Prevalence Pathologic Tooth Migration of Anterior Teeth with Moderate to Severe Periodontitis

Dr. Sudhanshu Agrawal¹, Dr. Dipti Singh², Dr. Mudit Mehrotra³, Dr. Pradeep Kumar Pandey⁴, Dr. Divyajot Kulbhaskar⁵, Dr Sunil Kumar Nayak⁶

¹ MDS, Asso. Professor, Dept. of Periodontology, Chandra Dental College & Hospital, Barabanki, U.P., India
² MDS, Asso. Professor & Head of Dept., Dept. of Oral Medicine, Chandra Dental College & Hospital, Barabanki, U.P., India
³ MDS, Consultant Prosthodontist, Lakhimpuri, U.P., India
⁴ MDS, Asst. Professor, Dept. of Prosthodontics, Chandra Dental College & Hospital, Barabanki, U.P., India
⁵ MDS Asst. Professor, Dept. of Prosthodontics, BBD College of Dental Sciences & Hospital, Lucknow, U.P., India
⁶ MDS Asst. Professor, Dept. of Oral Pathology, Vananchal Institute of Dental Sciences & Hospital, Garhwa, Jharkhand, India

Corresponding Author:
Dr Sudhanshu Agrawal
Assoc. Professor, Deptt. of Periodontology, Chandra Dental College & Hospital, Barabanki, U.P., India

Type of Publication: Original Research Paper
Conflicts of Interest: Nil

ABSTRACT
The purpose of this study was to determine the prevalence of pathologic migration of anterior teeth in patients with moderate to severe Periodontitis. The correlation between pathologic migration of anterior teeth and attachment loss (AL) was investigated, and an attempt was made to identify the most common early form of pathologic migration. Prevalence of tooth migration was studied in a group of 343 patients with moderate to severe Periodontitis before treatment. The presence of pathologic migration was determined from the chief complaint and patient awareness of tooth movement in the last 5 years. Forty-four patients (age range 18 to 69; mean = 48.75) with 75 pairs of migrated and non-migrated teeth were studied further to determine if there is a correlation between severity of periodontal AL and pathologic migration. Migrated teeth were compared to control contra lateral teeth that did not have migration. In addition, tooth mobility of the anterior teeth on 36 of the 44 patients was measured using the mobility meter. It was anticipated that tooth mobility would follow the same pattern as AL in relation to pathologic migration. The type and severity of displacement was recorded for each tooth affected by migration. The types of pathologic migration recorded were diastema, extrusion, rotation, facial flaring, and drifting into edentulous spaces. Pathologic migration prevalence was 30.03%±2.5 (103/343 subjects). The mean AL of migrated teeth (4.79 ± 0.28 mm) was significantly greater (P < 0.0001) than control teeth (3.21 ± 0.18 mm). The numeric values (called PTV) of migrated teeth (17.6 ± 1.5) were significantly greater (P < 0.0001) than control teeth (9.4 ± 1.1). It was difficult to identify a primary form of displacement, as most patients demonstrated a combination of movements. The percentage of the 44 patients who presented with a specific type of movement was: facial flaring (90.9 ± 4.4%), diastema (88.6 ± 4.8%), rotation (72.7 ± 6.8%), extrusion (68.2 ± 7.1%), and tipping (13.6 ± 5.2%). The results of this study confirm clinical impressions that periodontal disease destruction of the attachment apparatus plays a major role in the etiology of pathologic migration.

Keywords: Periodontal attachment loss; tooth migration

INTRODUCTION
One aspect of esthetic dentistry that seems to be overlooked is the problem of pathologic tooth migration related to periodontal disease. Pathologic migration is defined as a change in tooth position resulting from disruption of forces which maintain teeth in a normal position with reference to the skull. Although there is an awareness of pathologic migration, there has been very little information obtained concerning this widespread complication and thus little advancement in the diagnosis, prevention, and treatment of the problem. The prevalence of pathologic migration is not known precisely, but is a common chief complaint of periodontal patients and often motivates them to first seek dental treatment. Pathologic migration can be very disfiguring (Fig. 1).

Figure 1: Clinical Picture of Pathological Tooth Migration

Case reports and clinical observations indicate that the etiology is complex and multifactorial. This may explain why there has been very little objective information concerning this troublesome problem. Several etiologic factors have been listed for pathologic migration based mainly on clinical observations (Fig. 2).

Figure 2: Etiologic factors associated with pathologic migration.

These include periodontal attachment loss,4-8 inflamed tissues,9-12 occlusal factors,13-20 habits, loss of teeth without replacement,21-27 labial frenum,28 and iatrogenic dentistry.1-29 Specific behaviors associated with pathologic migration include bruxism,3031 tongue thrust,32-33 lip habits,34 sucking habits,34-37 and playing of wind instruments.38-39 Little scientific data have been collected to connect these etiologic factors with pathologic migration or to determine their relative importance. One controlled study reported data concerning the etiology of pathologic migration. Selwyn7 examined 30 patients whose major complaint was drifting of incisor teeth. Tooth displacement was observed visually and radiographically. Forty-five patients with periodontal disease but without pathologic migration were used as controls. Visual examination consisted of recording of overbite, lip morphology, and the habitual posture of the soft tissues. Radiographic examination consisted of a lateral skull radiograph, full-mouth periapicals, or an orthopantomograph. Degree of bone loss was measured from the intraoral radiographs, using the grid system. Skeletal pattern was determined using the lateral skull radiograph. Selwyn noted significantly higher prevalence of
skeletal Class II patients, with greater bone loss and migration of the incisors. Significantly more bone loss was found in the patients with pathologic migration than controls. The two types of migration observed were labial migration of an individual tooth or labial migration of groups of teeth. Based on published clinical observations and the Selwyn study, it appears that a major factor in the etiology of pathologic migration is destruction of tooth supporting structures. The general purpose of this clinical investigation was to obtain information concerning the prevalence, etiology, and nature of pathologic migration of anterior teeth. More specifically there were three aims to the study: 1) to estimate the prevalence of pathologic migration in patients with moderate to severe Periodontitis; 2) to determine if attachment loss (AL) was greater in displaced teeth than control teeth; 3) to study the most common type or form of pathologic migration.

**MATERIALS AND METHODS**

The prevalence of pathologic migration was studied in 343 patients seeking treatment in the Department of Periodontics, Chandra Dental College & Hospital, Safedabad, Barabanki. Patients were examined consecutively for the presence or absence of tooth displacement and moderate to severe Periodontitis. A diagnosis of pathologic migration was made by asking each patient if they were aware of anterior tooth migration in the last 5 years. Some patients offered this information as their chief complaint. Clinical evidence of the pathologic migration was verified in the patient's mouth. A diagnosis of moderate to severe Periodontitis was based on the findings of severe bone loss and probing depth. In addition, the presence of severe tooth mobility and class 2 and 3 furcations further helped to identify these patients. Patients with juvenile Periodontitis, rapidly progressive Periodontitis, and adult Periodontitis were included in the study if they had a moderate to severe form of the disease. Moderate to severe Periodontitis patients were selected for the study because clinical observations indicate that pathologic migration is very common in this group.2-3 The presence or absence of pathologic migration was based on the evaluation of the subject's chief complaint, their awareness of anterior tooth movement within the last 5 years, and on the examiner's ability to distinguish whether or not the teeth had migrated out of the normal position in the arch.

Forty-four patients (15 males, 29 females; ages 18 to 69, with mean age of 48.75 years) with pathologic migration of anterior teeth were further studied to determine if there is an association between severity of periodontal attachment loss and pathologic migration. The patients were chosen consecutively from the original 343 patients according to the following criteria: 1) presence of moderate to severe Periodontitis; 2) chief complaint and patient awareness of tooth migration in the last 5 years; and 3) presence of at least one homologous tooth without pathologic migration to be used as control. Therefore, patients with all anterior or both homologous teeth in an arch affected by pathologic migration were not included in this part of the study. Six probing depth measurements, using a manual periodontal probe, were made around each of the anterior teeth. Measurements were taken at mid-facial, mid-palatal, or mid-lingual surface of each tooth. Interproximal measurements were taken with the probe placed inside the line angle as close as possible to the interproximal contact attempting to maintain probe angulation as close as possible to the long axis of the tooth. Probing depth measurements were followed by attachment level measurements. These measurements were evaluated by determining the distance from the cemento-enamel junction to the depth of the pocket. The measurements were recorded to the nearest 1 mm. In addition, tooth mobility of the anterior teeth was determined using the mobility meter11 on 36 of 44 patients. This miniature computer device measures the damping capacity of a tooth to an applied force. This measurement has been shown to be directly related to tooth mobility and bone loss.40 It was expected that tooth mobility would follow the same pattern as attachment loss in relation to pathologic migration. Attachment loss and tooth mobility of teeth affected by pathologic migration were compared to control contra lateral teeth that did not have pathologic migration. The same 44 patients were further studied to identify the most common early form of pathologic migration. Individual teeth identified with pathologic migration were classified as to type. The types of pathologic migration recorded were diastema formation, extrusion, rotation, facial flaring, and drifting into edentulous spaces. The rationale for recording types of
Pathologic migration was to provide information concerning the early stages of pathologic migration. By identifying the most common early form of pathologic migration, insight may be gained into prevention and early treatment of this problem.

![Graph showing mean clinical loss and standard error in migrated and non-migrated teeth.](image)

**Figure 3:** Mean clinical loss and standard error in migrated and non migrated teeth

Intra-examiner reproducibility was evaluated by recording probing depths and attachment levels on 3 patients with moderate to severe adult Periodontitis. These patients were included in the primary study and underwent 3 different measurements at time intervals of approximately 20 minutes. These measurements were done with a conventional manual periodontal probe to the nearest 1 mm. The examiner was blinded to prior measurements. In total, 3 maxillary anterior sextants containing 18 teeth were included for this evaluation. Teeth were probed at 6 sites for a total of 108 sites. The results of this evaluation showed a standard deviation of 0.20 mm among the repeated measurements of the same teeth.

**RESULTS**

The prevalence of pathologic migration in the 343 patients with moderate to severe Periodontitis was 30.03 ± 2.5%SE (103/343 subjects). Seventy-five pairs of migrating and non-migrating teeth in the subset of 44 patients were compared for attachment levels. The average attachment loss in the migrated teeth of 4.79 ± 0.28 mm SE, significantly higher than an average attachment loss of 3.21 ± 0.18 mm SE in the non-migrated teeth (P < 0.0001 Wilcoxon signed rank test) (Fig. 3). A combination of types of displacements predominated in the 44 patients, making it difficult to identify a single form as the most common. The percentage of patients who presented with a particular type of movement were: facial flaring (90.9 ± 4.4%SE), diastema (88.6 ± 4.8%SE), rotation (72.7 ± 6.8%SE), extrusion (68.2 ± 7.1%SE), and tipping (13.6 ± 5.2%SE) (Table 1).

Mobility meter values (PTV) were measured in migrated and non-migrated control teeth of 36 patients. An average PTV in the migrating teeth of 17.6 ±1.5 was significantly higher than an average PTV in the non-migrating teeth of 9.4 ± 1.1 (P < 0.0001 Wilcoxon signed rank test) (Fig. 4). There was a significant correlation in the migrating and non-migrating teeth between the attachment loss and PTV with correlation coefficients of 0.59 (P = 0.0001) and 0.40 (P = 0.0008), respectively (Spearman rank correlation coefficients).

<table>
<thead>
<tr>
<th>Types Of Displacement</th>
<th>% Of Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facial Flaring</td>
<td>90.9 ± 4.0</td>
</tr>
<tr>
<td>Diastema</td>
<td>88.6 ± 4.8</td>
</tr>
<tr>
<td>Rotation</td>
<td>72.7 ± 6.8</td>
</tr>
</tbody>
</table>
Results indicated that pathologic migration was found in almost one-third of the patients studied. Teeth affected by pathologic migration had significantly more attachment loss than contralateral teeth without pathologic migration, while a combination of types of pathologic migration were noted making it difficult to identify a single form as being most common. This clinical investigation presents the first data available concerning the prevalence of pathologic migration. The prevalence of 30.03% among 343 patients with moderate to severe Periodontitis was higher than the estimated prevalence based on clinical observations and preliminary data found in the early stages of this study. The only other study that relates to the prevalence of pathologic migration reported 36.96% of periodontal patients seeking treatment presented with pathologic migration as part of their chief complaint.  
  
Tooth migration is also known to be a main symptom in patients over 40 years of age. A prevalence of such magnitude as found in this study warrants future research into the etiology, prevention, and treatment of pathologic migration. This is also the first investigation to report on the relationship of attachment loss with pathologic migration. These results confirm clinical impressions that periodontal disease destruction of the attachment apparatus plays a major role in the etiology of pathologic migration. While direct comparison with much of the published data is difficult, these results are indirectly comparable to the study by Selwyn. He studied 30 patients whose major complaint was drifting of the incisor teeth and compared them with 45 patients with periodontal disease but without pathologic migration. The degree of bone loss was measured from the intra-oral radiographs, using a grid system. The results showed significantly more bone loss in the patients with pathologic migration than controls. Selwyn used a separate cohort as controls. Understanding the multifactorial nature of migration of teeth, using the same patient as a control may be a more powerful means of studying these factors, since the factors which influence tooth position would remain relatively unchanged within an individual. Selwyn reported on two types of tooth migration, labial migration of an individual tooth and labial migration of groups of teeth. However no percentage of type or form of pathologic migration was reported. Thus, this study again represents the first concerning the percentages of different types of tooth displacement seen in patients with pathologic migration. As with all clinical studies, there are certain limitations inherent in the study design which makes interpretation difficult. For example, the population studied was not a random sample. The subjects were selected to a certain degree by their efforts to seek periodontal care at a dental school because of lower fees. A major limitation of the study was the subjective nature of determining whether the control teeth had any type of displacement or not. For this purpose an ideal arch form was estimated within the patient's arch and if any type of displacements were noted in the control teeth, the patients were not used in the controlled parts of the study. However, they were included in the prevalence data. Another limitation of the study was the method of measurement using a manual probe. Mean attachment loss difference between the migrated and non-migrated teeth was 1.58 mm. The error for manual probing is often regarded as ±1.00. Probing depth, probing force, probe angulation, state of tissue health, and tooth types and surfaces affect variability in repeated measurements. Thus, the use of a constant force automated probe in the study may have increased the reliability of the measurements. This concept, however, is refuted by Quirynen et al, who showed more reproducibility with conventional probing. Additionally, intra-examiner reliability showed a very low standard deviation of 0.20 mm, well within the error for manual probing. Mobility measurements obtained with the mobility meter indicated that teeth with pathologic migration had more mobility than teeth without migration. PTV values have previously been correlated with degree of bone loss but the relationship with attachment loss has not yet been studied. It is also known that orthodontic forces and occlusal interferences by themselves can cause tooth mobility without attachment loss. Therefore, a direct cause and effect

<table>
<thead>
<tr>
<th>Type</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extrusion</td>
<td>68.2 ± 7.1</td>
</tr>
<tr>
<td>Tipping</td>
<td>13.6 ± 5.2</td>
</tr>
</tbody>
</table>

Table 1: Percentage of 44 Subjects Presenting With Each Type of Displacement
relationship between tooth mobility and pathologic migration cannot be made. However, since loss of periodontal attachment is one of the important accepted causes of tooth mobility, the PTV values lend support to the findings in this study that loss of periodontal supporting tissues is a significant factor in the etiology of pathologic migration. Clinical observations indicate that pathologic migration has a multifactorial etiology and that attachment loss explains only a part of the etiology. Future research should be designed to analyze the role of other individual factors such as occlusion, soft tissue forces, and habits. For example, what percentage of patients with pathologic migration has these other etiologic factors present? Many patients with pathologic migration were observed to have a variety of oral habits. Therefore, further studies should be done to see what percentage of patients with tooth migration has a contributing habit. Future studies should also be designed to measure the predictability of spontaneous repositioning of migrated teeth after periodontal therapy. Case reports of such phenomenon have been reported throughout the literature;44-48 however, no controlled clinical investigations exist to substantiate such findings.

RESULTS
The results of the study suggest that loss of attachment from periodontal disease is an important part of the etiology of pathologic migration. However, from clinical observations it is obvious that other factors such as habits, occlusal interferences, and inflammation can cause tooth migration. Because of lack of objective information it is difficult to rank the other etiologic factors in order of importance.

CONCLUSION
It is hoped that new knowledge gained in this study will stimulate future research concerning this serious dental problem. Ultimately it is hoped that early diagnosis and prevention of pathologic migration will lead to less complex and time consuming treatment.

REFERENCES


45. Ross IF. Reactive positioning and improved gingival architecture, i Periodontol 1963;34:444-446.

