A Cross-sectional, Clinical Study to Evaluate Mobility of Teeth During Pregnancy Using Periotest

Abstract

Background and Objective: Over a century, an increased prevalence of gingival diseases associated with increasing plasma sex steroid hormone levels has been reported. These situations present unique challenges to the oral health-care professional. It is believed that hormonal fluctuations such as those associated with pregnancy, menstruation, and use of hormonal contraceptives lead to an increase in tooth mobility. However, this effect of female sex hormones on periodontal ligament and tooth-supporting alveolar bone has rarely been investigated. Hence, this study was conducted to understand the effect of hormonal changes during pregnancy on tooth mobility. 

Materials and Methods: Mobility of index teeth 16, 13, 21, 23, 24, 36, 33, 41, 43, and 44 was measured with periotest for fifty pregnant females at first trimester (12th week), second trimester (24th week), and third trimester (35th week). Simplified oral hygiene index, plaque index, Gingival index (GI), and probing depth were also evaluated during the three trimesters of pregnancy for each subject participating in the study. 

Statistical Analysis: The results of the study were subjected to statistical analysis. Data analysis was done by applying Z-test for comparing difference between two sample means. 

Results: A small but statistically significant influence on the periotest value was seen during the three trimesters of pregnancy. GI scores significantly increased throughout pregnancy despite no significant change in plaque levels. 

Conclusion: Pregnancy had a significant influence on tooth mobility. Highest value of tooth mobility was seen in the last month of pregnancy. The maximum severity of gingivitis was also seen during the third trimester of pregnancy.

Keywords: Gingival condition, hormonal changes, periotest value, tooth mobility

Introduction

The homeostasis of the periodontium involves a complex multifactorial relationship, in which endocrine system plays an important role.[1] Physiological events due to hormonal influences have been long recognized as an important influencing/predisposing or “risk factor” in periodontal diseases. Currently accepted periodontal classification also recognizes the influence of endogenously produced sex hormones on the periodontium.[2]

Changes in woman’s hormonal milieu have surprisingly strong influence on oral cavity and are reflected in her periodontal tissues as well. The data available from previous studies, strongly suggest that female sex hormones may alter periodontal tissue response to microbial plaque and thus indirectly contribute to periodontal disease.[3-5] It is believed that hormonal fluctuations associated with pregnancy, menstruation, and use of hormonal contraceptives lead to increase in mobility of teeth presumably because of physicochemical changes in periodontium. However, literature to support this belief is very scanty.[6]

A better understanding of the periodontal changes in response to hormonal changes can help a dental practitioner in the diagnosis as well as in providing appropriate treatment. Thus, the present study intends to understand the effect of pregnancy on tooth mobility and gingival condition.

Materials and Methods

The present study was conducted in the Department of Periodontics, Rural Dental College, Loni, in coordination with Department of Gynecology and Obstetrics, Rural Medical College, Loni (during August 2005–October 2006). After obtaining consent, a total of fifty pregnant females in the age group of 23–30 years were examined. Pregnancy was confirmed by obtaining a positive pregnancy test. 

Pregnancy was confirmed using Periotest. A Cross-sectional, Clinical Study to Evaluate Mobility of Teeth During Pregnancy Using Periotest

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depending on the history of last menstrual period, ultrasonography, obstetrical examination, and consent. Examination of the pregnant females was performed at first trimester (12th week), second trimester (24th week), and third trimester (35th week).

**Inclusion criteria**
- Subjects chosen were nonperiodontitis patients with probing depth (PD) ≤3 mm
- Permanent dentition
- Obstetrical consent.

**Exclusion criteria**
- Presence of any systemic disease which could influence the responses of periodontal tissues to the accumulation of plaque
- Presence of gross caries or inadequate restorations interfering with removal of dental plaque
- Teeth restored with crown or fillings
- Orthodontic treatment during the past 3 years.

**Clinical examination**
Simplified oral hygiene index (OHI-S), plaque index (PI), gingival index (GI), PD, and tooth mobility were evaluated for each subject participating in the study.\(^{[7-10]}\) Mobility of teeth 16, 13, 21, 23, 24, 36, 33, 41, 43, and 44 was measured with periopert [Figures 1 and 2].

The device consists of a handpiece connected by a cable to a unit which controls functions and analyzes measurements. Inside the handpiece, a metal rod is accelerated until it reaches its nominal speed and contacts the tooth. Upon impact, the tooth is slightly deflected, and rod is decelerated. The faster the deceleration, the higher the stability, and the greater the damping of periodontal tissues. The contact time between tooth and tapping head is the signal used for analysis by the system. 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 measured by the instrument that calculates the periotest valve (PTV), indicates tooth mobility. An average of three PTVs obtained was calculated. PTVs are based on a numerical scale from −8 to +50 [Table 1].

The methodology described for assessing damping characteristics of the periodontium using this device consists of the handpiece held in a horizontal position with the start button on top. Orthoradial percussion just in the middle of the vestibular tooth surface and perpendicular to the labial surface is done thrice for each tooth. During the measurement, the sleeve of the handpiece should be at a distance of 0.5 mm to 2.5 mm from the tooth. The measurement value is given by the synthetic voice and is also indicated digitally.\(^{[6]}\) The greater the stability of an object is, the quicker the deceleration of an impact load is, and thus more the object is to damp a load.\(^{[10]}\)

**Statistical analysis**
Mean and standard deviation were calculated. Data analysis was done by applying Z-test to compare the difference between two sample means.

**Observations and Results**
Table 2 shows the distribution of PTV values at first, second, and third trimester of pregnancy. Significantly greater values are seen in the third trimester of pregnancy. Table 3 shows a comparison of mean values of OHI-S, PI, and GI at first, second, and third trimester of pregnancy. There

| Table 1: Periotest value and its correlation to clinical mobility |
|----------------------|------------------|
| Values               | Mobility         |
| −8 to +9             | 0                |
| +10 to +19           | I                |
| +20 to +29           | II               |
| +30 to +50           | III              |

Figure 1: Armamentarium used for clinical examination

Figure 2: Periotest® used for measuring tooth mobility
is an increase in the gingival scores despite statistically similar plaque scores. Mean values of PD at first, second, and third trimester of pregnancy were compared in Table 4. It was seen that there was no significant difference in PD scores.

**Discussion**

Measuring the degree of tooth mobility is an important part of any thorough periodontal examination. Tooth mobility is the measurement of horizontal and vertical tooth displacement created by examiners’ force. Even a tooth with significant alveolar bone support reveals proper tooth mobility. Such physiologic tooth mobility is a product of the syndesmotic mechanism by which teeth are supported within the alveoli and the elasticity of entire alveolar process. Stability of a tooth is dependent on the resistance of its supporting structure and the character of forces directed against it. When either change so does mobility. Physiologic mobility represents the range of mobility level considered normal.

It is believed that hormonal fluctuations such as those associated with pregnancy, menstruation, and use of hormonal contraceptives lead to an increase in tooth mobility. It is undoubtedly possible that these structures react to changes in endocrine activity in a similar way the connective tissue does in other parts of the body. It is believed that this increase occurs in patients with or without periodontal disease presumably because of physicochemical changes in periodontium. The tooth-supporting structures, under the influence of hormones, would offer less resistance to the forces acting on them and accordingly a reduction in the capacity to dissipate forces and increased tooth mobility.

The present study was conducted to understand the possible association between the effects of female sex hormones during pregnancy and tooth mobility. Fifty pregnant females were examined.

Measuring tooth mobility and especially assessing changes in mobility is rather difficult. Method most commonly used to detect tooth mobility is luxation. Such methods are insufficient, nonscientific, and highly subject to individual variation. Since there was a need for a numerical assessment of tooth mobility to help assess changes during the different trimesters of pregnancy, a periotest (Siemens AG, Bensheim, Germany) was used. It is an electronic device that measures the damping characteristics of the periodontium and provides an objective measurement.

The effect of pregnancy on periodontium is more pronounced and commonly observed probably since the production of sex hormones is manifold as compared to other periods of hormonal changes.

Several authors have reported increased tooth mobility during pregnancy. In this investigation, we too found a small but statistically significant change in the values of PTV during the three trimesters of pregnancy. Highest tooth mobility values were recorded in the last month of pregnancy.

The mechanism operative in evaluating the physiological range of mobility by pregnancy hormones is difficult to elucidate. Rateitschak explained that mobility during pregnancy is increased mainly because of an increase in the initial free intrasocket movement of the roots (initial mobility) and not because of increased elastic bone distortion. Initial mobility is among other factors
dependent on the degree of vascularization and the vascular volume of the periodontal membrane. Experimental vasoconstriction and vasodilation of periodontal vessels have been shown to decrease or increase initial movement, respectively. When acting at high concentrations over longer periods of time, female sex hormones may have a hyperemic- and permeability-increasing action on the periodontal vascular system as shown for other parts of the body. In respect to the periodontal membrane, slight edema has a tooth extruding effect, increasing by this mechanism the horizontal mobility. In addition, changes in the viscosity of interstitial fluid and in the degree of ground substance polymerization and perhaps alterations of collagen fibers could also reduce resistance against intrasocket movements of roots during pregnancy.

Hence, it can be said that tooth mobility is certainly affected by the higher concentration of hormones for a longer duration of time, as seen during pregnancy. Pregnant women near or at term produce large quantities of sex steroid hormones on a daily basis. This prominent increase in plasma hormone levels over several months has a dramatic effect on the periodontium throughout pregnancy.[13]

The gingiva can be considered as a target tissue for estrogen and progesterone. Elevated levels of progesterone affect gingival microvasculature enhancing capillary permeability and dilatation. Their high concentration also affects the host defense mechanism such as neutrophil chemotactic response and also enhances the production of prostaglandins. Elevated levels of estrogen cause decrease in keratinization of gingiva with an increase in epithelial glycogen and this results in decreased effectiveness of epithelial barrier. Estrogen and progesterone reduce glycosaminoglycans synthesis and this may affect the ground substance of connective tissue. Thus, these hormones present as important influencing factors in the pathogenesis of periodontal diseases.[3]

Increase in gingivitis has been reported in conditions such as puberty, menstruation, and pregnancy.[5,9,15] Exaggerated gingival responses during pregnancy were first described during the 1800s.[16]

Clinical periodontal changes that have been described during pregnancy include increased gingival PDs, increased bleeding on probing or mechanical stimulation, increased gingival crevicular fluid (GCF) flow, and increased tooth mobility.[9,14,17] Increased transudation of fluid into the interstitial tissues allows the probe to penetrate deeper into the periodontal tissues which may result in increased gingival PD.[9] Pregnancy has shown to increase the clinical measures of gingival inflammation, but no effect on clinical attachment was seen.[18]

Pregnancy gingivitis is extremely common and affects 30%–100% of all pregnant women.[3,16] These gingival inflammatory changes usually begin during the 2nd month of pregnancy and increase in severity through the 8th month. It reflects in part a physiologic vascular phenomenon induced by increased levels of progesterone and estrogen. In the presence of dental plaque, gingival inflammation will develop superimposed on these physiologic alterations.[19]

In addition to the gingival changes seen, 0.5%–9.6% of women who are pregnant also experience localized gingival enlargement consistent with pyogenic granuloma [Figure 3].[18] First described by Coles in 1874, the pregnancy tumor develops as a result of exaggerated inflammatory response to an irritation. The etiology of the lesion may be due to an imbalance between angiogenesis enhancers and inhibitors. Overexpression of vascular endothelial growth factor and basic fibroblast growth factor and decreased amount of angiostatin may lead to the formation of pyogenic granuloma. Female steroid hormones not only enhance the quantity of angiogenic factors from activated monocytes/macrophages but also protect activated macrophages from apoptosis and thus may prolong the angiogenic effects. The combination of these effects may help inflammatory tissues cross the threshold from regular gingivitis to granuloma formation.[20]

Thus, effects of pregnancy on the periodontium are profound, since the production of sex hormones is manifold than during other periods of hormonal changes. Hence, in this study, an attempt was also made to determine the gingival condition during the three trimesters of pregnancy.

It was seen that severity of gingivitis increased throughout pregnancy, and maximum changes were seen in the third trimester. Although the plaque levels remained unchanged, there was a progressive increase in gingival inflammation with advancement in the stage of pregnancy.

The above findings are in agreement with studies by Loe and Silness and Tilakaratne et al. who found that there was a progressive increase in gingival inflammation during pregnancy and reached a maximum at the third trimester[9,18]

Figure 3: Pyogenic granuloma associated with buccal aspect of 15 and 16 in a female patient in the 12th week of pregnancy
The increase in severity of gingivitis during pregnancy has been attributed to a rise in circulating levels of progesterone affecting the gingival microvasculature. Elevated progesterone levels in pregnancy enhance capillary permeability and dilatation resulting in increased gingival exudates. The elevated levels of estrogens in pregnancy cause changes in keratinization of gingival epithelium and alter the connective tissue ground substance. The decreased keratinization of the gingiva together with an increase in epithelial glycogen results in decreased effectiveness of the epithelial barrier. These effects together with vascular changes caused by the above hormones give rise to a more overelaborate response to the irritant effects of plaque.[4,21]

Alterations in composition of subgingival plaque have been reported during pregnancy.[22] Proportions of Prevotella intermedia are increased, a situation that is positively correlated with the severity of pregnancy gingivitis. The prevalent hormones act as growth factors by satisfying the naphthoquinone requirement for this Gram-negative anaerobe.[23]

Susceptibility to infection increases during early gestation due to alterations in the immune system. Cytotoxicity toward antigen-presenting cells may diminish initial events in the development of an immune response, whereas cytotoxicity directed against B cells may result in an inadequate production of antibodies against bacteria associated with gingivitis such as P. intermedia. Decrease in the ratio of T-helper cells to T-suppressor/cytotoxic cells (CD4/CD8 ratio) may contribute to increased gingival inflammation during pregnancy as T-helper cells are thought to play a primarily protective role in the pathogenesis of periodontal diseases.[19,24]

However, the presence of plaque and preexisting gingival inflammation appear to be necessary for the subclinical hormonal changes to be manifested as overt gingivitis. In the presence of dental plaque, gingival inflammation will develop superimposed on these physiologic alterations. No notable changes occur in gingiva during pregnancy in the absence of dental plaque. Therefore, controlled oral hygiene surely improves gingival condition both during pregnancy and postpartum.[19] Yalcin et al. demonstrated that during pregnancy, periodontal therapy resulted in improvement in clinical parameters which was accompanied by a parallel decrease in prostaglandin levels in GCF.[25]

No change in the mean PD during the three trimesters of pregnancy was found. Our findings are similar to the study done by Tilakaratne et al. who concluded that the high concentrations of the circulating hormones were insufficient to cause significant periodontal breakdown and had an effect only on the gingiva.[19]

Conclusion

Our investigation showed that pregnancy did influence tooth mobility. There was a significant change with tooth mobility being the highest in the last month of pregnancy. The maximum severity of gingivitis was seen also during the third trimester of pregnancy. Hence, it can be concluded that a very high concentration of hormones over a prolonged period such as that seen in pregnancy may affect the periodontium.

However, much research is needed to address the increasing number of patients who present to our periodontal practices with sex hormone-mediated infection. Studies regarding the correlation of hormonal levels with specific tooth mobility and detailed microbiologic investigation would help us gain further insight and knowledge about issues regarding female health and periodontal therapy. Furthermore, a better understanding of periodontal changes to varying hormone levels throughout life can help dental practitioner in diagnosis and treatment.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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