Prevalence and Antimicrobial Susceptibility Pattern of Pathogens Isolated from Patients with Juvenile Periodontitis in Jamaica: A Prospective Multi-centre Study of 15 Cases over a 15-year Period

C Ogunsalu¹, H Daisley², PE Akpaka²

ABSTRACT

Prevalence and antimicrobial susceptibility pattern of most frequent pathogens isolated from patients treated with juvenile periodontitis at three separate dental centres in Jamaica from 1989 to 2003 were studied. Swabs were taken from these patients periodontal pathologic pocket or root of most of their teeth with active disease processes. These swabs were processed at the microbiology department of the University Hospital of the West Indies Kingston, Jamaica and the Microbiology laboratory, School of Veterinary Medicine, Faculty of Medical Sciences, University of the West Indies, St. Augustine, Trinidad and Tobago. The identification of the micro-organisms from positive cultures and their antimicrobial susceptibility profile were performed using standard microbiological procedures and disk diffusion (Kirby-Bauer) methods. Over 80% of the patients were females. The most frequent micro-organisms isolated were Enterobacter (40.5%), followed by Klebsiella species (19%) and Acinetobacter species (10.8%). Actinobacillus actinomycetemcomitans, a widely known key pathogen in juvenile periodontal diseases was encountered only in 5.4% (2/37) of the cases in this study. The most frequent organism isolated were still highly susceptibility to the commonly used and available antimicrobials such as amoxycillin/clavulanate,trimethoprim/sulphamethoxazole, chloramphenicol and aminoglycosides.

The most frequent pathogens encountered in this study were totally different from what obtains in other places. There is the need to be aware of microbes in other countries during the microbiology investigations of juvenile periodontitis and that the antimicrobial chemotherapy should always be based on susceptibility test results. Surgical treatment for mechanical debridement of the site and bone grafting with guided tissue regeneration should be mandatory in conjunction with specific antimicrobial chemotherapy.

Keywords: Juvenile, pathogens, periodontitis

Prevalencia y Patrón de Susceptibilidad Antimicrobiana de Patógenos Aislados de Pacientes con Periodontitis Juvenil en Jamaica: Estudio Prospectivo Multicentro de 15 Casos por un Período de más de 15 Años

C Ogunsalu¹, H Daisley² PE Akpaka²

RESUMEN

Se estudió la prevalencia y el patrón de susceptibilidad antimicrobiana de los patógenos más frecuentemente aislados de los pacientes tratados por periodontitis juvenil en tres diferentes centros

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INTRODUCTION
Periodontitis is a chronic inflammation of supporting tissues of the teeth with progressively destructive changes that lead to loss of the supporting bone and periodontal ligament. Three types of periodontitis acute, chronic and juvenile are described in the literature. These entities, particularly juvenile periodontitis, can be mistaken for rapidly progressive periodontitis seen in AIDS and the varying degrees of periodontal bone loss associated with systemic conditions such as diabetes mellitus and syndromes such as Papillon-Lefèvre syndrome (1).

Following the recent reclassification of periodontal diseases, aggressive periodontitis is the term now given to those conditions previously known as juvenile periodontitis and rapidly progressive periodontitis (2). Juvenile periodontitis is a localized or generalized (rapidly progressive) degenerative disease of the periodontium. It is a relatively uncommon disease with a predilection for females and may have a higher prevalence in developing countries and among black patients (3, 4). It can be differentiated from acute or chronic periodontitis because of its specific clinical and radiological presentation.

The understanding of the aetiology of periodontal disease has improved markedly over the last three decades. Several studies have evaluated the micro-flora typically associated with periodontitis (including juvenile periodontitis) and available data strongly implicate such organisms as relevant aetiological pathogens including, *Actinobacillus actinomycetemcomitans*, *Tannerella forsythensis* (formerly *Bacteroides forsythus*), *Campylobacter rectus*, *Eikenella corrodens*, *Eubacterium species*, *Fusobacterium nucleatum*, *Porphyromonas gingivalis*, *Prevotella intermedia*, *Micro mona micros* (formerly *Peptostreptococcus micros*), *Trep onema denticola* as well as viruses (5–7).

Factors such as genetic and environmental have also been known to be strongly associated with different patterns of colonization by periodontal pathogens (8–10). *Pseudomonas aeruginosa*, *E coli* and several other pathogenic microbes have achieved sophistication in the type of characteristic secretory systems they have to produce highly specialized translocation machinery that is able to promote processes that enable their adherence and/or internalization (11–12).

The purpose of this present study is to highlight the prevalence of some other common bacterial pathogens that could be associated with juvenile periodontitis and their antimicrobial susceptibility patterns for an understanding by healthcare providers of the varying aetiology, epidemiology and geographical agents of the disease.

SUBJECTS AND METHODS
Clinical evaluation
This was an observational prospective study that involved 26 swabs taken from appropriate sites in the oral cavity of 15 patients with clinical and radiological features of juvenile periodontitis seen at three dental centres in Jamaica between 1989 and 2003. The dental centres were Chapelton Community Hospital located in the central region; “Fish” Medical and Dental Clinics in the southeast region and Cornwall
Dental Centre located in the northwest region of the country, respectively.

**Specimen collection and processing**
The swabs on each occasion were taken from the periodontal pathologic pocket or root of most of the affected teeth with active disease processes. Swabs were taken using Ames and transported at room temperature to the laboratory within 24 hours for processing. The specimens were processed at the Microbiology department at the University Hospital of the West Indies, Kingston, Jamaica and the Microbiology laboratory, School of veterinary medicine, Faculty of Medical Sciences, University of the West Indies, St. Augustine, Trinidad and Tobago at different times during the study period.

Gram-staining was performed on each clinical specimen and this was followed by culture using appropriate solid media such as blood agar, chocolate agar, sabourauds agar etc and were incubated at 35–37°C overnight under both aerobic and anaerobic conditions.

**Isolates identification and susceptibility tests**
Specimens that yielded positive growth in the culture were further subjected to biochemical tests such as catalase, coagulase, oxidase, several sugar tests and so on to identify the organism growing from the swab.

The disk diffusion (Kirby-Bauer) methods were used to determine the antimicrobial susceptibility profiles of the microbial isolates from the swabs following Clinical Laboratory and Standards Institute, CLSI recommendations (13). The antibiotics tested included ampicillin, amoxycillin-clavulanate, chloramphenicol, trimethoprim-sulphamethoxazole, gentamicin and amikacin. All the patients had surgery and were treated with the appropriate antibiotic regime for the isolated pathogens. Post “appropriate” antimicrobial chemotherapy, culture and susceptibility test were done for only one patient, particularly because she requested advanced fixed restoration for her missing teeth that was lost because of juvenile periodontitis.

Each patient also had radiological examinations of the site of the periodontitis. All the patients gave their permission to be included in the study when consented for treatment at the different dental centres.

**RESULTS**
All the patients included in this study presented with clinical and radiological features consistent with a diagnosis of juvenile periodontitis. A photograph of one of the affected teeth as well as a radiological picture of one of the cases with juvenile periodontitis is shown in Figs. 1 and 2a–b. Also, a summary of the distribution of the sites of swab collection and the micro-organisms isolated are depicted in Table 1. Of the 26 swab specimens collected from these 15 patients (13 females and 2 males, ages between 11 and 28 years, mean

![Fig. 1: A photograph of one of the patients seen in Jamaica with severe pathological migration of the upper anterior with clinical grade 3 mobility.](image)

<table>
<thead>
<tr>
<th>Patient</th>
<th>Site of swab</th>
<th>Micro-organism isolated</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Gingival crevice</td>
<td>Enterobacter spp</td>
</tr>
<tr>
<td>2</td>
<td>PPP of 32</td>
<td><em>Candida albicans</em>, Enterobacter spp</td>
</tr>
<tr>
<td>3</td>
<td>PPP mesial side of 17</td>
<td><em>K. oxytoca</em> &amp; Enterobacter spp</td>
</tr>
<tr>
<td>4</td>
<td>Gingival crevice of 16</td>
<td>Enterobacter spp, Acinetobacter spp, <em>Alcaligenes spp</em></td>
</tr>
<tr>
<td>5</td>
<td>Apex of 46 post extraction</td>
<td><em>Staph aureus</em>, Klebsiella spp</td>
</tr>
<tr>
<td>6</td>
<td>Gingival crevice 35</td>
<td>Enterobacter spp, Acinetobacter spp, <em>P. aeruginosa</em>, <em>K. oxytoca</em></td>
</tr>
<tr>
<td>7</td>
<td>Gingival crevice 36</td>
<td>Enterobacter spp</td>
</tr>
<tr>
<td>8</td>
<td>PPP of 11</td>
<td>Enterobacter spp</td>
</tr>
<tr>
<td>9</td>
<td>PPP of 16</td>
<td>Enterobacter spp</td>
</tr>
<tr>
<td>10</td>
<td>PPP of 21</td>
<td>Microaerophilic Strep, Klebsiella spp</td>
</tr>
<tr>
<td>11</td>
<td>Gingival crevice of 21</td>
<td>Enterobacter spp &amp; Klebsiella spp</td>
</tr>
<tr>
<td>12</td>
<td>PPP of 41</td>
<td>Enterobacter spp</td>
</tr>
<tr>
<td>13</td>
<td>Gingival recession of 41</td>
<td>Enterobacter spp</td>
</tr>
<tr>
<td>14</td>
<td>PPP of 26</td>
<td>Enterobacter spp, Klebsiella spp</td>
</tr>
<tr>
<td>15</td>
<td>Gingival recession of 26</td>
<td>Enterobacter spp</td>
</tr>
<tr>
<td>16</td>
<td>PPP 18</td>
<td>No organism isolated</td>
</tr>
<tr>
<td>17</td>
<td>Gingival recession 11</td>
<td><em>A. actinomycetemcomitans</em></td>
</tr>
<tr>
<td>18</td>
<td>Gingival recession 31</td>
<td>Enterobacter spp</td>
</tr>
<tr>
<td>19</td>
<td>Gingival recession 41</td>
<td>Microaerophilic Strep spp</td>
</tr>
<tr>
<td>20</td>
<td>No swab taken</td>
<td>–</td>
</tr>
<tr>
<td>21</td>
<td>PPP of 45</td>
<td>No organism isolated</td>
</tr>
<tr>
<td>22</td>
<td>Gingival crevice of 22</td>
<td><em>A. actinomycetemcomitans</em></td>
</tr>
<tr>
<td>23</td>
<td>PPP of 46</td>
<td><em>P. aeruginosa</em></td>
</tr>
<tr>
<td>24</td>
<td>PPP of upper anterior teeth</td>
<td><em>S. viridans</em>, Enterobacter spp</td>
</tr>
</tbody>
</table>

PPP = Periodontal pathologic pocket
The Enterobacter species demonstrated poor susceptibility to oral antibiotics including ampicillin (48.8%) and amoxicillin-clavulanate (21.4%); and high susceptibility to trimethoprim-sulphamethoxazole (93.8%), chloramphenicol (93.8%) and excellent (100%) susceptibility pattern to the aminoglycosides – gentamicin and amikacin. Klebsiella species susceptibility to amoxycillin-clavulanate, trimethoprim-sulphamethoxazole and chloramphenicol were perfect. Acinetobacter species also had an excellent (100%) susceptibility to trimethoprim-sulphamethoxazole and amikacin. Only one of the cases had a post-antimicrobial treatment culture and susceptibility tests done and these revealed complete eradication of the pathogenic organisms. Post-treatment culture was not done for the rest of the patients because they responded very well to the appropriate antibiotic treatment in conjunction with surgical manipulation.

**DISCUSSION**

The microbiological findings of this series clearly show a variation from what has been previously documented by other authors throughout the world as indicator micro-organisms or key pathogens that include Actinobacillus actinomycetemcomitans, T. forsythenesis, Eubacterium species, Porphyromonas and Prevotella species that are implicated in the initiation and progression of Juvenile periodontal diseases (14–16).

Enterobacter, Klebsiella and Acinetobacter species were the most encountered micro-organisms in this study, and to the best of our knowledge, none of these microbes has been described in literature as associated with any form of Juvenile periodontal disease. These organisms are widespread throughout the environment or vegetal sources (17). The Enterobacter and Klebsiella species are opportunistic pathogens belonging to the enterobacteriaceae family that includes several other microbes. They are facultative gram-negative rods and are described as glucose and lactose...
fermenters, oxidase negative, capable of reducing nitrates to nitrites. While Enterobacter species are motile, Klebsiella species are not. Their virulence or pathogenicity lies in the fact that both organisms can establish infection through several factors such as their fimbriae, prominent capsule, cell wall containing lipopolysaccharide that act as endotoxin. These factors provide these organisms with an increased resistance to phagocytosis and the action of complement and antimicrobial resistance mechanisms (17).

*Actinobacillus actinomycetemcomitans* that is regarded as a key pathogen or most notorious bacterium linked to periodontitis, has been demonstrated to evade host defenses by different mechanisms such as production of leukotoxins, collagenase, polymorphonuclear (PMN) chemotaxis-inhibiting flora factors after its initial colonization (18–22).

A minimal number of the micro-organisms that were isolated in this study were gram-positive cocci. This is in contrast to reports from other researchers that observed a high relative proportion of gram-positive facultative cocci such as *S. aureus* and Streptococcus species (15).

The three most frequently isolated micro-organisms in this study (Enterobacter spp, Klebsiella spp and Acinetobacter spp) had good susceptibility to many common and easily available antimicrobial agents in our locality. Since they were not the regularly isolated pathogens in previous reports by other researchers, report on their susceptibility is tardy. Although only a few classes of antimicrobial agents had their susceptibility tests performed for Enterobacter, Klebsiella and Acinetobacter, these organisms still had very high susceptibility rates to the commonly used and available antimicrobials in the country.

All the cases encountered in this present study were placed on the appropriate antimicrobial agent based on the culture and susceptibility test results.

In summary, the most predominant organism in cases with juvenile periodontitis from Jamaica is the Enterobacter species. The antimicrobial chemotherapy was predominantly based on the outcome of culture and susceptibility testing. We propose that further studies in other countries on the microbiology of juvenile periodontitis should always look out for these other organisms that were encountered in the present study from Jamaica and that antimicrobial treatment should always be based on susceptibility test results. Surgical treatment of juvenile periodontitis should also be mandatory.

**REFERENCES**