Periotest values: Its reproducibility, accuracy, and variability with hormonal influence

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Abstract

Tooth mobility can be assessed by both subjective and objective means .The use of subjective measures may lead to bias and hence it becomes imperative to use objective means to assess tooth mobility. It has also been observed that hormonal fluctuations may have significantly influence tooth mobility. **Aims:** The study was undertaken to assess the reproducibility of periotest in the assessment of tooth mobility and, to unravel the obscurity associated with the hormonal influence on tooth mobility. **Materials and Methods:** 100 subjects were included in the study and were divided equally into two groups based on their age, group I (11-14 years) and group II(16-22 years). **Results:** There was no statistical significant difference between the periotest values (PTV) taken at two different time periods with a time difference of 20 minutes. PTV of group I was found to have a statistical significant greater PTV than group II. **Conclusion:** Periotest can reliably measure tooth mobility. Tooth mobility is greater during puberty as compared to adolescence and during adolescence mobility was slightly greater in males.

Keywords: Hormonal influence, periotest, periotest value, tooth mobility

Introduction

Even a tooth with a healthy periodontium is mobile to a certain range, and this mobility is termed as physiological tooth mobility. This mobility depends on biophysical properties of periodontium and the amount of alveolar bone.[1] Evaluation of tooth mobility can be done by using various methods that are either subjective or objective. Subjective assessment of tooth mobility is examiner dependent and subjective to bias; this emphasizes the need of an objective method. Various objective methods that have been described are laser diodes, magnetic sensors, Doppler vibrometer, and Mühlemanns periodontometer; these are time consuming, cost intensive, or limited to *in vitro* investigations.[2] Mühlemanns periodontometer is a static objective method for assessing tooth mobility, but it is a time consuming and complex procedure for routine clinical practice.[3] Periotest is a dynamic device designed to provide objective measurement of tooth mobility by assessing damping characteristics of periodontium; it does not require fixing a rigid measuring apparatus on the teeth.[4,5] The amount of tooth mobility is displayed by a value called periotest value (PTV) ranging from –8 to +50, which can be correlated to 4° of tooth mobility reported by Miller. The PTV and its correlation to clinical mobility are given in Table 1.

It is now accepted that physiological mobility is influenced by hormonal fluctuations associated with puberty, pregnancy, and menstrual cycle. The present study aimed at measuring the degree of tooth mobility during puberty (11–14 years) and adolescence (16–22 years) in male and female subjects; concomitantly evaluation of reproducibility of periotest device was also carried out.

Materials and Methods

Ethical clearance for the study was received from the institutional Ethical Committee and review board of the institute. The data was collected from the subjects visiting the out-patient section of Department of Periodontics of the institution. Written informed consent was obtained from all patients who participated in the study. The subjects included in the study were systemically healthy with no history of trauma, no history of orthodontic or restorative treatment in relation to maxillary and mandibular anterior teeth and no signs of periodontal disease.

A total of 100 subjects were divided into two groups on the basis of their age with 50 subjects in each group. Group I consisted of subjects in the age group 11–14 years and group II consisted of subjects in the age group 16–22 years. Both the groups had equal numbers of male and female subjects.

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Clinical evaluation

Mobility of teeth 11, 21, 31, and 41 was measured by positioning the periotest device at the center of the tooth [Figure 1]. The periotest device is placed in a horizontal position 0.6–2 mm away from the tooth surface [Figure 2] and two PTVs (PTV1 and PTV2) were calculated with a time difference of 20 min. During each measurement, the device delivers 16 impacts in 4 s to the object. The duration of contact of the tapping head on the tooth surface is measured by the instrument that calculates the PTV, indicating tooth mobility. Mean of the two PTVs was calculated and taken into consideration for comparison. The time difference of 20 min was left between the two PTVs to allow the periodontium to return to its normal functioning state.

Statistical analysis

Data analysis was performed using a software program (SPSS, version 14.0, Chicago, IL, USA). Correlation between the PTV1 and PTV2 was assessed in each group by Pearson correlation coefficient. Unpaired *t*-test has been used to compare the PTV of males and females in each group and to compare the PTV between the two groups.

Results

Periotest value 1 and PTV2 values of males and females of the group I and group II measured with a time difference of 20 min are shown in Tables 2-5. Correlation between the PTV1 and PTV2 showed no significant difference between the two values except in relation to 41 in group I females. However, this difference was marginal. This implies a reliable reproducibility of periotest device. Thus, it can be assumed that periotest readings are reproducible even if the position of device (acceptable deviation is ± 20° from the horizontal) and patient are slightly altered. Tables 6 and 7 show comparison between mean PTVs of males and females in group I and group II using unpaired *t*-test. The comparison in both the groups revealed a statistical insignificant relationship between the the two PTV values. Table 8 shows a comparison between group I and group II with a significant difference between them.

Figure 1: Markings on the center of the tooth

Discussion

Quantification of tooth mobility during periodontal screening is vital to establish a proper diagnosis. Even a tooth with good alveolar bone has tooth mobility to a certain range which is due to biomechanical relationship of a tooth with the elasticity of the alveolar bone present. Stability of a tooth is dependent upon the resistance of its supporting structure and the character of forces directed against it.[1]

Hormonal influences during puberty, pregnancy and menstruation alter the response of periodontal tissues creating diagnostic and therapeutic dilemmas. Increased tooth mobility during these phases of hormonal fluctuation is because of increase in the initial free intrasocket movement of the roots.[6] This may be because of less resistance of the supporting periodontal tissues towards forces acting on the

Table 1: PTV and its correlation to clinical mobility

Values	Mobility grade
8 to+9	0
+10 to+19	I
+20 to+29	II
+30 to+50	III

PTV: Periotest value

Table 2: Mean of PTV1 and PTV2 readings in group I females (*n*=25)

Tooth	PTV1 (SD)	PTV2 (SD)	*P* value	CI
11	6.7 (2.0)	6.6 (1.8)	0.3	−0.17, 0.49
21	6.9 (2.3)	6.8 (2.4)	0.4	−0.15, 0.31
31	5.5 (2.5)	5.5 (2.4)	0.8	−0.28, 0.36
41	6.4 (2.4)	6.0 (2.2)	0.009	0.10, 0.69

SD: Standard deviation; CI: Confidence interval; PTV: Periotest value

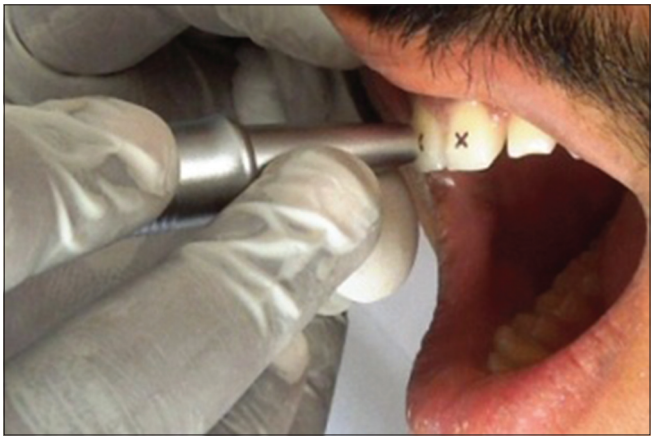

Figure 2: Horizontal positioning of device away from the tooth surface

Table 3: Mean of PTV1 and PTV2 readings in group I males (*n*=25)

Tooth	PTV1 (SD)	PTV2 (SD)	*P* value	CI
11	6.5 (1.8)	6.3 (1.9)	0.2	−0.11, 0.51
21	7.1 (2.0)	7.0 (0.6)	0.2	−0.25, 0.41
31	6.3 (1.9)	6.4 (1.9)	0.3	−0.49, 0.17
41	6.2 (2.1)	6.3 (2.1)	0.6	−0.30, 0.23

SD: Standard deviation; CI: Confidence interval; PTV: Periotest value

Table 4: Mean of PTV1 and PTV2 readings in group II females (*n*=25)

Tooth	PTV1 (SD)	PTV2 (SD)	*P* value	CI
11	3.1 (1.7)	3.0 (1.8)	0.7	−0.21, 0.29
21	3.3 (1.6)	3.1 (1.5)	0.3	−0.25, 0.41
31	3.5 (2.1)	3.4 (1.8)	0.6	−0.23, 0.39
41	3.2 (1.7)	3.0 (1.6)	0.1	−0.06, 0.46

SD: Standard deviation; CI: Confidence interval; PTV: Periotest value

Table 5: Mean of PTV1 and PTV2 readings in group II males (*n*=25)

Tooth	PTV1 (SD)	PTV2 (SD)	*P* value	CI
11	1.6 (1.4)	1.8 (1.3)	0.2	−0.53, 0.13
21	1.8 (1.1)	1.8 (1.1)	1.0	−0.23, 0.23
31	1.9 (1.7)	2.0 (1.8)	0.5	−0.34, 0.18
41	2.0 (2.0)	2.2 (1.8)	0.1	−0.38, 0.06

SD: Standard deviation; CI: Confidence interval; PTV: Periotest value

Table 6: Mean of PTV1 and PTV2 readings in group I (*n*=50)

Tooth	PTV1 (SD)	PTV2 (SD)	*P* value
11	6.6 (1.9)	6.4 (1.8)	0.1
21	7.6 (2.2)	6.9 (2.1)	0.4
31	5.9 (2.3)	6 (2.2)	0.5
41	6.3 (2.3)	6.2 (2.1)	0.1

PTV: Periotest value; SD: Standard deviation

Table 7: Mean of PTV1 and PTV2 readings in group II (*n*=50)

Tooth	PTV1 (SD)	PTV2 (SD)	*P* value
11	2.4 (1.7)	2.4 (1.7)	0.4
21	2.6 (1.5)	2.5 (1.5)	0.4
31	2.7 (2.1)	2.7 (1.9)	1.0
41	2.6 (2.0)	2.6 (1.7)	0.8

PTV: Periotest value; SD: Standard deviation

Table 8: Comparison of mean PTV readings of groups I and II

Tooth	Mean (SD) (*n*=50)		CI	*P* value
	Group I	Group II		
11	6.6 (1.9)	2.4 (1.7)	3.58, 4.93	0.00*
21	7.0 (2.2)	2.6 (1.5)	3.68, 5.23	0.00*
31	5.9 (2.3)	2.7 (2.1)	2.33, 4.02	0.00*
41	6.3 (2.3)	2.6 (2.0)	2.94, 4.46	0.00*

*Value of *P* is significant at *P*<0.05. SD: Standard deviation; CI: Confidence interval; PTV: Periotest value

crown of a tooth and thereby, a reduction in the capacity to dissipate the forces (damping characteristics).[1]

Hence, this study was carried out to measure the normal range of tooth mobility in two different age groups and also to analyze the possible influence of hormonal fluctuation during puberty on tooth mobility. All the readings were carried out by a single examiner with a time gap of 20 min. Readings were recorded on all the central incisors of maxilla and mandible, assuming that the root apex of all the central incisors will be closed by the age of 9 years. Premolars and molars were not included in the study keeping in mind the difficulty of positioning the device as per instructor's manual.

Readings were recorded randomly from the selected teeth to eliminate the bias from systematic allocation of tooth creeping into the results.[7] To assess the reproducibility of the device, two measurements have been recorded by percussing the tooth at the center of the marked measuring point by positioning it horizontally 0.6–2 mm away from the buccal tooth surface. The periotest readings were found to be reproducible and the variations were statistically insignificant. The readings obtained were in the physiological range according to Schulte and Lukas.[5]

Inter group comparison of mean PTV scores of two groups reveals that subjects in group I have increased range of teeth mobility compared to subjects of group II. The significant variation in the reading can be explained by the hormonal fluctuations during puberty,[8] which then remains constant during the remainder of the reproductive phase.

In the intragroup comparison, it was seen that there was no significant difference between males and females in group I. However, a significant variation in the PTV reading of females when compared to males was seen in group II, with females displaying increased tooth mobility. This leads to the possibility that the hormonal fluctuation in females might exert an influence on the periodontium even after the phase of puberty. The results obtained are contradictory to the results obtained by Mackie *et al*.[7] who has in his study; found that females have a lower PTV in comparison to males in the age group of 9–16 years. The results also contradict the statement by Lukas and Schulte[4] that the stage of the menstrual cycle in females has no significant influence on the PTV.

However, this study is limited by the absence of statistical assessment of the gingival status of the subjects to assess the possible contribution of gingival inflammation to tooth mobility. The small sample size is also a drawback of the study.

Conclusion

It was concluded from the study that periotest device can be reliably used to assess tooth mobility. It was also shown

that mobility is increased during puberty and after the phase of puberty with greater values in females compared to males.

A better knowledge of hormonal influences on the periodontium causing tooth mobility can help us in accurate diagnosis and proper treatment plan, which also guides us for careful selection of subjects when longitudinal studies are performed on the tooth mobility. Further longitudinal studies, using a larger sample size, are required to measure the reproducibility of periotest that could be a reproducible and objective tool in clinical trials and diagnosis.

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