Tooth Mobility : A Review

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Introduction

Increased tooth mobility has concerned dentists since the 19th century[1]. The stability of the dentition is dependent on the resistance of the supporting structures of the teeth and the magnitude, frequency, duration and the direction of forces acting upon them[2]. To evaluate the effectiveness of periodontal treatment, the examination of tooth mobility is significant & should therefore be accurate. Examination of tooth mobility is an important diagnostic aid in determining the severity of periodontal disease[3]

Pathophysiology of Tooth Mobility

Types of Tooth Mobility

1. Physiologic Tooth Mobility is the limited tooth movement or tooth displacement that is allowed by the resilience of a healthy and intact periodontium when a moderate force is applied to the crown of the tooth. It is 4-12/100 mm for 500 g force applied with incisors have the highest (10-12/100 mm) and molar the lowest (4-8/100 mm). Children and females obtain higher values than adults & males respectively. The greatest tooth mobility is observed upon arising, and decreases during the day[5]

2. Pathologic Tooth Mobility includes any degree of movement that may be reduced or eliminated once the pathologic cause is identified and corrected.[5] Tooth mobility can be detected by holding the ball of a finger on the facial surface of a tooth while the patient goes through various mandibular movements.[6]

3. Altered Tooth Mobility represents a transient or permanent change in periodontal tissues as a result of therapy e.g. after surgery[4].

4. Functional Mobility or fremitus is the movement of teeth during function or para-function[4] and signifies occlusal traumatism[2].

5. Adaptive Mobility is the absence of an etiologic factor that might be improved upon to directly improve stability by decreasing or eliminating tooth mobility, example, short roots, poor crown to root ratio[5].

6. Passive Mobility relates to how loose teeth are on palpation, while **Dynamic Mobility** defines how loose teeth are during functional and parafunctional movements.[5]

7. Reduced tooth Mobility is seen in an ankylosed tooth after failing reimplantation or if autogenous bone grafts are placed in contact with detached root surfaces.[4, 7]

8. Increased / Static Tooth Mobility is usually due to trauma from occlusion, but may be due to periodontal diseases where the periodontal structures become adapted to an altered functional demand. It is self limiting.[4]

9. Hypermobility is a form of increased mobility persisting after completion of periodontal treatment. It is often referred to as 'residual mobility'.[4, 7]

10. Increasing or Progressive Mobility is of a progressive nature and can be identified only through a series of repeated tooth mobility measurements carried out over a period of several days or weeks.[4, 7]

11. Initial and Secondary Tooth Mobility - Muhlemann (1954) in a series of studies, while using progressively increasing forces (50-1500g) showed that the force / displacement relationship had a typical pattern which could be illustrated by a double sloped curve which had two points defined as "initial" (ITM) and "secondary" (STM) tooth mobility components. During ITM forces smaller than 100g moved the crown by 0.05 to 0.1 mm and is the result of intra alveolar displacement of the root. On the other hand, during STM part forces ranging between 100-1500 g allowed additional tooth movement by the distortion and compression of the periodontium on the pressure side .[4] During mastication, teeth & their supporting structures are generally subjected to severe occlusal forces, upto 50 Kgs.[8]

Causes of Tooth Mobility

I. Local Factors:

1. Marginal inflammation: Disruption of the gingival, transseptal and circular fibres which contribute significantly to the firmness of the tooth.[6]

2. Periodontal inflammation & Trauma from Occlusion: The excessive occlusal forces change the pathway of the spreading inflammation so that it extended directly into the periodontal ligament leading to angular resorption of the alveolar bone and infrabony pocket formation (Glickman and Smulow 1962). It was observed that the furcation regions were the most susceptible to trauma from occlusion (Glickman, Stein and Smulow, 1961). This was known as Glickman's codestruction hypothesis.

3. Trauma From Occlusion[7]

4. Pathology of Jaws like tumours, cysts, osteomyelitis etc[4].

5. Traumatic Injuries to dentoalveolar units. Torquing force applied to clasped teeth by removable partial dentures can result in marked increase in tooth mobility in the absence of bone loss.

6. Hypofunction: The periodontal ligament of a non-functional tooth undergoes disuse atrophy with a concomitant loss of resistance. In teeth without antagonists there is widening of periodontal ligament initially due to reduced stresses.[2, 4]

7. Periapical Pathology: An acute inflammatory response within the periodontal ligament as occurs with a periapical or periodontal abcess, can cause disorganization & destruction of principle fibres.[2, 4]

8. Para-functional Habits such as Bruxism

9. Supporting Structures of the Teeth: A decrease in the supporting structures of teeth or an increase in the magnitude, direction, duration and frequency of forces, or a combination of both may result in tooth mobility.[2]

10. Tooth Morphology: The degree of mobility depends upon the number of roots; their length & diameter as well as the relationship of the alveolar crest to the cement-enamel junction.
The contour of the root i.e. flat, conical or dilacerated and the relationship of two or more roots of a multi rooted tooth to each other i.e. divergent or convergent, may also influence tooth resistance.[2, 4]

11. Overjet & Overbite are directly proportional to tooth mobility.[4]

12. Loss of Supporting Bone can be due to gingival inflammation or trauma from occlusion[4].

14. Occlusal Prematurities: A gross prematurity between two occluding teeth often results in pathologic mobility of one or both of the involved teeth.[6]

15. Afunctional Occlusal Habits: Grinding, clamping & "doodling" (grinding on one tooth) habits can result in marked elevations in tooth mobility in the absence of clinically detectable gingival inflammation and bone loss.[6]

16. Tooth Loss: When a large number of teeth have been lost, the remaining teeth must assume all functional demands. These teeth often display pathologic mobility values.[6]

17. Transient Increases In Tooth Mobility: Large increases in tooth mobility may be seen after the insertion of large restorations, after endodontic treatment, on contiguous teeth after extractions, periodontal therapeutic procedures and after traumatic injuries to the teeth.[12] The injury may be transient or lasting depending on the intensity and nature of the insult to the supporting tissues.[4, 6, 9]

II. Systemic Factors

1. Age: In the absence of periodontal disease, older individuals showed somewhat more mobility for both maxillary central incisor and second molar.[4, 10]

2. Sex & Race: Mobility has higher

incidence in females and in Negroes.[4,10]

3. Menstrual Cycle: Increased horizontal tooth mobility has been suggested during 4th week of menstrual cycle. [4, 10]

4. Oral Contraceptives: Periodontal disease and attachment loss are more common among women on pills.[4, 11]

5. Pregnancy: Tooth mobility can increase during the course of pregnancy and post-partum.[4]

6. Systemic Diseases: Certain systemic diseases aggravate periodontal disease viz Papilon Lefevre syndrome, Down's syndrome, Neutropenia, Chediak Higashi syndrome, Hypophosphatasia, Hyperparathyroidism, Acute leukaemia, Pagets disease etc.[4]

Measurement of Tooth Mobility

Method for Measuring Tooth Mobility

1. Direct visualization when tooth is held between two rigid instruments.
2. Direct observation of movement resulting from occlusal forces (functional mobility).
3. Percussion sound
4. Electronic devices.[12]
5. **Miller** (1950)[12] recognized three grades of tooth mobility.
6. The first to report the use of a dial indicator mounted on an impression tray and fixed in the mouth by means of quick setting plaster was **Muhlemann** (1954)[13]. The indicator pointer was adapted to the labial or buccal surfaces of the teeth and measurements made in hundredths of millimeters. The deflections of the teeth to be measured were obtained with a forcemeter by means of which a static force was applied ranging from 200 to 1000 grams. Muhlemann termed his method periodontometry and distinguished between macro-periodontometry and micro-periodontometry, depending upon the size of his equipment. The application of macro-periodontometry is limited to measurements on incisors, canines and first bicuspids and was used preferably in the upper jaw. The reproducibility appears to be very high. Readings can be made to one ten thousandth of an inch.
7. **Picton** (1957)[14] demonstrated axial tooth mobility relative to its neighbors by the use of resistance wire strain gauges. Any change in the position of the test tooth relative to the adjacent teeth was detected by the two strain gauges.
8. **Parfitt** (1958)[15] recorded the tooth movement in an axial direction using the adjacent tooth as the reference point. The instrument was fastened to the posterior teeth with impression compound. Both systems used transducers, and test output could be read on D.C. meters, strip-chart recorders or X-Y recording force and movement. Parfitt stated that the axial movement could be measured with an accuracy of 0.001mm ±7 percent.

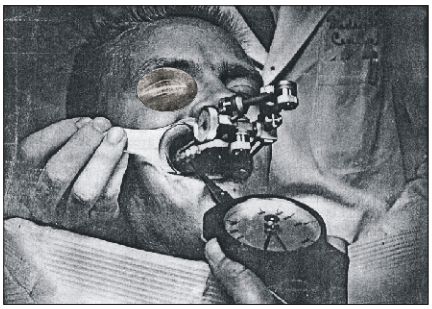

Fig. 4: Periodontometer positioned to assess the mobility of the maxillary right first molar. Five hundred grams of force is being applied to the tooth from the palatal surface.

9. A method whereby mobility of maxillary and mandibular teeth could be measured simultaneously was developed by **Goldberg** (1961)[16]. It consisted of a carriage device which was used with a dial indicator described in Muhlemann's periodontometer or with other measuring devices. With cold cure acrylic or impression plaster the carriage device was fixed in the oral cavity whereby the occlusal surfaces of the posterior teeth of maxillary and mandibular arches were engaged.
10. **Joel** (1958)[17] described a technique in which a mirror was attached to the tooth and the tooth movement was shown by a reflected image on the opposite wall or any suitable surface. Another mirror was attached to the tooth some distance away and if this reflected image did not move, the measurement was reported to be accurate. To move the teeth, a force was employed with a V-notch cut in a cement spatula.
11. **O'Leary and Rudd** (1963)[18] designed the USAFSAM Periodontometer which permits assessment of the mobility of all anterior and posterior teeth in reasonable alignment through the second molar in both arches.
12. **Korber and Korber** (1963)[19] and **K.H.Korber** (1970)[20] have described and employed a system that employs electronic transducers of an inductive non-contact design. Extremely small movements can be detected and recorded with this system.

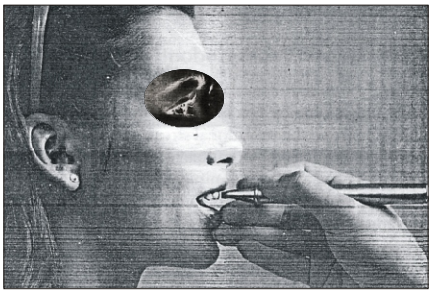

Fig. 5: During measurement the Periotest handpiece must always be held perpendicular to the tooth axes. An audible signal from the computer indicates unacceptable deviations. The point of impact, that is, the point of measurement, is the middle of the anatomical crown.

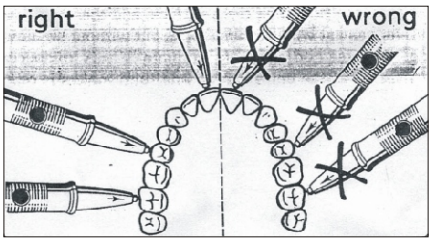

Figure 6: The Periotest measurement must be made in a midbuccal direction.

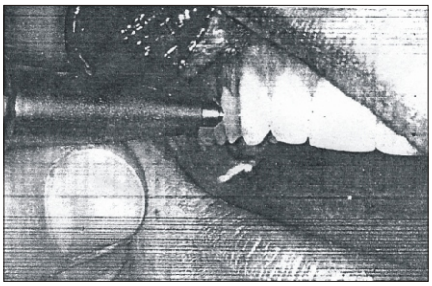

Figure 7: Exposed tooth necks enlarge the clinical crown and must be taken into consideration

13. The Periotest Method

After many years of research the authors established, in 1972, an interdisciplinary group of scientific investigators and after 12 years of research, the Periotest method

was successfully developed (German Patent 2617779, Patented February 11, 1982). The 'Periotest value' depends mainly on the damping characteristics of the periodontium. An electro-magnetically driven, electronically controlled tapping head in a handpiece percusses the tooth 16 times, 4 times per second (Figure 4). The tapping head is decelerated when it hits the tooth. The greater the stability of the periodontium, the higher is the damping effect and the faster the deceleration. This 'braking' effect is recorded by an accelerometer in the tapping head. The contact time between tooth and tapping head, approximately a millisecond, is the signal used for analysis by the periotest system. Diseased or functional changes of the periodontal tissue, including bone, can be quantitatively recorded with great accuracy even if there is no radiological evidence.

14. Zwick Method[21] An artificial model as described by Berthold et al was used. It consisted of a round aluminium base with six alveolar sockets, arranged in a half round arc to stimulate an almost naturally shaped dental arch. To allow increased tooth mobility, close to the clinical situation of injured loose teeth, the two middle sockets were enlarged. The root and the crown section of the simulation teeth were made of stainless steel. The PDL for the uninjured teeth was made with silicon while the PDL of the injured teeth was made of silicon and rubber foam. For fine adjusting tooth mobility apical screws were used. Tooth mobility was measured in the horizontal and then in the vertical dimension with the universal testing machine Zwick value. A continuous load of 0-10 N was used. The Zwick method provides quantitative metric information about tooth mobility.

Indices Used For Measuring Tooth Mobility

Miller's Index

Grade I: The first distinguishable sign of movement.

Grade II: A movement of the tooth which allows the crown to deviate within 1 mm of its normal position and

Grade III: Easily noticeable and allows the tooth to move more than 1 mm in any direction or to be rotated or depressed in the socket.

Index suggested by Prichard (1972)

1. Slight mobility
2. Moderate mobility
3. Extensive movement in a lateral or mesiodistal direction combined with vertical displacement in the alveolus. Plus and minus sign can be used for added refinement.

Index given by Waserman et al, (1973)

1. Normal
2. Slight mobility: Less than approximately ¾ mm ($295X10^{-4"}$) of bucco-lingual movement
3. Moderate Mobility: Up to approximately 2 mm ($790X10^{-4"}$) movement bucco-lingually
4. Severe Mobility: More than 2 mm ($790X10^{-4"}$) of movement

Index Utilized by Nyman et al. (1975)

Mobility degree 0 = horizontal mobility or mesiodistal of less than 0.2 mm ($79X10^{-4"}$)
Mobility degree 1 = horizontal mobility or mesiodistal of 0.2-1 mm ($79\text{-}394X10^{-4"}$)
Mobility degree 2 = horizontal mobility or mesiodistal of 1-2 mm ($394\text{-}788X10^{-4"}$)
Mobility degree 3 = horizontal mobility or mesiodistal exceeding 2 mm ($788\ X10^{-4"}$) and/or vertical mobility.

Treatment

Various Methods for Controlling Tooth Mobility Are:

1. Periodontal Treatment

The elimination of periodontal pockets by definitive periodontal treatment and optimal procedures for plaque control practiced by the patient should establish total control of plaque-induced inflammatory disease and related alveolar bone loss.

2. Occlusal Adjustment / Treatment of Occlusal Habits

Various Methods of Treating Occlusal Disease Are:

1. Selective grinding (Occlusal equilibration)[5]
2. Occlusal appliances to stabilize mobile teeth & eliminate interferences.
3. Splinting
4. Tooth movement (correction of axial inclinations and tooth-to-tooth as well as arch-to-arch relationships)
5. Extraction of hopeless teeth.

3. Restorative Dentistry

Prematurities may be corrected by establishing new occlusal relationship through restorative techniques, i.e., onlays or crowns. Prosthodontic replacement of missing teeth may distribute those forces, thus reducing mobility.[7]

4. Fixed and removable splinting

In the absence of successful reattachment procedures, the most reliable method of completely eliminating mobility is to distribute the forces over a maximum number of teeth by splinting. The presence of splints, however, often makes it difficult for the patient to achieve adequate plaque control and thus may predispose to further periodontal destruction.[6]

Conclusion

Tooth mobility is considered to be significant when evaluating the effectiveness of periodontal therapy.[1] The etiology of mobility has been attributed to either a reduction in the resistance of the teeth or to an accentuation of the magnitude of the forces placed upon them. The significance of mobility, however, is not clear. Since many of the therapeutic modalities employed in its treatment have negative aspects, the decision to treat or not to treat mobility should be based upon & critical evaluation of the possible advantages and disadvantages of the proposed therapy.

References

1. Turnelis H. Pameijer, Richard E. Stallard : A method for quantitative measurements of tooth mobility. J Periodontol volume 44, Number 6; 339-346.
2. Timothy, J.O 'Leary : Indices for measurement of tooth mobility in clinical studies J. Periodontal Res 9, 1974; Suppl. 14; 94-105.
3. Gerald S. Wank, Yale J. Kroll : Occlusal trauma - An evaluation of its relationship to periodontal prosthesis, Dental Clinics of North America 25, No. 3, July 1981; 511-532.
4. Neiderud A-M, Ericcson I & Lindhe J : Probing pocket depth at mobile/non-mobile teeth J Clin Periodontol 1992 ; 19 : 754-759.
5. Bernard H. Wasserman, Arnold M. Geiger, Livia. R. Turgeon : Relationship of occlusion and periodontal disease : Part VII - Mobility J. Periodontol, September 1973, volume 44, Number 9, 572-578.
6. Dr. Shrinidhi M.S., Dr. G.V. Pramod, Dr. D.S. Mehta : Tooth mobility in clinical periodontics : JISP (2003) Vol. 6, Issue 2 : 94-99.
7. W. Schulte & D. Lukas : The Periotest method : International dental journal (1992) 42, 433-440.
8. Sigurd P. Ramfjord and Major M. Ash : Significance of occlusion in the etiology and treatment of early, moderate and advanced periodontitis J Periodontol 1981 September 511-515.
9. Sudhir Kamath, Neeta V. Bhaskar : Periodontal splints - a boon or bane : The Journal of Indian Society of Periodontology : 21-25.
10. Matthew Kessler : A variation of "A" splint: 268-271.
11. David S. Greenfield, Dan Nathanson : Periodontal splinting with wire and composite resin - A revised approach : J Periodontol, August Volume 51, Number 8, 465-468.
12. Ralph P. Pollock : Non-Crown and bridge stabilization of severely mobile, periodontally involved teeth : A 25 year perspective : Dental Clinics of North America, Volume 43, Number 1, January 1999; 77-103.
13. Howard E. Strasslar, Alireza Haeri, Jerrold P. Gultz : New - generation bonded reinforcing materials for anterior periodontal tooth stabilization and splinting : Dental Clinics of North America, Volume 43, Number 1, January 1999. 105-126.
14. A. Jon Goldberg, Martin A. Frelich: An innovative pre-impregnated glass fiber for reinforcing composites : Dental Clinics of North America, Volume 43, Number 1, January 1999,127-133.
15. Neville Mc Donald, Howard E. Strassler : Evaluation of tooth stabilization and treatment of traumatized teeth : Dental Clinics of North America, Volume 43, Number 1, January 1999, 135-149.
16. Stuart D. Josell : Tooth stabilization for orthodontic retention : Dental Clinics of North America, Volume 43, Number 1, January 1999;151-165.
17. Howard E. Strassler, David A. Garber : Anterior esthetic considerations when splinting teeth : Dental Clinics of North America, Volume 43, Number 1, January 1999, 167-178.
18. http://www.thejcdp.com/issue012/bernal/figure01.htm
19. Robert J. Cronin, David R. Cagna: An update on fixed prosthodontics, JADA; Volume 128. April 1997, 425-436.
20. Michael W. O' Riordan, Curt S Ralstrom, Susan E Doerr : Treatment of avulsed permanent teeth: an update: JADA Volume 105, December 1982: 1028-1030.
21. Christine Berthold, Friedrich Johannes Auer, Sergej Potapov, Anselm Petschelt: In vitro splint rigidity evaluation comparison of a dynamic and a static measuring method. Dental traumatology 2011; 27: 414-421