adversely affects the patient's function, aesthetics and comfort. Splints are used to overcome these problems.

Tooth mobility resulting from trauma from occlusion can be corrected by occlusal therapy without the need for a periodontal splint. In mobile teeth, resulting from periodontal disease, splinting is becoming an important addition to the periodontal therapy. It is important to note that periodontal splinting alone will not eliminate the cause of tooth mobility. The splint is only an aid for the stabilization of the mobile tooth.

Although splinting is a method used since ancient times, it has been a topic of controversy to this day due to its poor effect on oral health, including poor oral hygiene and adverse effects on supporting teeth. Today, significant progress is being made in the materials used for splinting.

REFERENCES

1. Varma BRR, Nayak RP. Current Concepts in Periodontics. 1st edition. Delhi: Arya Publishing House; 2000.
2. The Academy of Prosthodontics. Glossary of Prosthodontic Terms. 6th ed. J Prosthet Dent. 1994;41-112.
3. O'Leary TJ. Tooth mobility. Dent Clin North Am; 1969.
4. Perlitsh MJ. A systematic approach to the interpretation of tooth mobility and its

clinical implications. Dent Clin North Am. 1980;24(2):177-93.

5. Pollack RP. Non-crown and bridge stabilization of severely mobile, periodontally involved teeth. A 25-year perspective. Dent Clin North Am. 1999;43(1):77-103.

6. Mühlemann HR. Tooth Mobility. The Measuring Method. Initial and secondary tooth mobility. J Periodontol. 1954;25:22-29.

7. Kurashima K. Viscoelastic properties of periodontal tissue. Bull Tokyo Med Dent Univ. 1965;12:240.

8. Mühlemann HR, Savdir S, Rateitschak KH. Tooth mobility – its causes and significance. J.Periodontol. 1965;36:148-53.

9. Mühlemann HR. Tooth mobility: a review of clinical aspects and research findings. J Periodontol. 1967;38(6):686-713.

10. O'Leary TJ, Rudd KD. An instrument for measuring horizontal mobility. Periodontics. 1963;1:249.

11. Paritt GJ. The dynamics of a tooth in function. J Periodontol. 1961;32:102.

12. Schulte W, D'Hoedt B, Scholz F, Muhlbradt L, Scholz F, Bretschi J, et al. Periotest - neues messverfahren der funktion des parodontiums. Zahnarztl Mitt. 1983;73(11):1229-40.

13. Miller SC. Textbook of Periodontia. 3rd edition. Philadelphia: Blakiston Co; 1950.

14. Heitz-Mayfield LJ. Disease progression: identification of high-risk groups and individuals for periodontitis. J Clin Periodontol. 2005;32(Suppl 6):196-209.

15. Timmerman MF, van der Weijden GA. Risk factors for periodontitis. Int J Dent Hyg. 2006;4(1):2-7.

16. Eke PI, Wei L, Borgnakke WS, Thornton-Evans G, Zhang X, Lu H, McGuire LC, Genco RJ. Periodontitis prevalence in adults ≥ 65 years of age, in the USA. Periodontol 2000. 2016 Oct;72(1):76-95.

17. Albandar JM. Epidemiology and risk factors of periodontal diseases. Dent Clin North Am. 2005;49(3):517-32

18. Eke PI, Dye BA, Wei L, Thornton-Evans GO, Genco RJ. Prevalence of periodontitis in adults in the United States: 2009 and 2010. J Dent Res. 2012;91(10):914-20.

19. Haffajee AD, Socransky SS. Microbial etiological agents of destructive periodontal diseases. Periodontol 2000. 1994;5:78-111.

20. Heitz-Mayfield LJ, Schätzle M, Löe H, Bürgin W, Anerud A, Boysen H, et al. Clinical course of chronic periodontitis. II. Incidence, characteristics and time of occurrence of the initial periodontal lesion. J Clin Periodontol. 2003;30(10):902-8.

21. Dentino A, Lee S, Mailhot J, Hefti AF. Principles of periodontology. Periodontol 2000. 2013;61(1):16-53.

22. Loe H, Theilade E, Jensen SB. Experimental gingivitis in man. J Periodontol. 1965;36:177-87.

23. Loesche WJ, Giordano JR, Soehren S, Kaciroti N. The nonsurgical treatment of patients with periodontal disease: results after five years. J Am Dent Assoc. 2002;133(3):311-20.

24. Ericsson I, Giargia M, Lindhe J, Neiderud AM. Progression of periodontal tissue destruction at splinted/non-splinted teeth. An experimental study in the dog. J Clin Periodontol. 1993;20(10):693-8.

25. Bernal G, Carvajal JC, Muñoz-Viveros CA. A review of the clinical management of mobile teeth. J Contemp Dent Pract. 2002;3(4):10-22.

26. Tarnow DP, Fletcher P. Splinting of periodontally involved teeth: indications and contraindications. N Y State Dent J. 1986;52(5):24-5.

27. Sanz-Sánchez I, Ortiz-Vigón A, Matos R, Herrera D, Sanz M. Clinical efficacy of subgingival debridement with adjunctive erbium:yttrium-aluminum-garnet laser treatment in patients with chronic periodontitis: a randomized clinical trial. J Periodontol. 2015;86(4):527-35.

28. Miteva M. Comparison of Nd:YAG, Er,Cr:YSGG and diode lasers in nonsurgical periodontal treatment. International Journal of Science and Research (IJSR). 2019;118-121.

29. Miteva M. Diode lasers in non surgical periodontal treatment. Int J Sci Res (IJSR). 2019;554-5.

30. Miteva M. Laser reduction of periodontal pathogens in the periodontal pocket using a Nd:YAG laser - a literature review. Int J Sci Res (IJSR). 2019;603-605.

31. 31. Miteva M. Nd:YAG lasers in nonsurgical periodontal treatment - a literature review. Scripta Scientifica Medicinae Dentalis, [S.l.], v. 5. 2019;16-19.

32. Ferencz JL. Splinting. Dent Clin North Am. 1987;31(3):383-93.

33. Kathariya R, Devanoorkar A, Golani R, Shetty N, Vallakatla V, Bhat MY. To Splint or Not to Splint: The Current Status of Periodontal Splinting. J Int Acad Periodontol. 2016;18(2):45-56.

34. Mangla C, Kaur S. Splinting- A Dilemma in Periodontal Therapy. Int J Res Health Allied Sci. 2018; 4(3):76-82.

35. Nyman SR and Lang NP. Tooth mobility and the biologic rationale for splinting teeth. Periodontology 2000. 1994;4:15-22.

36. Belikova N, Petrushanko T. Biomechanical basis splinting of loose teeth while preserving their mobility at physiological. Georgian Med News. 2013;(222):23-8.

37. Lemmerman K. Rationale for stabilization. J Periodontol. 1976;47(7):405-11.

38. Glickman I, Carranza FA. Glickman's Clinical periodontology: prevention, diagnosis, and treatment of periodontal disease in the practice of general dentistry. 5th edition. Philadelphia: Saunders; 1978.

39. McGuire MK, Nunn ME. Prognosis versus actual outcome. II. The effectiveness of clinical parameters in developing an accurate prognosis. J Periodontol. 1996;67(7):658-65.

40. Alkan A, Yasar Aykaç Y and Bostanci H. Does temporary splinting before non-surgical therapy eliminates scaling and root planing-induced trauma to the mobile teeth? J Oral Sci2001;43:249-54.

41. Gallers C, Selipsky H, Phillips C and Ammons WF Jr. The effect of splinting on tooth mobility (2) after osseous surgery. J Clin Periodontol. 1979;6:317-33.

42. 42. Kegel W, Selipsky H and Phillips C. The effect of splinting on tooth mobility. I. During initial therapy. J Clin Periodontol. 1979;61:45-58.

43. Cortellini P, Tonetti MS, Lang NP, Suvan JE, Zucchelli G, Vangsted T, et al. The simplified papilla preservation flap in the regenerative treatment of deep intrabony defects: clinical outcomes and postoperative morbidity. J Periodontol. 2001;72(12):1702-12.

44. Glickman I, Stein S, Smulow J. The effect of increased functional forces upon the periodontium of splinted and non-splinted teeth. Journal of Periodontology. 1961;32:290-300.

45. Carranza FA, Newman, MG. Clinical Periodontology. 8th edition. Philadelphia: WB Saunders; 1996.