Correlation of Transient Bacteremia with Duration of Orthodontic Treatment

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ABSTRACT

Objective: The study was conducted to find out the correlation if any between the duration of wearing orthodontic appliances and the intensity of transient bacteremia.

Materials and methods: Study has been carried out on 50 subjects (21 males and 29 females), age ranging from 11 to 21 years, categorized in the separate groups with 25 subjects in each group of fixed (E1) and active removable appliances (E2). Both groups have been further divided into two subgroups separately, according to treatment duration; subgroup A, where treatment duration was less than 1 year and subgroup B, where treatment duration was more than 1 year. To find out transient bacteremia, blood samples from median cubital vein were collected before and after 5 minutes of brushing in all groups. Blood was cultured to observe growth of aerobic and anaerobic bacterial strains.

Results: Study indicates no association between treatment duration and transient bacteremia in Group E1 but there was significant association between treatment duration and aerobic bacterial growth in Group E2. Findings reveal that the transient bacteremia was found more in orthodontic patients wearing appliances less than 1 year than those wearing appliances more than 1 year.

Conclusion: There is significant association between treatment duration and transient bacteremia in case of active removable appliances. Further the duration of fixed orthodontic appliances in patients following proper oral hygiene instructions has no effect on transient bacteremia.

Keywords: Orthodontic appliances, Transient bacteremia, Tooth brushing, Aerobic and anaerobic bacterial strains.


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Conflict of interest: None

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INTRODUCTION

A symbiotic balanced state among the various oral microorganisms is well known in the healthy mouth. It is known that, the members of healthy microflora are traditionally non-pathogenic as long as they are confined within the oral cavity. Manipulative procedures in the oral cavity may force this microbiota into the blood and can cause local damage. The normal and abnormal state of the oral cavity is governed by the different group of microorganisms. The balanced state of the normal microbial flora gets upset during oral pathogenesis and further, it can increase the severity of oral diseases. Bacteremia is defined as the temporary presence of bacteria in the blood. The condition is not manifested by any clinical signs but may be followed by the development of embolic infections, such as arthritis, meningitis, endocarditis liver and lung abscess.

The presence of bacteria in blood stream, i.e. bacteremia may be transient, intermittent or continuous. Transient presence of bacteria in the blood is termed as transient bacteremia. Transient bacteremia may result from various manipulative orodental procedures like extractions of teeth, scaling and root planning and gingivectomy. Continuous bacteremia is defined as a kind of bacteremia where bacteria are always in the blood which may be pathogenic or non-pathogenic. Intermittent is a kind of bacteremia where the bacteria enter the blood at various time intervals which also may be pathogenic or nonpathogenic. The studies by Chung et al and Schlein et al elicit that the orthodontic procedures may be responsible for transient bacteria after tooth brushing. But, the fact remains that, the above studies were carried out on orthodontic patients wearing fixed appliances only.

Literature reveals that, there are inconsistencies regarding incidence of transient bacteremia to any one cause. Degling et al(1972) reported in his study that, no transient bacteremia is produced in fully banded orthodontic patients or nonbanded orthodontic patients after 5 minutes of chewing bubble gum. He further noticed that no transient bacteremia could be demonstrated after orthodontic banding or debanding. Bloom and Brown (1964) using paraffin
stimulating saliva sample showed that, the total microflora is greater after orthodontic bands were placed on the teeth than the before band placement. They concluded that, this was caused by the increase in area for plaque retention and that the increased number of the organisms was directly related to the number of bands placed in the mouth. Zachrisson and Zachrisson\(^9\) (1972) found that, even with good cleaning, most patients with fixed orthodontic appliances exhibited hyperplastic gingivae.\(^3\) Chung et al\(^5\) (1986) observed in a sample of 16 patients (11 showing good oral hygiene and 5 showing poor oral hygiene) that, the ten patients with good and poor oral hygiene undergoing orthodontic therapy with fixed appliances exhibited transient bacteremia. Their study demonstrated the ability of the body immune system, to reduce the bacteria of blood stream in 15 minutes. The majority of blood cultures were negative 15 minutes after brushing. Petrovitch et al\(^10\) (1986) using the same technique as that of Chung et al, did not detect any bacterial growth in blood samples taken from 26 orthodontic patients wearing fixed appliances. Schlein et al\(^6\) (1991) carried out his study on 20 patients, wearing fixed orthodontic appliances and observed that, blood samples taken from 25% of patients revealed transient bacteremia.

Kilian\(^11\) (1982) noted that, unless severe inflammation in the marginal or apical periodontium maintained, a persistent supply of bacteria to the blood stream, the transitory bacteremic condition would usually be of short duration. The bacteria were high after 5 minutes and thereafter, it reduces and becomes negative within an hour. It is cleared by the action of phagocytizing WBC. However, in some cases, the bacteria could find a suitable nidus in the body.

Hussein et al\(^12\) (2009) stated that the tooth brushing in orthodontic patients yielded to an increase in the occurrence rate of bacteremia when using normal toothpaste or no toothpaste at all. In this experiment sample consist of patients wearing fixed appliances only and checked effects of different methods of oral hygiene on bacteremia.

Dubey et al\(^13\) (2012) observed transient bacteremia in all the treatment groups fixed, active removable and myo-functional as well as in control group.

No study was done correlating transient bacteremia with treatment duration in the past. So, it was decided to take up this research project to find out the correlation, if any between the duration of wearing orthodontic appliances and the intensity of transient bacteremia.

**MATERIALS AND METHODS**

Experiments were conducted with approval from college ethics committee. Study has been carried out on 50 patients (21 males and 29 females), age ranging from 11 to 21 years, randomly selected out of about 600 patients undergoing orthodontic treatment in the Department of Orthodontics, College of Dentistry, Indore. Consent was taken from all subjects included in the study.

The patients were categorized into two separate groups with 25 subjects in each group as follows:

- **Experimental Group 1:** Subjects undergoing orthodontic treatment with ‘fixed appliances’ (E1).
- **Experimental Group 2:** Subjects undergoing orthodontic treatment with ‘active removable appliances’ (E2).

Both groups have been divided into two subgroups separately, according to treatment duration:

- **Subgroup A**—where treatment duration was less than 1 year.
- **Subgroup B**—where treatment duration was more than 1 year.

Keeping in view, the possibility of plaque influencing the status of transient bacteremia, plaque index\(^14\) and gingival index\(^15\) were also recorded in each case (Tables 1 and 2).

The guidelines observed under each of these indices were as under:

**Plaque Index\(^14\)**

- No plaque in the gingival area.
- A film of plaque adhering to the free gingival margin and adjacent area of the tooth. The plaque may be recognized only by running a probe across the tooth surface.
- Moderate accumulation of soft deposits within the gingival pocket and on the gingival margin and or adjacent tooth surface, which can be seen by the naked eye.
- Abundance of soft matter within the gingival pocket and on the gingival margin and adjacent tooth surface.

**Gingival Index\(^15\)**

- Normal gingiva
- Mild inflammation, slight change in color, slight edema, no bleeding on palpation.
- Moderate inflammation, redness, edema and glazing, bleeding on palpation.
- Severe inflammation, marked redness and edema, ulceration, tendency to spontaneous bleeding.

The oral hygiene status of all subjects were recorded weekly for the period of 1 month by using plaque index\(^14\) and gingival index.\(^15\) Subjects were educated for brushing thrice daily using Bass’s method\(^16\) and were watched to brush their teeth for 2 minutes with the help of a new soft angular tooth brush and same brand of toothpaste, except subjects of E1 who were asked to use conventional orthodontic toothbrush.
Inclusion Criteria

The following criteria were taken for selection of each subject:

- The subjects were of age group ranging from 11 to 21 years.
- First group (E1) were wearing fixed orthodontic appliances and second group (E2) were wearing active removable appliances.
- Subjects had not taken any type of antibiotic within last 30 days.
- Subjects with gingival and plaque index of 0 to 1 score.

Exclusion Criteria

Exclusion criteria for both groups included previous or ongoing rheumatic heart disease, rheumatic fever, congenital heart disease, arteriosclerotic heart disease or hematologic disease or disorders.

After their written informed consent, the subjects were prepared for the experiment. To find out transient bacteremia, blood samples from median cubital vein were collected before and after 5 minutes of brushing in all groups, using disposable 10 cc syringes with 21 gauge needles. To eliminate the possibility of spontaneous transient bacteremia at one time, four pairs of 10 ml blood samples were taken in each case at weekly interval, instead of one single time. Thus in all 400 collections were made. All subjects were instructed, not to brush their teeth, chew or eat bubble gum or hard candy for 2 hours before collection of blood sample.

Selection of Culture Medium

For the purpose of culture of blood samples, beef extract broth and thioglycolate broth (Hi-Media Company) were selected to study aerobic and anaerobic bacterial growth respectively. Aseptic technique was observed during transferring of blood into the culture media, through rubber cork to eliminate the risk of contamination. The top of the each culture bottles wiped with the ethanol ether swab and shaken the bottle with the broth gently.

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Table 2: The scoring in gingival and plaque index of the selected samples for active removable appliances (E2) group

<table>
<thead>
<tr>
<th>Sl. no.</th>
<th>Age</th>
<th>Sex</th>
<th>Treatment duration (months)</th>
<th>Gingival index&lt;sup&gt;15&lt;/sup&gt;</th>
<th>Total</th>
<th>Plaque index&lt;sup&gt;14&lt;/sup&gt;</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0 day mean</td>
<td>7th day mean</td>
<td>14th day mean</td>
<td>21st day mean</td>
</tr>
<tr>
<td>1</td>
<td>13</td>
<td>F</td>
<td>7</td>
<td>0.40</td>
<td>0.46</td>
<td>0.44</td>
<td>0.57</td>
</tr>
<tr>
<td>2</td>
<td>18</td>
<td>M</td>
<td>15</td>
<td>0.05</td>
<td>0.04</td>
<td>0.17</td>
<td>0.06</td>
</tr>
<tr>
<td>3</td>
<td>14</td>
<td>M</td>
<td>9</td>
<td>1.19</td>
<td>1.19</td>
<td>0.58</td>
<td>0.58</td>
</tr>
<tr>
<td>4</td>
<td>15</td>
<td>M</td>
<td>13</td>
<td>0.69</td>
<td>0.67</td>
<td>0.68</td>
<td>0.49</td>
</tr>
<tr>
<td>5</td>
<td>15</td>
<td>F</td>
<td>9</td>
<td>0.54</td>
<td>0.61</td>
<td>0.40</td>
<td>0.56</td>
</tr>
<tr>
<td>6</td>
<td>15</td>
<td>M</td>
<td>7</td>
<td>0.48</td>
<td>0.41</td>
<td>0.53</td>
<td>0.30</td>
</tr>
<tr>
<td>7</td>
<td>13</td>
<td>F</td>
<td>13</td>
<td>0.84</td>
<td>0.65</td>
<td>0.41</td>
<td>0.39</td>
</tr>
<tr>
<td>8</td>
<td>17</td>
<td>M</td>
<td>7</td>
<td>0.66</td>
<td>0.85</td>
<td>0.74</td>
<td>0.75</td>
</tr>
<tr>
<td>9</td>
<td>21</td>
<td>M</td>
<td>16</td>
<td>0.02</td>
<td>0.04</td>
<td>0.11</td>
<td>0.10</td>
</tr>
<tr>
<td>10</td>
<td>18</td>
<td>F</td>
<td>12</td>
<td>1.14</td>
<td>1.28</td>
<td>1.01</td>
<td>1.03</td>
</tr>
<tr>
<td>11</td>
<td>15</td>
<td>F</td>
<td>9</td>
<td>0.86</td>
<td>0.94</td>
<td>0.89</td>
<td>0.95</td>
</tr>
<tr>
<td>12</td>
<td>15</td>
<td>M</td>
<td>12</td>
<td>0.84</td>
<td>0.83</td>
<td>1.06</td>
<td>0.82</td>
</tr>
<tr>
<td>13</td>
<td>16</td>
<td>F</td>
<td>6</td>
<td>0.57</td>
<td>0.57</td>
<td>0.59</td>
<td>0.42</td>
</tr>
<tr>
<td>14</td>
<td>15</td>
<td>F</td>
<td>6</td>
<td>0.35</td>
<td>0.38</td>
<td>0.42</td>
<td>0.41</td>
</tr>
<tr>
<td>15</td>
<td>15</td>
<td>M</td>
<td>12</td>
<td>0.68</td>
<td>0.72</td>
<td>0.67</td>
<td>0.67</td>
</tr>
<tr>
<td>16</td>
<td>17</td>
<td>M</td>
<td>17</td>
<td>1.70</td>
<td>0.83</td>
<td>0.84</td>
<td>0.83</td>
</tr>
<tr>
<td>17</td>
<td>15</td>
<td>F</td>
<td>6</td>
<td>0.59</td>
<td>0.68</td>
<td>0.66</td>
<td>0.61</td>
</tr>
<tr>
<td>18</td>
<td>13</td>
<td>F</td>
<td>14</td>
<td>0.76</td>
<td>0.89</td>
<td>1.05</td>
<td>0.99</td>
</tr>
<tr>
<td>19</td>
<td>16</td>
<td>F</td>
<td>6</td>
<td>0.61</td>
<td>0.41</td>
<td>0.51</td>
<td>0.57</td>
</tr>
<tr>
<td>20</td>
<td>17</td>
<td>M</td>
<td>6</td>
<td>0.70</td>
<td>0.66</td>
<td>0.69</td>
<td>0.62</td>
</tr>
<tr>
<td>21</td>
<td>13</td>
<td>F</td>
<td>13</td>
<td>1.06</td>
<td>0.76</td>
<td>0.75</td>
<td>1.07</td>
</tr>
<tr>
<td>22</td>
<td>13</td>
<td>F</td>
<td>15</td>
<td>0.97</td>
<td>0.85</td>
<td>0.87</td>
<td>0.87</td>
</tr>
<tr>
<td>23</td>
<td>13</td>
<td>F</td>
<td>6</td>
<td>0.51</td>
<td>0.50</td>
<td>0.50</td>
<td>0.49</td>
</tr>
<tr>
<td>24</td>
<td>17</td>
<td>F</td>
<td>8</td>
<td>0.42</td>
<td>0.47</td>
<td>0.42</td>
<td>0.42</td>
</tr>
<tr>
<td>25</td>
<td>15</td>
<td>F</td>
<td>14</td>
<td>0.60</td>
<td>0.60</td>
<td>0.58</td>
<td>0.60</td>
</tr>
</tbody>
</table>

Incubation of Culture Media

All the bottles were transferred as earliest as possible to the incubators at 37°C. All the bottles were checked daily, but on 3rd and 5th day, from the bottles showing turbidity, sub culturing test were carried out for aerobic and anaerobic organisms respectively. But, for bottles showing sterile culture were observed for 7 days.

Inoculation of Culture Media into Blood Agar and Kanamycin Blood Agar

Blood agar media was used to grow a wide range of pathogens, particularly those, which are difficult to grow otherwise. Blood agar is a media of choice; it helps in detection and differentiation of hemolytic and nonhemolytic organisms especially the *Streptococcus* species. Kanamycin blood agar media—this medium was used for growth of anaerobic organisms.

Inoculation

Complete aseptic precaution was observed in this procedure, to avoid any contamination. Each time before and after use, the Nichrome wire loop was sterilized by flaming. Simultaneously, after shaking the bottles, the rubber cork of the bottle was removed and the neck of the bottle was brought near to the flame and with sterilized, cooled Ni-chrome wire loop, media was procured and transferred on to the petri dishes of blood agar and kanamycin blood agar on a small area. These petri dishes were kept in the incubators at 37°C for 30 to 40 minutes before inoculation, to get dry surface. The inoculum was spreaded on to the dishes to ensure the growth of single colony. These plates were labelled for the date and patients serial number with glass marking pencil. Blood agar petri dishes were labelled—‘A’ for aerobic and Kanamycin petri dishes with ‘An’ for anaerobic to avoid mixing of two.

Incubation of Inoculation Media

**Incubation of Aerobic Inoculated Media**

All the inoculated media petri dishes were transferred into the incubator at 37°C temperature immediately after
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inoculation. Twenty-four hours after inoculation, petri dishes were observed for growth, if any.

Incubation of Anaerobic Inoculated Media

An anaerobic atmosphere is essential for the growth of strict anaerobes; it also helps to differentiate pathogens and to isolate facultative anaerobes from specimen.

Technique: Dynamicro jar with lids were taken and silicon grease were applied generously on the rim of the jars and lids. Then, Dynox charge powder sprinkled at the bottom of the jars. Forty millilitre, 1: 4 sulphuric acid then poured on the bottom of the jar. Inoculated kanamycin petri dishes were placed into the jar and lid was closed quickly and clamped tightly. External cups of the Dynox jar were filled with 10 ml saturated solution of sodium carbonate. Vigorous reaction in the form of bubbling was observed immediately. Then, Dynox jars were kept in the incubator. After 4 to 6 hours, the reagent became clean blue, indicating thereby the anaerobic condition.

Making of Smears

Sterilized new glass slides were used for preparing smears. The slides were labelled giving the date and patients number. A drop of normal saline was kept on the slide with the help of flame sterilized Nichrome wire loop. Small amount of growth material was transferred into the normal saline of glass slides for the emulsification. Then, the slides were kept in dry air and were fixed with the help of spirit lamp and slides were transferred in a closed container. Then, all stained slides were examined under a conventional microscope, first with the 40× objective to check the staining and distribution of material and then with the help of oil immersion objective to note the type of bacteria and their morphology.17-19

RESULTS

The data were analyzed with the help of appropriate statistical technique. These are: (A) arithmetical mean and (B) Chi-square test. The Chi-square test represents a useful method of comparing experimentally obtained results with those of to be expected theoretically on some hypothesis. The observations have been made to find out transient bacteremia consequent to tooth brushing in two groups according to treatment duration.

Both groups have been further divided into two subgroups separately, according to the treatment duration, as follows:

- **Subgroup A**—where treatment duration was below 1 year.
- **Subgroup B**—where treatment duration was above 1 year.

The findings have been specifically analyzed in the lights of scoring in gingival and plaque index of the selected samples for E1 and E2 groups (Tables 1 and 2), sample distribution (Table 3), aerobic and anaerobic bacteremia—Comparison of both treatment groups according to treatment duration (Tables 4 to 7). Quantitatively aerobic and anaerobic bacterial growths were further categorized into four categories as follows:

1. No growth (or negative to negative).
2. No change (or positive to positive or S to S, H to H and M to M).
3. Change from low to high (or negative to positive or S to H, M to H and S to M).
4. Changes from high to low (or positive to negative or H to S, M to S and H to M).

Comparison of Bacteremia of Both the Groups, According to Treatment Duration

Aerobic Bacteremia (Tables 4 and 5)

In order to find the association between treatment duration and aerobic bacterial growth, the data were analyzed with the help of Chi-square test and results are given in Tables 4 to 5. For E1 subgroups, Chi-square value being 0.696 which is not significant. It indicates that the observations under various cells did not differ significantly. Thus, there was no significant association between treatment duration and aerobic bacterial growth in case of fixed appliance groups. In case of E2 subgroups, Chi-square value being 6.26 which is significant at 0.05 level with DF = 2. It indicates that the observation under various cells differed significantly from the expected. Thus, there was significant association between treatment duration and aerobic bacterial growth in case of active removable appliance group.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Mean age</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1</td>
<td>15.92</td>
<td>9</td>
<td>16</td>
</tr>
<tr>
<td>E2</td>
<td>15.36</td>
<td>12</td>
<td>13</td>
</tr>
</tbody>
</table>

Table 4: E1 group—comparison of aerobic bacteremia between subgroups A and B

<table>
<thead>
<tr>
<th>(number of observations)</th>
<th>Subgroup A</th>
<th>Subgroup B</th>
</tr>
</thead>
<tbody>
<tr>
<td>No growth (– to –)</td>
<td>38</td>
<td>22</td>
</tr>
<tr>
<td>Growth (– to + and + to +)</td>
<td>17</td>
<td>14</td>
</tr>
<tr>
<td>High to low (+ to –)</td>
<td>5</td>
<td>4</td>
</tr>
</tbody>
</table>

DF: 2; \( \chi^2 \) value: 0.69 (not significant)
Table 5: E2 group—comparison of aerobic bacteremia between subgroups A and B

<table>
<thead>
<tr>
<th></th>
<th>Subgroup A (number of observations)</th>
<th>Subgroup B (number of observations)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No growth (– to –)</td>
<td>37</td>
<td>25</td>
</tr>
<tr>
<td>Growth (– to + and + to +)</td>
<td>17</td>
<td>11</td>
</tr>
<tr>
<td>High to low (+ to –)</td>
<td>10</td>
<td>0</td>
</tr>
</tbody>
</table>

DF: 2; \( \chi^2 \) value: 6.25; Significant at 0.05 level

Table 6: E1 group—comparison of anaerobic bacteremia between subgroups A and B

<table>
<thead>
<tr>
<th></th>
<th>Subgroup A (number of observations)</th>
<th>Subgroup B (number of observations)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No growth (– to –)</td>
<td>37</td>
<td>25</td>
</tr>
<tr>
<td>Growth (– to + and + to +)</td>
<td>17</td>
<td>12</td>
</tr>
<tr>
<td>High to low (+ to –)</td>
<td>6</td>
<td>3</td>
</tr>
</tbody>
</table>

DF: 2; \( \chi^2 \) value: 0.19 (not significant)

Table 7: E2 group—comparison of anaerobic bacteremia between subgroups A and B

<table>
<thead>
<tr>
<th></th>
<th>Subgroup A (number of observations)</th>
<th>Subgroup B (number of observations)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No growth (NG) (– to –)</td>
<td>44</td>
<td>26</td>
</tr>
<tr>
<td>Growth (GR) (– to + and + to +)</td>
<td>14</td>
<td>8</td>
</tr>
<tr>
<td>High to low (HI-LO) (+ to –)</td>
<td>6</td>
<td>2</td>
</tr>
</tbody>
</table>

DF: 2; \( \chi^2 \) value: 0.46 (not significant); Quantitative grading of E1, E2 (NG: No growth; GR: Growth; HI-LO: High to low)

Anaerobic Bacteremia (Tables 6 and 7)

In order to find the association between treatment duration and anaerobic bacterial growth, the data were analyzed with the help of Chi-square test and results are given in Tables 6 and 7. From the Tables, it can be seen that Chi-square value of 0.19 and 0.461 for E1 and E2 subgroups respectively were found to be not significant. It means that there is no association between treatment duration and anaerobic bacterial growth.

DISCUSSION

The studies exhibiting transient bacteremia consequent to tooth brushing in cases undergoing orthodontic treatment with fixed appliances were bound to cause apprehension in the mind of orthodontists. It raises the question, whether orthodontic treatment for long duration could pose a danger to the health of the patients through increase in bacterial count by various manipulative orodental procedures including brushing. Above studies on the transient bacteremia were carried out on orthodontic patients wearing fixed appliances only.

Even the sample size of these studies was small and not enough to conclude the results. So, it cannot be considered authentic to prove the harmful effect of transient bacteremia after brushing in patient wearing different orthodontic appliances for more than 1 year and the statement made by these authors that, the transient bacteremia observed in patients wearing fixed orthodontic appliances could alarm deleterious consequences. None of the previous study evaluated the effect of duration of orthodontic treatment on transient bacteremia.

Keeping in view above controversy, the present study was undertaken to find out the transient bacteremia in orthodontic patients to two groups namely; wearing fixed and active removable appliances were taken for the purpose of comparison to find out, if there is any significant difference in the occurrence of transient bacteremia on the basis of duration of wearing appliances.

In present study, the aerobic bacterial strains—Staphylococcus, Streptococcus beta haemolyticus, Streptococcus nonhaemolyticus, Sarcina, Bacillus subtilis and anaerobic bacterial strains—Staphylococcus, Streptococcus beta haemolyticus, Streptococcus nonhaemolyticus, anaerobic cocci, Bacteroides fragilis, Gram-positive bacilli, Fusobacterium, Bacteroides melaninogenicus, Bacillus subtilis were found.

The result of this study confirms the findings of Chung et al in many aspects:

- Observed positive cultures before and after brushing.
- Negative blood culture before brushing was anticipated, but it showed positive culture.
- Grampositive and gramnegative anaerobic bacterial strains were recovered.

Unlike Petrovitch findings aerobic and anaerobic bacteria were found in both pre and post brushing samples in all treatment groups. Similar to Schlein’s study aerobic and anaerobic bacteria were also recovered in the post brushing samples.

Several factors in the present study may be considered responsible for recovery of bacteria in blood sample after brushing as follows:

- Favorable timing of blood sampling, i.e. 5 minutes after brushing on the basis of studies of Kilian’s and Schlein et al.
- Increased blood volume sample (10 ml).
- Paired culture bottles, presence of aerobic and anaerobic bacteria in the present study may be attributed to the selection of paired culture bottles as taken by Schlein et al, whereas Chung et al used a single bottle culture.

In present study, the Chi-square value being 0.696 for fixed appliance group (E1). In fixed appliance 17 observations showed negative to positive growth in subgroup A in comparison with subgroup B where only 14
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observations showed negative to positive aerobic growth. In high to low growth subgroup A showed 5 in comparison with subgroup B with 4 observations (Table 4). Thus, there was no significant association between treatment duration and aerobic bacterial growth in case of fixed appliance group.

The Chi-square value being 6.25 for active removable appliance group (E2), which is significant at 0.05 level with DF = 2. In active removable appliance, 17 observations showed negative to positive growth in subgroup A in comparison with subgroup B where only 11 observations showed negative to positive aerobic growth. In high to low growth, subgroup A showed 10 in comparison with subgroup B with 0 observation (Table 5). The result of this study indicates significant association between treatment duration and aerobic bacterial growth in E2 group.

The Chi-square value being 0.19 for fixed appliance group (E1). In fixed appliances 17 observations showed negative to positive in subgroup A in comparison with subgroup B where only 12 observations showed negative to positive anaerobic growth. In high to low growth, subgroup A showed 6 in comparison with subgroup B with 3 observations (Table 6). The Chi-square value being 0.46 for active removable appliance group (E2). In active removable appliance 14 observations showed negative to positive growth in subgroup A in comparison with subgroup B where only 8 observation showed negative to positive anaerobic growth. In high to low growth, subgroup A showed 6 in comparison with subgroup B with 2 observations (Table 7). It means that there is no significant association between treatment duration and anaerobic bacterial growth.

On comparison of percentage of number of observations of aerobic bacteremia of E2 groups according to treatment duration, it was found that the aerobic transient bacteremia observed in subjects wearing active removable orthodontic appliances for more than 1 year, was found less than those wearing appliances less than 1 year. It could be due to patient’s higher oral health awareness as treatment progresses or the body in course of time is capable to produce antibodies against the induced antigen.

Some of the workers5,6 have expressed their apprehension that, in patients with a history of rheumatic heart disease, infective endocarditis, congenital heart defects, prosthetic valve replacement, transient bacteremia can increase the risk of bacterial endocarditis and present a special problem in orthodontic treatment. Whereas, the results of this study show that the risk of transient bacteremia in patients undergoing orthodontic treatment for more than 1 year, with fixed orthodontic treatment is not anyway higher as there was no association of transient bacteremia with treatment duration. Moreover, Alpha streptococci and Streptococcus viridans reported the most frequent causative organism by Johnson, Rosenthal, Nadas20 and Egglestan21 were not spotted in present study nor these have been recorded by Chung et al7 and Schlein et al.8 Thus, a dogmatic statement the orthodontic treatment poses a danger of bacterial heart lesions does not seem to be justified and lacks scientific support.

Moreover, according to current concept of immunology,22 only the presence of pathogens need not be sufficient for disease activity to occur. Initiation and progression of disease is a resultant of interplay between a large number of factors and in order that the disease result from this pathogen.

- It must be a virulent clonal type.
- It must process the chromosomal and extra chromosomal genetic factor to initiate disease.
- The host must be susceptible to pathogen.
- The pathogen must be in number sufficient to exceed the threshold of that host.
- It must be located at the right place.
- Other bacterial species must foster, or at least not inhibit the process.
- The local environment must be one which is conducive to the expression of species virulence properties.

The findings of these studies, thus endorse the concept of immunology to clear the confusions and controversies regarding the risk of bacterial endocarditis and other lesions related to manipulative orodental procedures, specially the orthodontic treatment.

Further research with large sample sizes for long duration are warranted for establishing more significant values of all the parameters measured under this study.

CONCLUSION

On comparing the different treatment groups, according to treatment duration, it was interesting to note that the transient bacteremia was found more in orthodontic patients wearing appliances less than 1 year than those wearing appliances more than 1 year. It shows orthodontic appliances would not affect patients health adversely under proper oral hygiene care.

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