Using an Equivalent Point System (EPS) to Calculate Implant Failure

Hazem Mourad[1,2,3,4]*

[1]*Specialist Senior Registrar, Prosthodontics and Implant Dentistry, Dubai Health Authority, United Arab Emirates*
[2]*Board member and Head of Scientific Committee, Alexandria Oral Implantology Association (AOIA), Egypt*
[3]*Owner of Hazem Mourad Dental Clinic, and Consultant of Prosthodontics and Implant Dentistry, Alexandria, Egypt*
[4]*Former Lecturer of Prosthodontics and Implant Dentistry, Faculty of Dentistry, Pharos University in Alexandria, Egypt; and College of Dentistry, Qassim University, Kingdom Saudi Arabia*

*Corresponding Author: Hazem Mourad, Prosthodontics Unit, Dental Department, Dubai Health Authority, Dubai, United Arab Emirates.

Abstract

No clear guidelines or objective methods were presented in the literature regarding the calculation of implant failure in dental practice. It was always referred to either implant success or survival based on clinical judgment on an interval of time up to 7 years, and again without a clear objective way of measuring or assessment. This article represents a mathematical way to calculate implant loss or failure that can be used in any type of dental practice to monitor the quality of service provided, calculating key performance indicators, and as a feedback for the implant manufacturers to track the effectiveness of their produced implants into the market.

Keywords: *KPI; Quality Assurance; Objective Evaluation*

Introduction

A great development was reported to dental implants, since they were introduced as a predictable treatment modality for replacing missing teeth, aiming mainly to increase success rate and decreasing the treatment time. The success rate in patients treated with dental implants, in general, is high for all implant systems [1,2]. In prospective and retrospective studies, it varies from 84.9% to 100% in longitudinal studies of up to 24 years [3-6]. However, despite the low number, failures occur, most of the time unexpectedly [7-10].

Implant loss is divided into early failure, before the occurrence of the osseointegration, and the late failure, after the implant receives occlusal load [11-14]. Based on the literature, implant failure refers to implants that require removal or have already been lost. The question is; shall we consider the lost implant after 1 year of loading equal in failure to that lost after 15 years of loading?

Literature addressed survival and success criteria with no clear guidelines that can be used in institutes, hospitals, dental clinics, research work, or even for the companies to report their real/relative success or failure. It was all about subjective assessment even if it includes some objective clinical judgement criteria. The main idea presented here is to formulate an objective assessment methodology to calculate real success and failure percentages.

As reported in the International Congress of Oral Implantologists (ICOI) Pisa Consensus Conference, the primary function of a dental implant is to act as an abutment for a prosthetic device. Accordingly, any success criteria, therefore, must include first and foremost support of a functional prosthesis. The term implant success may be used to describe ideal clinical conditions; it should include a time period of at least 12 months for implants serving as prosthetic abutments. The term early implant success is suggested for a span of 1 to 3 years, intermediate implant success for 3 to 7 years, and long-term success for more than 7 years. The implant success rate should also include the associated prosthetic survival rate in a clinical report [15].

Implant failure is easier to describe than implant success or survival and may consist of a variety of factors [15]. Despite other attempts to classify success and failure, and although no clear justification was presented for choosing this time interval in the ICOI-Pisa classification; it was chosen to build up the proposed Equivalent Point System (EPS) for calculating implant failure as the assessment criteria were valid clinically.

The Equivalent Point System (EPS) is taking into consideration the survival time of the failed implant, and loading status. For application of the EPS, the total number of failed implants will not be taken as a total indicator of failure; the EPS will be used to formulate a percentage using the following formula: EPS factor X 100 / total number of implants used. Depending on the failure time, and whether the implant was loaded or not, EPS factor is going to be calculated as follows:

Failure Time/Loading Status	Number of Failed Cases	Equivalent Point	EPS Factor (Number of failed cases X Equivalent Point)
Failure before loading	10	1	10
Failure within 1 year of loading	10	0.75	7.5
Failure between 1 and 3 years of loading	10	0.5	5
Failure between 3 and 7 years of loading	10	0.25	2.5
Failure more than 7 years of loading	10	0	0
Total	50		25

In the previous example and assuming that an institute placed 1000 implant/year and they have reported 50 failed implants in that year (10 per each category), this means that they have a failure percentage of 5% (50X100/1000). But when using the EPS, the percentage will be 2.5% (25X100/1000). This was achieved by giving an Equivalent Point in relation to categorized failure time/loading status, as shown in the Equivalent Point column. Accordingly, the failure rate of dental implants in that institute is lower than calculated.

The main idea is to differentiate between failure that happens before loading the implant (giving it a total 1 point), and that happens after loading according to the time interval, considering the implants that fail after 7 years "successful" with a 0 equivalent point. The reasons of failure should be investigated, and then having this EPS for calculation of percentage and not for analyzing the real cause of failure. The EPS is highly recommended as a key performance indicator in institutes providing implant service for quality improvement issues. Moreover, it can be used by implant companies and researchers for long term follow up of implant success and failure.

Acknowledgements

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