Review Article

Incidence of Microbes on Dental Implants

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ABSTRACT

Dental implants are inert, alloplastic materials embedded in the maxilla or mandible for the management of tooth loss and to aid replacement of lost orofacial structures as a result of trauma, neoplasia and congenital defects. The most common type of dental implant is endosseous comprising a discrete, single implant unit (screw- or cylinder-shaped are the most typical forms) placed within a drilled space within dentoalveolar or basal bone. Microbial colonization and host-tissue integration are fundamentally related with molecular principles of cell attachment and adhesion. Thus, implant materials, which are chosen because of their "friendliness" to tissue cells, offer particularly conducible environment for bacterial adhesion. The long term success of a dental implant strongly depends on good adhesion of the surrounding tissue to the biomaterial. The interactions between bacteria and oral implant materials show microbial adhesion and aggregation. Colonization of the the oral cavity by bacteria in humans starts at birth and remains constant through life. Large quantities of lactobacillus spp, responsible for biofilm adhesion, and Streptococcus spp (mainly *S. sanguinis, S.oralis, S.mitis* and *S. sobrinus*), which promote biofilm growth, are initial colonisers.Actinomyces spp and Gram-negative species are found in low proportion at this phase. However a variety of bacterial species are transitory in the oral cavity.

The person's satisfaction with a prosthetic rehabilitation of dental care on a person as a whole has both positive and negative impact on their life. The present review emphasizes the microbial population after implantation, its affinity towards various types of implants and the social impact of it towards the life of people.

Keywords: Alloplastic material, actinomycetes spp, biofilm, gingival sulcus, implant-abutment interface, osseointegration, peri-implant microbiota, streptococcus spp

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INTRODUCTION

The social recognition of implants in dentistry has shown a dramatic increase in recent years. In Japan the term "implant" has come to represent dental implant. However, the definition of a dental implant: "artificial material that is inserted into the jawbone or the periosteum by an invasive method, which can be used as a substitute for teeth", is vague, and has not been strictly defined [1]. An appropriate name for a dental implant that will suit the current practice would be the term, "artificial root". Implant is defined as "an artificial material or tissue that shows biocompatibility upon its surgical implantation". This is inclusive of implants that are removed afterwards for diagnostic or experimental purposes [1].

HISTORY OF IMPLANTS

Table 1: History of Implants

TIME	REPORTER	REPORTED YEAR
3000 BC	Bremner ADK	1954
2000 BC	Coleman AI	1970
550 BC	Atilla G	1993
600 AD	Asbell MB	1988
800 AD	Ring ME	1995
1050-1122 AD	Coleman AI	1970

1. Ancient Era - 1000 A.D
2. Medieval Period (1000-1799 A.D)
3. The Foundation Period (1800-1910) The Endosseous Oral Implantology Truly Began In The 19 th Century
4. Premodern Era (1910-1930)

5. The Dawn Of The Modern Era (1935-1978) A.D

The history of the dental implant dates back to 3000 B.C., to the period when the ancient Egyptian civilization prospered as shown in (**Table 1**). During the period from the 1500s to the beginning of the 1800s, teeth were bought off from the resurrectionists which were collected from the poor for purposes of allotransplantation [2]. This method, which was most common in Europe, has since disappeared for various reasons, particularly due to the existence of common secondary infections such as syphilis and tuberculosis [3]. The foremost person to publish a description of the technique of modern dental implants was a French dentist, Maggiolo J. According to M.E. Ring, Maggiolo had described a method to implant 18-karat gold alloy, with three branches into the jawbone, and installed a porcelain crown as a superstructure in his book: "Le Manuel de l'Art du Dentiste" [4].By 1886, the process of intraoperative sterilization had undergone vast improvements, in which time, Harris had constructed a socket in the jawbone to insert a column made of porcelain. Interestingly, this porcelain was coated with a rough layer of lead in order to increase the supporting strength. A porcelain crown was placed as the superstructure, and this is the approach that was followed for 27 years [4].In a similar manner, in the latter half of the 1800s, Berry constructed a root-form implant that was lead-free. Following this trend, Pajime used silver, and Bonwil, gold and iridium as the material, each of which were implanted for single tooth replacement or for support of a complete denture [3]. Entering the 20th century, Scholl made a root-form, porcelain implant in 1905 that was made of corrugated structure. He also proposed a design in which a wire was initially incorporated within the superstructure for forming a connection with the remainder of the original tooth [3]. Most of the surgical methods for dental implants in the past had involved immediate implantation. However, surgical tools such as the drilling systems used in present practice were developed and was improved by Greenfield, who also introduced trephine bur and dental implants with a hollow cylindrical design. He was also the first to demonstrate the failure of implant treatment due to infection, and thus his contributions to the history of dental implants are immeasurable [4]. In 1937, Vitallium, a cobalt-chromium-molybdenum alloy was developed which was used on patients by Stock at Harvard University [3]. Meanwhile, in 1940, Dahl was the first to attempt subperiosteal implant, but this approach did not come into existence before being employed by Gershkoff and Goldberg in 1948. In 1951, the Academy of Implant Dentures was established, which is presently known as the American Academy of Implant Dentistry [5]. Reflecting back on the dental history in Japan around this time, the late Dr. Toshio Yamane set up the Yamaguchi Plastic Dental Society in 1956, which later became the driving force for Artificial root research in Japan. Dr. Yamane established an independent institute to experiment on animals, which produced many experts in the field of artificial roots. The institute is currently known as the Japan Institute for Advanced Dentistry [6]. The oldest academic report in Japan is a collection of consecutive reports by Dr. Toshitaka Kaketa constituting a series of reports that were published in the academic journal of the Japan Prosthodontic Society. In retrospect, it is no exaggeration to say that his achievements in the 1950s–1960s were monumental, particularly in the time when the opportunity to report the use of artificial roots was limited and this kind of practice were not kindly perceived [7,8].

DEFINITION

Dental implants are inert, alloplastic materials embedded in the maxilla and/or mandible for the management of tooth loss and to aid replacement of lost orofacial structures as a result of trauma, neoplasia and congenital defects [9].

TYPES OF IMPLANTS:

Implants rely on titanium fixtures inserted into the jawbone. Most implants are made of titanium, which is very effective at fusing with living bone (osseointegration) [10]

ROOT FORM DENTAL IMPLANT:

This screw type implant is shaped like the root of a tooth. This is the most widely used

implant and is used where there is enormous width and depth in the jawbone. If the jawbone is too narrow or short for placement of the Root Form implants, bone grafting may be needed to allow for its placement. The number of incisions and bone preparations depend on how many implants was needed [10].

PLATE FORM DENTAL IMPLANT:

Plate Form implant is placed into the jawbone if is too narrow for bone grafting. The Plate Form implant is used exclusively for this purpose as it has a flat and long shape for a better fit into a narrow jawbone [10].

SUBPERIOSTEAL DENTAL IMPLANTS

When there is no enough bone width or height for the Root Form or Plate Form implants, the Subperiosteal implant is recommended. The Subperiosteal implant is primarily made to rest on top of the jawbone and under your gums like the Plate Form implant [10]

MINI DENTAL IMPLANTS

Mini Dental Implants are cost less than traditional implants and can be used to attach a dental implant supported denture or partial [10].

MICROBIOTA OF DENTAL IMPLANTS:

MICROFLORA OF THE HEALTHY GINGIVAL SULCUS:

A healthy gingival sulcus contains predominantly of gram-positive cocci and rods, principally *Actinomyces naeslundii* (14%), *Actinomyces gerencseriae* (11%), *Streptococcus oralis* (14%) and *Pepto-streptococcus micros* (5%). Gram-negative anaerobic rods account for 13% of the total cultivable organisms on average. With the development of periodontitis, microflora shifts, containing higher number of Gram-negative rods and decreased proportions of Gram-positive species. In an established periodontal lesion, low numbers of cocci and high numbers of motile rods and spirochetes are seen. Increased proportions of *Porphyromonas gingivalis*, *Bacteroides forsythus and species* of *Prevotella, Fuso-bacterium*,*Campylobacter* and *Treponema* h ave been detected [11]. However, Danser et al noted that when all teeth are extracted in patients with periodontitis, *A. actinomyce-temcomitans* and *P. gingivalis* are no longer detectable within a month after full-mouth tooth extraction, but bacteria like *P. gingivalis*, *T. forsythensis*, and other pathogenic bacteria that were present before the teeth were extracted reemerge after 6 months of implant placement. These results indicate that bacteria that cause periodontitis also cause periimplantitis. It was also suggested that the higher the full-mouth clinical probing pocket depth and the greater the full-mouth attachment loss, the higher the attachment loss is to be expected around implants in the susceptible patient [12]. Also, according to a classic postulate of Koch- states that transfer of bacteria from one locus to another can cause the same disease in the other locus, whether this is between or within subjects. Medium of transfer of infection in oral cavity is saliva.

INITIAL COLONISERS OF DENTAL IMPLANTS:

Microbial adhesion and aggregation have been studied on different substrata, *in vivo* and *in vitro* by Mergenhagen and Rosan [13]. Few studies by Nakazato *et al*.,1986, Fujioka-Hirai *et al.,* 1987, Joshi and Eley, 1988, Wolinsky *et al.,* 1989, had proved the interactions between bacteria and oral implant materials such as titanium [14, 15, 16, 17]. Likewise, Theilade and Theilade 1985, had studied the general growth and maturation patterns of bacterial plaque by light and electron microscopy and bacterial culture [18]. However only two investigations by Nakou *et al.,* 1987, Mombelli *et al.,* 1988 had shown the development of plaque on newly inserted implants [19,20]. In edentulous patients, the flora developing on successfully integrated one-stage transmucosal titanium implants was found to be very similar to the mucosal flora on the adjacent alveolar ridge [20]. This flora was established shortly after the installation of the implant. Over 85% of the micro-organisms were identified, in the microscope, as coccoid cells, and over 80% of the cultivated bacteria were Gram positive facultative cocci. During the first six months after insertion, no significant longitudinal changes were noted in these proportions. Spirochetes were never detected; Fusobacteria and black-pigmenting Gram-negative anaerobes were found infrequently. The microflora

associated with stable osseointegrated implants serving successfully as abutments for overdentures was investigated in 18 edentulous patients, two years after implantation (Mombelli and Mericske-Stern, 1990) [21]. Over 50% of the organisms cultured in this study were facultatively anaerobic cocci, and 17% were facultatively anaerobic rods, while Gram-negative anaerobic rods accounted for only 7%. Both *Fusobacterium* sp. and *Prevotella intermedia* were found in 9% of the samples. *Porphyromonas gingivalis* and spirochetes were not reported. Repeated microbiological and clinical data were collected in nine patients during the third, the fourth, and the fifth years after implantation. No significant time trends were noted. Separate samples taken within the same patient from different sites showed a similar composition of the microflora. The data of this study are coherent from the studies of Lekholm *et al.,* (1986) [22], Apse *et al.,* (1989) [23] and Bower *et al.,* (1989) [24] from successful Branemark-type implants. This suggests that the normal microbial flora of ITI and of Branemark fixtures are not substantially different from each other. Intra-individual topographical variation of the bacterial flora seems to be more pronounced in partially edentulous patients than in edentates. The microbiota of remaining teeth is probably the primary source of putative pathogens to colonize adjacent implants. Apse *et al.* (1989) found higher percentages of black-pigmenting Gram-negative anaerobes and "wet spreaders" *(Capnocytophaga)* on implants of partially edentulous patients than in edentulous patients. This means that the microbial status of remaining teeth influences the fate of newly incorporated implants.

DENTAL IMPLANT PLAQUE:

Peri-implant microbiota is soon established after implant placement and is largely influenced and depends on the presence of teeth. In edentulous patients, the subgingival area around implants consists mainly of Gram-positive facultative cocci and nonmotile rods. On clinically stable implants, *S. sanguis* and *Streptococcus mitis* are the most predominant organisms, while motile rods, spirochetes, fusiforms, and filaments are infrequently found [25]. In partially edentulous patients, the total number of peri-implant microorganisms is increased, and the proportion of motile rods, spirochetes, and cocci is increased when compared to edentulous patients [26, 27].According to Quirynen *et al.,* there is an increase in spirochetes and motiles around the implants in proportion of cocci, if the flora of the remaining teeth harbored more than 20% spirochetes [28]. Different implant characteristics might display difference in microbiota (i.e. surface roughness, material, shape), however, studies by Alcoforado et al, Rams et al and Mombelli *et al.,* did not show any relation between specific implant system and microbiota around it [29- 31].

Astrand *et al.,* demonstrated that rough-surfaced implants had a higher incidence of peri-implantitis than smooth (turned) surfaces [32], whereas, Wennstrom *et al.,* [33] reported similar bone level changes for turned and relatively rough surface implants. Nakoa *et al.,* collected microbial samples from patients with 2 to 10-week-old implants and proved that *A.odontolyticus*, *E.corrodens*, *H.actinomycetemcomitans*, *P.micros*, *C.sputorum* and *L. buccalis* are exclusively found in implant related microbiota [34].

MICROFLORA AROUND TEETH AND DENTAL IMPLANTS**:**

When an implant is exposed to oral cavity, its surface gets colonized by micro-organisms. The microbiological parameters in sulci around the teeth and the crowns supported by dental implants was comparatively evaluated in a study by Shahabouee *et al.,* which has shown six anerobic bacteria in teeth and implants sulci such as Gram-positive cocci, Gram-negative cocci, Prevotella, Porphyromonas gingivalis, Bacteroides fragilis and Fusobacterium.Gram-positive cocci and Gram-negative cocci had maximum and minimum percentage frequency in the two groups, respectively. It was indicated that microflora in implant sulci is similar to the tooth sulci, when the depth of sulci is normal (<4 mm) which implicates that implants' susceptibility to inflammation is the same as teeth [35].

MICROFLORA – IMPLANT ABUTMENT INTERFACE:

The hollow spaces between implant and abutments may act as reservoir for commensal and pathogenic bacteria, especially anaerobic or microaerophilic species, acting as a potential source of tissue inflammation. Hence, microbial colonization of the interfacial gaps may ultimately result in bone resorption which was evident from the studies of Quirynen *et al.,* 1990; Quirynen *et al.,* 1994; Mombelli *et al.,* 1995 [36, 37, 38]. According to Quirynen *et al.,* (2002), gaps in the implant-abutment interface may act as a trap for bacteria, favoring the development of biofilm with varying composition and impact on periodontal tissues. *Agregatibacter actinomycetemcomitans*, *Tannerella forsythia and Porphyromonas gingivalis*, isolated frequently in these biofilms, are pathogens intimately related to the development and maintenance of periodontitis and peri-implantitis [39].Other pathogens with relevant participation in these diseases are *Prevotella intermedia, Campylobacter rectus, Peptostreptococcus micros, Fusobacterium nucleatum, Eubacterium nodatum, Streptococcus intermedius* and spirochetes as demonstrated by Quirynen *et al.,* 2002; Socransky & Haffajee, 2002 [40]. Periodontal disease affects tissues that support teeth and is characterized by loss of periodontal ligament insertion, and resorption of adjacent alveolar bone. This disease has multifactorial etiology, which includes biofilms as having an essential role in its pathogenesis (Lamont & Jenkinson, 1998) [41]. The initial bacterial colonization of peri-implant sulci is characterized by an increasing number of facultative anaerobic *streptococcus*, although Gram-negatives anaerobes may be occasionally found but in smaller numbers (Mombelli *et al.,* 1988) [42]. With time, strict gram–negative anaerobes as *Fusobacterium spp and Prevotella spp* become increasingly predominant (Mombelli & Mericske-Stern, 1990) [43].

BIOFILM & THE DENTAL IMPLANT:

Biofilm formation around natural teeth occurs in minutes and the specific species start colonizing as early as 2-6 hours. The reason attributed possibly lies in the fact that the clean tooth surfaces are likely to have remnants of unattached microbiota that can immediately multiply and provide a favorable surface for the attachment of the late colonizers [44]. The pristine surfaces of the implants lack the desired indigenous microbiota and demand the early colonizers to set the stage for the complex communities to develop [45].The pellicle starts forming on the implant surface as early as 30 minutes after the implant is exposed in the oral cavity [46]. The acquired pellicle on the dental implants owing to their lower albumin absorption capacity causes a low plaque formation around implants. Early colonizers are predominantly the gram-positive cocci, rods, and actinomyces species.The periodontal pathogens colonizing on the *Streptococci* (*P. gingivalis, P. intermedia,* etc) are the causative microorganisms responsible for peri-implantitis and periodontitis [47].

AFFINITY OF MICROBES TOWARDS VARIOUS IMPLANTS:

Precious and basic metals, as well as ceramic materials, are also used in the manufacture of abutments. Ceramic materials, such as zirconium dioxide, or simply zirconia, are popular materials, increasingly used in prosthetic abutments. They are similar in color to dental structures and have potential advantages over metallic materials (Brodbeck, 2003; Watkin & Kerstein, 2008) [48, 49] besides other properties such as higher translucency, (Denry & Kelly, 2008) [50], good tissue adhesion (Pessková et al., 2007) [51], less tissue discoloring effect (Bressan et al., 2010) [52], lower bacterial adhesion and growth (Scarano et al., 2004) [53] and lower toxicity (Uo et al., 2003) [54]. Few studies have compared bacterial adhesion in metallic and non-metallic components. While some authors claim that bacterial adhesion is lower in zirconia components (Scarano et al., 2004), others show that there is no difference between zirconia and titanium components (Salihoglu et al., 2010) [55].

DEMONSTRATION OF MICROBES IN IMPLANTS:

The presence of bacterial contamination of implants and components has traditionally been detected by conventional microbiological cultures, which have inherent deficiencies, particularly in the identification of fastidious species and strict anaerobes (Rolph et al., 2001; Moraes et al., 2002) [56].The last two decades witnessed the development and extensive use of new molecular techniques to detect, identify and quantify microbial species dwelling in the oral cavity. These rapid, sensitive and specific techniques revealed an enormous, hitherto unknown, microbiota. (Sakamoto et al., 2005; Haffajee et al. 2009) [57].

CULTURE AND CULTURE-INDEPENDENT METHODS FOCUSING ON ORAL MICROBIOTA OF DENTAL IMPLANTS:

Identification of microorganisms inhabiting peri-implant crevices and the internal parts of implants has been of relevant importance in respect to the outcome of the treatment with dental implants, since several studies showed a correlation between bacterial species of the oral cavity, especially those involved in periodontal diseases, and the occurrence of failure in the treatment with implants (Ong et al. 1992; Shibli et al., 2007) [58]. Periodontal pathogenic bacteria in peri-implant crevices and teeth with periodontitis close to dental implants are considered risk factors for the success of dental implants (Gouvoussis et al., 1997; Saito et al.,1997) [59]. To date, a large number of microbial species related to periodontal and peri-implant diseases have been identified and can be quantified by different methods.

CONVENTIONAL CULTURES:

Bacterial culture is a well-known method historically used to characterize the oral cavity microbiota, and considered a classical reference method in microbiology. Traditionally, culture-dependent methodologies are used to isolate, enumerate and detect probiotic organisms, especially from mixed cultures (Charteris *et al.,* 1997) [60]. Several variables in culture technology, especially an appropriate sample collection technique and media selection, have been recognised as having a significant impact on the sensitivity and specificity of the test, mainly on the organism recovery rates and time for reporting results (Riedel & Carroll, 2010) [61]. This method constitutes an important epidemiological tool, with results that serve as a base for building an empirical therapeutic strategy. Also, this methodology is essential in the initial phase of several culture-independent techniques, where bacterial growth and isolation is necessary to DNA probes confection. These methods are essentially designed around the recovery and (or) enumeration of viable bacteria in the contaminant media. Detection of viable bacteria is traditionally performed by implementing a means of culturing growth of individual species. The use of non-selective media such as trypticase soy agar or standard methods agar, known as the aerobic or standard plate count, is routinely applied in this methodology. In addition, in specific conditions, the increased sensitivity of these standard media has been achieved using a selective agar overlay approach designed to recover a larger proportion of bacteria from contaminant media (Specket *et al.,* 1975; Harrigan, 1998) [62]. Most studies describing the microbial leakage through the implant-abutment interface are based on results with conventional culture method (Aloise *et al.,* 2010) [63]. However, an inherent limitation of microbiological cultures is that the difficulties to identify strict anaerobes frequently associated with periodontal and peri-implant diseases, as well as fastidious species (Barbosa *et al.,* 2009; Roças *et al.,* 2010) [64, 65]. It is estimated that 50% of the oral microbiota is not cultured by conventional methods and several of these species are directly related to infectious processes in the oral cavity (Parahitiyawa *et al.,* 2010) [66]. Furthermore, non-viable cells, still able to produce aggressive compounds against peri-implant tissues are not detected by culture methods. Despite of the efforts to optimise broth composition, enhance the growth of microorganisms and prevent contamination during procedures, the methodology is time-consuming and the microbial viability is essential to confirm the presence pathogens. Cell killing and degradation by bacteriocin as well as

degradation of DNA by proteolytic enzymes and endonucleases has been demonstrated in several studies (Loyola-Rodriguez *et al.,* 1992, Cascales *et al.,* 2007) [67, 68]. These substances may cause deleterious effects on the peri-implant support tissues. Therefore, despite the advantages of these familiar culture methods in detecting viable bacteria, such as ease of use and low cost, assay sensitivity is still relatively low compared with alternative methods (such as molecular-based approaches). Quantitative bacterial measurements are widely used in microbiology. Many years of research studies using quantitative microbiology on solid media have demonstrated that such measurements provide clinically valuable information. For example, bacterial load is predictive for the occurrence of complications. However, the bacteria quantitation in conventional culture method is difficult to achieve and is rarely practised in clinical laboratories because it requires subsequent plating on solid media rather than incubation in liquid media. The time required for liquid culture bottles to become positive provides some suggestion of bacterial load, but is a weak quantitative measure and varies with the microorganisms present. Also, each bacterial must be individually evaluated with a specific media (Yagupsky & Nolte 1990) [69].

CULTURE- INDEPENDENT METHODS

In the last two decades great advances in molecular diagnostic methods were achieved, which have been extensively used in the detection and identification of microbial species inhabiting the oral cavity (Sakamoto *et al.,* 2005; Haffajee *et al.,* 2009 [57, 70]. These techniques are more rapid, sensitive and specific when compared to the conventional culture methods. Species showing diverse phenotypic behavior may be identified by their genomic characteristics, which are not dependent on cell viability, a great advantage in studies evaluating anaerobic infections, when cell death may occur during sample collection or transportation (Whelen & Persing, 1996; Pitt & Saundres, 2000) [71, 72].These techniques have also promoted advances in the knowledge of the microbiota in other parts of the human body (Eckburg *et al.,* 2005; Dethlefsen *et al.,* 2007; Grice *et al.,* 2008; Oakley *et al.,* 2008) [73, 74, 75, 76] revealing a great quantity of bacterial species not cultured, whether associated or not to infectious processes

PSYCHO SOCIAL IMPACT OF DENTAL IMPLANT:

By definition, people who lose teeth are impaired (i.e., have lost a body part). Other less well documented consequences of tooth loss include disability (lack of ability to perform tasks of daily living such as speaking and eating) and handicap (e.g., minimising social contact due to embarrassment with complete denture wearing). The oral cavity has historically been dissociated from the rest of the body when considering general health status. However, recent research has highlighted that oral disorders have emotional and psycho-social consequences as serious as other disorders [77, 78]. Reisine and Gift et al have indicated that approximately 160 million work hours a year are lost due to oral disorders. Reisine and Weber compared baseline quality of life scores of patients with temporomandibular joint disorders (TMD) against a group of patients with cardiac disorders. They reported that TMD patients were disabled to a greater extent in the areas of sleep and rest, social interaction, intellectual functioning and communication [79].

OHRQOL - Person's assessment on how functional, psychological and social factors and pain / discomfort affect his/her well being – in the context of oral health.

Oral Health Assessment Index (GOHAI) had constructed scales which provide an index of the impact of oral disorders. The impact of oral disorders on health related quality of life is calculated by assigning an overall score to indicate the extent of a range of functional and psycho-social consequences. GOHAI contains 12 statements (e.g. "How often did you feel uncomfortable eating in front of people because of problems with your teeth or dentures") with a Likert response format (i.e. 0 = never, 1 = seldom, 2 = sometimes, 3 = often, 4 = very often, 5 = always) [80].

DENTAL IMPACT PROFILE:

This measure contains 25 statements using the format "do you think your teeth or

dentures have a good (positive) effect, a bad (negative) effect or no effect on your eating." The 25 statements are divided into 4 sub-scales (eating, health/well being, social relations, romance), and an overall profile score is calculated as the proportion of positive or negative responses among all items answered [81].

Oral Health Impact Profile [OHIP], Dental Impact on Daily Living [DIDL], Oral Impacts on Daily Living [OIDP] - measures the frequency and severity of oral problems on functional and psycho-social well being.

OHIP is a 49 item measure, with statements divided into seven theoretical domains, namely functional limitation, pain, psychological discomfort, physical disability, psychological disability, social disability and, handicap. An example of an OHIP statement is "Have you had to interrupt meals because of problems with your teeth, mouth or dentures". A Likert response format (0 = never, 1 = Hardly ever, 2 = occasionally, 3 = fairly often, 4 = very often) is used [82]

DIDL consists of 36 items accumulated into 5 scales, i.e., comfort, appearance, pain, performance and, eating restriction. Impacts for each statement are coded as follows: + 1 = a positive impact, 0 = impacts not considered totally negative, and, - 1 = negative impacts [83].

OIDP attempts to quantify relative frequency of impacts of oral problems on 8 daily tasks, namely: eating and enjoying food, speaking and pronouncing clearly, cleaning teeth, sleeping and relaxing, smiling, laughing and showing teeth without embarrassment, maintaining usual emotional state without being irritable, carrying out major work or social role, and, enjoying contact with other people [84].

ORAL HEALTH MEASURES & FUNDINGS:

Slade and Spencer suggested that measures of oral health status may also be used to advocate oral health, especially when attempting to secure public funds for oral health care. The information provided by these measures facilitates an increasing understanding of how individuals perceive oral health needs and what oral health outcomes drive them to seek health care. In a public health context, resources for oral health care are diminishing at the same time as availability of sophisticated treatment options is increasing. For instance, dental implants are now available and are used to anchor prostheses in jaw bone which can be used to replace missing teeth. They are a comparatively expensive treatment option, and demonstrating substantial improvement in oral health related quality of life, as assessed by health status measures, could justify public funding of this type of treatment [85].

CONCLUSION

Dental implants are an inevitable form of prosthetic device implanted into patients. The high success rate for the placement of endosseous dental implants under unrestricted environmental conditions and through a heavily colonized oral environment appears counterintuitive. If dental implants become infected the causative micro-organisms are usually those implicated in periodontal disease and include a range of Gram negative anaerobes and spirochaetes. Staphylococcus aureus and coliforms detected in implant infection sites may represent cross-infection as they are rarely encountered in oral infection. Data on failure and complications of dental implants in a systematic fashion would enable a more detailed analysis of the microbiology, treatment outcomes and assist in the formulation of clinical guidelines in implant placement and treatment of implant-associated infections.

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