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Veillonella parvula: An update from a stomatological point of view

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Abstract
Introduction: Veillonella species found in oral cavity are among the most abundant members of the oral flora, they are involved in bone and joint infections.
Objective: To analyze the literature on *V. parvula*, particularly bacteremia, treatment, colonization of dental implants, and symbiosis with other microorganisms.
Methodology: A review of the literature was carried out in the databases PubMed, Google Scholar and SCOPUS with the words ¨*Veillonella parvula* and Treatment and Clinical Advancements and biological markers, and dental implants".
Results: *Veillonella parvula* has different clinical manifestations and usually presents in a variety of systemic diseases. Among its treatment is the use of antibiotics, surgical lavage and photodynamic therapy. This bacterium is a very effective colonizer of dental implants of different composition. It is related to several oral microorganisms, including *Streptococcus*, *Fusobacterium* nucleatum and *Aggregatibacter actinomycetemcomitans*.
Conclusion: It is important to identify *V. parvula* for proper treatment, as it exacerbates various oral diseases by making symbiosis with other oral pathogens.

Keywords: *Veillonella parvula*", "bacteremia", "colonization", "symbiosis, "treatment

1. Introduction

Veillonella parvula is a bacterium that can cause microbial spondyscystis; it is a poorly studied bacterium because it is so rare [1]. *Veillonella parvula* is a gram-negative anaerobic coccus that is rarely involved in bone and joint infections. It is a commensal and opportunistic pathogen that inhabits complex human microbial communities, including the gut and dental plaque microbiota. It has also been observed to have anaerobic anthracene biodegradation activity in non-smoking patients, and because of this the microbiome of the oral cavity is not affected [2, 3, 4]. This bacterium is a high colonizer in endodontic infections [5]. *Veillonella parvula* has been found not to colonize dental implants as successfully [6] and may cause preorbital cellulitis [7]. *Veillonella parvula* may be involved in caries development through interactions with *Streptococcus* mutans [8], is closely linked to hepatic encephalopathy [9] and has also been found to promote intestinal inflammation [10].

Veillonella parvula has a natural competence ability that is highly influenced by the composition of the growth medium and is useful for genetic manipulation of the bacterium [11].

There is no adequate review of *Veillonella parvula* in the literature from a stomatological point of view, therefore, the objective is to review the importance of this bacterium on dental field, particularly; bacteremia, treatment, dental implant and symbiosis with other microorganisms.

2. Materials and Methods

Articles on the subject published through the PubMed, SCOPUS and Google Scholar databases were analyzed, with emphasis on the last 5 years. The quality of the articles was evaluated using guidelines, i.e., identification, review, choice and inclusion.

The quality of the reviews was assessed using the measurement tool for evaluating systematic reviews [12]. The search was performed using Boolean logical operators AND, OR and NOT; with the keywords: "*Veillonella parvula*", "bacteremia", "treatment", "dental implant ", "microbiota". The keywords were used individually, as well as each of them related to each other.

3. Results and Discussion

3.1 Bacteremia Due to *Veillonella parvula*

It has been documented that *Veillonella parvula* can cause spondylitis [1], osteomyelitis [3], and epidural abscesses in immunocompromised patients [13]. This bacterium has been seen in children with pneumonia [14] and acromioclavicular septic arthritis [15], reduces the activity of bronchial epithelia in obstructive pulmonary disease [16, 17] and produces nasal sepsis [18]. It has also been found at a high level in patients with COVID 19 [19], as well as with early childhood caries [20], lung cancer [21], nasopharyngeal carcinoma [22], and epithelial squamous cell carcinoma [23]. It has effects in patients with cell death in oral epithelium [24] and with severe alcoholic hepatitis [25], while it was increased in patients using proton pump inhibitors as treatment [26]. This bacterium is also elevated in the same way in patients with Sjorgen's syndrome [27] and with nephropathies [28].

Several authors conclude that *Veillonella parvula* bacteremia can cause different clinical manifestations and symptomatology in patients, such as spondylitis, arthritis, reduced bronchial activity and nasal sepsis in patients with different ages and comorbidities. Likewise, this bacterium seems to be increased in different systemic diseases such as COVID-19, cancers, etc.

3.2 Treatment

Veillonella parvula is generally considered a contaminating bacterium associated with polymicrobial infection. Antibiotics recommended in the therapy of infections caused by Veillonella species include penicillins, metronidazole, cephalosporins, aminoglycosides, imipenem, clindamycin, doxycycline, erythromycin, and chloramphenicol [29]. The use of ceftriaxiona together with amoxicillin with clavulanic acid has also been shown to be effective in patients with endocarditis with bilateral abscess and osteomyelitis in a 6-month recovery [30]. However, in another investigation in anaerobic bacteria, including *Veillonella parvula*, greater pharmacological tolerance to amoxicillin and clindamycin was found, presumably due to metabolic changes of the bacteria residing within the biofilm [31]. In addition, in another study, when treating fibrous cystitis with antibiotics, *Veillonella parvula* and other bacteria were not affected [32]. This bacterium is resistant to herbal treatments, such as Armoracia rusticana and Capuchina [33].

In particular cases, such as *Veillonella parvula* bacteremia making a nasal abscess, drainage may help to relieve symptoms [18]. Surgical lavage has been shown to be effective in patients with sepsis of the acromioclavicular joint infected by *Veillonella parvula* [15]. Photodynamic therapy has been shown to be effective in the treatment of this bacterium [34] and a toothpaste with amorphous calcium phosphopeptide-phosphate in the mouth has also shown effectiveness [35].

Veillonella parvula shows different bacterial resistances and has different types of treatment, such as drainage and surgical lavage, the use of pastes and photodynamic therapy is equally effective. The use of different antibiotics in hospital use has shown efficacy on certain occasions and more research is required to determine the best treatment.

3.3 Colonization of dental implants

Veillonella parvula is an early colonizer of dental implants in adult patients. Implants with moderately rough surfaces accumulated more bacterial biomass and significantly higher numbers of pathogenic bacteria [36]. Sloped implants had significantly higher mean probing depth and plaque index compared to axial implants [37]. Biofilm control of dental implants is hampered by their design and can cause oral and systemic problems, mainly in immunocompromised patients such as the elderly. Knowledge about the microbiota reinforces awareness of the need for periodic maintenance of professional cleaning [38]. In a study of 46 young people, they found that this bacterium is a colonizer on implants in young patients [39]. *Veillonella parvula* together with *Fusobacterium* nucleatum colonize implants on the first day of placement [40]. This bacterium has adherence to sterile titanium, hydroxyapatite and zirconium implants [41].

To reduce colonization on dental implants, titanium disc antibiotics have been used with implant solutions in combination with 0.12% chlorhexidine brushing and 0.05% cetylpyridinium chloride mouthwash, measured with polymerase, and showed a reduction of bacteria at 48 and 72 hours [42]. Probiotics have also been shown to be effective in drastically reducing biofilm formation by secondary colonizers that act as bridges, thus inhibiting biofilm formation on the titanium surface [43]. Peptide-based coatings have been shown to reduce the colonization of *Veillonella parvula* and other bacteria by 25% [44].

This bacterium is a colonizer of dental implants of different composition, there have been investigations on how to avoid its colonization and all have shown positive results, mainly with antibiotics and chlorhexidine.

3.4 Symbiosis with Other microorganisms

The Veillonella family, including *Veillonella parvula*, can form a biofilm with different *Streptococcus* families such as *Streptococcus* mutans, *Streptococcus* gordonii and *Streptococcus* salivarius [45]. Veillonella acts as a bridge to different bacteria such as *Streptococcus* gordonii and *Fusobacterium* nucleatum, producing nutrients for the survival and growth of periodontal pathogens [46]. In one study, *Veillonella parvula*, *Fusobacterium* nucleatum and *Aggregatibacter actinomycetemcomitans* were found to have interactions with each other, making a mutualism for the progression of periodontal disease [47]. Another investigation showed that there is coaggregation of *Veillonella parvula* with *Streptococcus* gordonii in saliva [48]. Likewise, several studies demonstrated that the Veillonella family coaggregates with the *Streptococcus* family [49]. As well as *Veillonella parvula* was found to interact with *Streptococcus* mutans in helping with dental caries [8]. In one study, it was shown that between 4 and 8 hours after plaque development, dominant strains of Veillonella change in their phenotypic characteristics (Coaggregation and antibody reactivity), as well as in their genotypic characteristics (16S RNA gene sequences, as well as strain-level fingerprinting patterns). This succession is coordinated with the development of mixed-species bacterial colonies. Changes in community structure can occur very rapidly in the development of natural biofilms, and it is suggested that this process may influence evolution within this ecosystem [50].

Veillonella parvula interacts with other bacteria such as *Streptococcus*, *Fusobacterium* nucleatum and

Aggregatibacter actinomycetemcomitans to form biofilm communities and thus, manifest oral pathologies such as caries and periodontal disease.

4. Conclusions

Veillonella parvula is a poorly studied bacterium that can manifest itself differently in symptomatology. Its treatment is mainly with antibiotics, although it is still being studied to determine the most effective way to eliminate it. This bacterium has been increased with different diseases and has been shown to colonize dental implants of different composition. It interacts with *Streptococcus*, *Fusobacterium* and Aggregatibacter, forming a biofilm in the oral cavity creating a variety of pathologies.

Author's Contribution

Not available

Conflict of Interest

Not available

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Not available

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