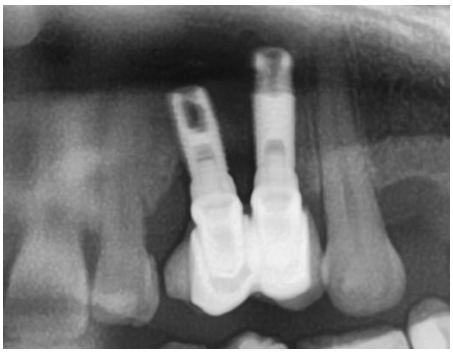
Dental implants

Success or survival?



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Background:

Replacement of missing teeth by means of dental implants is an essential innovative part of modern dento-alveolar rehabilitation. During the early stages of their use, dental implants were manufactured and placed in variety of types and designs, retained in the arches and indirectly anchored to the peripheral bone, via a process called "fibro-osseo integration", which later described by Albrektson "human experience without informed consent" [(1)] . The concept of Osseo-integration, a process by which the surface of root-formed titanium fixture was directly integrated to the peripheral growing bone was first introduced by Branemark in 1969.

The understanding of the limitations and complications involved during and after the placement of dental implants is important for patients to clarify the risk and cost benefit ratio of such elective and costly intervention. It is also crucial prior to an ethical and professional decision-making process considering saving an endodontically compromised tooth versus tooth extraction followed by Implant replacement [(3)]. Therefore, the scientific investigation of long-term success and survival rate of dental implants have always been a relevant area of both experimental and clinical research.

Success criteria:

The experimental and clinical evidence-based research suggests a number of parameters for measuring success of osseo-integrated dental implants [(6)].

Some of main criteria which have been expanded, modified and revised during the recent decades are mentioned below:

1) Mobility

The clinical mobility of "less than 1mm" proposed by Schnitman evolved to "clinical immobility" as acceptable criteria for successful implant [(1)]. The clinical expression "rigid fixation" is related to the histological osseo-integration which is used for sub-clinical immobility. An entirely integrated dental implant may move up to 75 microns, with no sign of clinical mobility. Clinical Immobility refers to partial to full direct contact between bone and implant surface. An Implant with clinical sign of mobility may indicate the presence of connective tissue interface instead of bone interface around the implant. This is one of the criteria for diagnosis of implant failure [(2)].

2) Radiographic assessment of bone response

Absence of peri-implant radiolucency seen in the radiographs was initially proposed by Schnitman and later by Alberktsson as second criteria for implant success [(1)]. Radiographs can be utilized to assess peri-implant radiolucency and to monitor bone apposition around implants only in a two dimensional projection.

3) Bone level

The maintenance of the surrounding marginal bone level around dental implants has been interpreted as an important radiographic and histological sign of implant success. Measuring bone level in relation to implant platform and comparing it after healing phase is widely used to assess bone loss during radiographic evaluation. The out-dated accepted marginal bone loss of less than one third of implant length as criteria for implant success in 1986, was revised later to marginal bone loss of <1- 2mm during the first year and < 0.2mm during the following years [(1)]. Although conventional peri-apical radiographs reveal only mesial and distal aspects of peri-implant bone level, the use of CBCT due to its high radiation doses is not justified for routine evaluation of bone loss around dental implants [(2)].

4) Absence of permanent symptoms:

Persistence of any irreversible symptom such as pain, infection, neuropathies, paraesthesia, suppuration or damage to adjacent anatomic structures is indicated as failure [(1)]. An implant must be pain free on loading after healing period. Persisting pain or discomfort caused by other reasons than impinging on nerves in jaws, may be linked to mobility of implant, ill-fitting supra-structure or irritation of soft tissue. Pain and sensitivity during function are subjective parameters which put an implant in failure/survival category [(2)].

5) Longevity

Success rate over 85% in fifth year and 80% in tenth year after implant placement were suggested as successful in 1986 by Alberktsson[(1)]. These values increased later in the literatures to 95.2% and 89.4% respectively [(4)]. This will be discussed further in this paper.

6) Patient satisfaction

The revised criteria for implant success considering patients' perception rather than clinical parameters have been investigated in just 2% related published research[5]. According to Pjetursson based on a 10 years prospective cohort study more than 90% of patients reported to be satisfied with functional (mastication and phonetic) as well as aesthetic aspects of their implants while believing the incurred cost was justified [5]. This figure may be questioned since the sample size is small (214 implants in 104 patients), all those implants were ITI – Straumann brand and this was not a multi centred study since all implants in this study were placed and monitored in a university setting. Patient satisfaction may vary depending on the questionnaire's structure and the focus groups. While above study focuses on implant supported fixed prosthetic dentures (52%) and single crowns (47.5%) [5], other literatures dealing with edentulous patients report much higher degree of patients' satisfaction. They even bring it to higher level and talk about improvement of quality of life following rehabilitation of chewing organ by implant supported fixed bridge or over denture [6][8].

7) Probing depth

While the depth of probing is not primary recommended to measure the implant success, yet it can be considered as an indicator for tissue stability. Probing depth in conjunction with presence of other clinical symptoms such as persisting pain, suppuration or bleeding is suggested to be relevant to the clinical success. An increase in probing depth following base line measurements after initial tissue healing could be used as a failure risk indicator. Implants could be considered sound despite probing depth of 2-6mm, while the sulcus depth exceeding 5-6mm facilitates the emergence and growth of anaerobic microorganisms in a strict anaerobic micro-environment which require regular monitoring and treatment in the presence of inflammatory process. On the other hand, probing depth measurement process is operator sensitive which require calibration and when exercised with excessive force, it may harm the delicate attachment or implant surface[2].

Evolving description of success:

Although, Alberktsson's proposed criteria for success of osseo-integrated implants is advocated to be mostly recognised by clinicians, however these criteria may refer mainly to the surgical aspects rather than post-operative complications involving prosthetic super-constructions or patient satisfaction as part of evaluation protocol. This former evaluation criteria used at that time, was vastly applied for different implant systems e.g. blade-vent, carbon, crystal implant which are counted obsolete at present rating the related publications not valid anymore. Besides, it discusses merely the failure and success without considering "survival" which refers to a stable status in situ following some bone loss.

Doyle et al suggested the evaluation of outcome of dental therapy should be categorized as one of the four classes: success, survival with intervention, survival without intervention, and failure" [(7)].

The ICOI Pisa consensus conference in 2007 drafted a document suggesting a range from health to disease to describe success of dental implants and relevant prognosis based on related health condition. A "Health Scale for Dental Implants" has been proposed defining "ideal clinical condition" as success. A sub-ideal condition without need of treatment has been considered as "satisfactory survival", and in need for intervention to prevent failure as "compromised survival". Accordingly, the "prosthetic survival" on a lineal time factor considered definition of success: "early" (1-3years), "intermediate" (3-7 years) and "long term" (over 7 years) [(2)].

Pjetursson *et al.* in a systematic review compared the survival and complication rates of implant-supported and tooth-supported restorations. The result of their meta-analysis showed 5-year-survival rate for implant-supported fixed restorations was about 95% which drops to about 90% following a 10-year period of functionality based on biological and technical complications. Technical complications were significantly higher in implant-supported restorations mostly as ceramic fractures, abutment or screw loosening and loss of retention [(4)].

Elemam and Pretty measured both tooth and implant success rates in a systematic review based on longevity and reported 90.9% overall success rate for implant treatment in comparison to 86.02% for primary endodontic, 78.2% for endodontic retreatment and 63.4% for surgical endodontics[(3)]. The question would be: if the longevity is a good representative of success? We will discuss it further in this paper below.

Also reported success figure for implant in this review is based on 8 papers, 6 of those are extracted data related to implants which are placed in academic settings, most probably by experienced or specialist practitioners. This figure is not applicable and would be different when implant placement is carried out in dental practices by potentially less experienced practitioners and do not represent the success rate in reality.

Current definition of successful implant:

While initial definitions of success were focused on Osseo-integration of implant fixture only, the current definitions focus on long term functionality, aesthetics of prosthetic construction, as well as patient's satisfaction. This means shifting of the position of judgment from clinician to patient. Understanding of distinction between success and survival is extremely important not only in research and clinic, but also for patients and have to be part of informed consent. Success is defined as absence of any symptom or easily manageable complications while survival means Implant (including abutment and crown) is still in mouth functional irrespective of issues on recall date[(6)].

Pjurtsson et al. in 2007 introduced biological and technical complications for assessing success. Soft and hard tissue problems such as peri implantitis and bone loss were defined as biological complications. In contrast fracture of acrylic or porcelain, loss of retention due to cement or screw loosening and also less common problems such as component fracture (screw, abutment or implant) were classified under technical complications. Despite high survival rate of dental implant and prosthesis shown in this systematic review (over 95% in 5 years and around 90% in ten year period), large number of 38.7% of single implant supported crowns were subject to some forms of biological or technical complications within first five years. This means success rate of 61.3 % for single implant supported crowns [(4)]. These figures show why it is important to have a precise definition for complication which affects the gap between success and survival. Careful analysis of this gap and seeking materials and methods to minimise it by reducing complications is essential and provides us with valuable knowledge for more successful clinical implantology. It is also important from patients' point of view to understand this discrepancy which suggests adjusting their expectations with reality and awareness of lifetime potential need for maintenance of implants and involved cost.

Long term issue

One of the most common complications in Implant dentistry is peri-implantitis. According to some literatures, up to 56% of all implants will develop peri-implantitis(6) .The bone loss incurred by bacterial inflammation around the implant is called peri-implantitis (2). It is differentiated from Peri implant mucocitis which is a reversible inflammation of gums surrounding the implant. Anaerobic bacteria in sulcus over 5mm depth have been reported as cause of this disease. In some cases the initial bone loss is stress induced due to overloading. Once bone loss occurs, deep sulcus and lack of oxygen contribute to growth of anaerobe bacteria which may cause further bone loss. Persistent pus for longer than 2 weeks suggests need of surgical intervention to eliminate source of this symptom. The reduced level of bone would be a risk factor making implant more susceptible to occlusal forces. This explains the importance of re-evaluation of stress factors for new bone status and adapting forces to bone level in order to maximising longevity[(2)].

Conclusion

Restoring edentulous site using dental Implants is more and more suggested, requested and performed as treatment of choice in the last few decades. Initial definition of success evolved and differentiated between success and survival. Criteria of success measurement expanded and discussed in thousands of publications. Current literatures show dental implants have very good long term prognoses and according to several publications report high survival rate of over 90-95%. Comprehensive knowledge about success, survival, limitations and complications of this elective and costly treatment is beneficial for both patients and practitioner. Clinical application of research outcomes will help us in case selection, connecting patients' expectation and reality, better consent, more predictable results and finally higher success rate leading to both patients' and practitioners' satisfactions. Continuous monitoring and researches are needed to keep this valuable k knowledge up to date. .

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