



Association between Implant Primary Stability and Operator Experience - A Retrospective Hospital Based Study

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ABSTRACT

Primary stability plays a major role in determining the success of implant therapy. The main aim of this study was to investigate the association between primary stability and operators experience. This retrospective study was conducted among operators who placed implants in Saveetha Dental College, Chennai. Data were reviewed and collected from 86,000 patient records over ten months from June 2019 to March 2020. Data collected was assessed and tabulated using Microsoft excel. The study included 990 implant sites from 476 patients with a mean age of 42.5 years and a gender distribution of 293 males and 183 females. Implants were placed by 125 operators who belonged to different years of study. The gender distribution of the operators included 73 males and 52 females. Data collected was then exported to Microsoft Excel 2010. The collected data were then subjected to statistical analysis using the Statistical Package for Social Science (SPSS). The most frequently obtained primary stability value was 30-40 Ncm with 53.8%. It was observed that clinicians with four or more years of experience place more implants when compared to others with 69.7% of the total study sample. Clinicians with four or more years of experience attain the optimum insertion torque value of 30-40 Ncm. Within the limits of the study, the implants were most frequently placed by students with four or more years of experience and the most frequent primary stability value observed was 30-40 Ncm. Insertion torque value of 30-40 Ncm was obtained by students with four or more years of experience.



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INTRODUCTION

Edentulism is a debilitating irreversible condition that is described as the final marker of disease burden for oral health (Ashok *et al.*, 2014; Venugopalan *et al.*, 2014; Ganapathy *et al.*, 2016; Jyothi *et al.*, 2017). Treatment for edentulism with dental implants has a phenomenal rise and has occupied the summit in modern dentistry (Ajay *et al.*, 2017; Ariga *et al.*, 2018; Duraisamy *et al.*, 2019). Scientific researchers are in constant effort to improve, excel, and simplify implant therapy (Kannan, 2017). Out of several factors like Implant design, bone biology,

osseointegration, prosthetic options, etc. Primary stability also plays a significant role in determining the success of implant therapy (Gill and Rao, 2012).

(Ranganathan *et al.*, 2017; Ariga *et al.*, 2018) Osseointegration is essential for the success of implant treatment. Branemark defined it as "a direct structural and functional connection between ordered, living bone and the surface of a load-carrying implant." (Branemark, 1983). Primary implant stability has been acknowledged as an essential criterion for the attainment of such osseointegration (Ashok and Suvitha, 2016). Implant primary stability is a measure of the anchorage quality in the alveolar bone and is considered to be the ensuing parameter in implant dentistry. The primary stability of an implant can occur at two different stages: primary and secondary (Atsumi *et al.*, 2007). It has been established to affect the process of osseointegration, implant loading, and, finally, the success of an implant (Meredith, 1998). Primary stability mostly comes from the mechanical engagement of an implant with the cortical bone (Cehreli *et al.*, 2009). Micromotion or movement between the bone and a freshly placed implant can jeopardise osseointegration. The primary stability of an implant is a prerequisite to undisturbed peri-implant bone healing and to prevent any infection (Selvan and Ganapathy, 2016; Vijayalakshmi and Ganapathy, 2016). Primary stability immediately after implant placement is necessary until secondary implant stability is gained by bone remodelling and osseointegration (Albrektsson *et al.*, 2000).

The success of implant placement can be attributed to primary stability (Neugebauer *et al.*, 2006; Duyck *et al.*, 2010). It is determined by the density of the bone at site, the surgical technique and the skill of the operator (Turkyilmaz and McGlumphy, 2008).

(Basha *et al.*, 2018) Achieving good primary stability is crucial for the immediate loading protocol of an implant. With this comes to play the importance of assessing the primary stability of the implant, as based on the stability a clinician can make judgments about the treatment procedures such as healing period and loading protocol. It can be measured using non-invasive clinical methods such as Resonance Frequency Analysis (RFA), protest and Insertion Torque (Turkyilmaz and McGlumphy, 2008; Cehreli *et al.*, 2009; Sotto-Maior *et al.*, 2010).

Torque is a measure of rotating force on an object. In oral implantology, the force used to insert a dental implant is defined as insertion torque (Cehreli *et al.*, 2009). It is the force required to advance the implant into the prepared osteotomy, which is expressed as

Ncm (Newton centimetre) units.

Reports have revealed that as clinicians become more familiar with modern technology, the clinical performance improves over time, and is termed as the learning curve (Franceschetti *et al.*, 2015). A clinician's skill and experience is of high importance in providing successful implant therapy. Literature by previous authors reveals that clinician's inexperience makes the treatment complex, and only experienced clinicians should attain tougher protocols like immediate loading (Ramsay *et al.*, 2002). In a previous retrospective study, it was observed that due to the improvement of the skill of the surgeon, implants previously installed five years ago or earlier had a higher failure rate than those that were inserted more recently (Geckili *et al.*, 2014). However, Jemt *et al.* published a study in 2016, where he couldn't find any difference between the failure rates of inexperienced surgeons and the experienced (Jemt *et al.*, 2016).

The factors that may influence the primary stability of dental implants have been investigated in many clinical and in vitro studies (Friberg *et al.*, 1999; Geckili *et al.*, 2009; Bilhan *et al.*, 2010; Toyoshima *et al.*, 2011).

However, there are very fewer reports based on the experience of a clinician and its influence on primary stability (Ranganathan *et al.*, 2017). Today, clinicians are keen on imbibing simplified implant procedures and techniques and would like to carry out in their private practice (Ariga *et al.*, 2018; Ranganathan *et al.*, 2017). Previously our department has published extensive research on various aspects of prosthetic dentistry. This vast research experience has inspired us to research this topic. Hence, the main aim of this study was to investigate the association between primary stability and operators experience (Duraisamy *et al.*, 2019).

MATERIALS AND METHODS

Study Setting

This university hospital-based retrospective study was carried out by reviewing the dental records of prosthodontic patients who had undergone implant therapy and the experience of the operator who had placed the implant in Saveetha Dental College and Hospitals, Chennai. Since this is a university hospital setting the large sample size and distribution of population contributed a significant advantage for this study. Data collected was reliable and with evidence. The study was conducted after obtaining approval from the Institutional Ethical Review Board.

Sampling

Data were reviewed and collected from 86,000 patient records over ten months from June 2019 to March 2020. Data of those patients who underwent implant treatment and the clinicians' experience was recorded. The operators were divided into five groups based on their year of experience with a minimum of 1 year to a maximum of five years. Incomplete dental records were excluded from the study. Cross verification was done using photographs and radiographs.

Data Collection

The following data were recorded as follows: hospital record number of the patient, demographic details of the patient and operator, year of study of the operator, clinical experience of the operator and insertion torque value obtained by the operator.

The study included 990 implant sites of 476 patients with a mean age of 42.5 years and a gender distribution of 293 males and 183 females. Implants were placed by 125 operators who belonged to different years of study. The gender distribution of the operators included 73 males and 52 females.

Data collected was then exported to Microsoft Excel 2010.

Data Analysis

The acquired data were subjected to statistical analysis. Microsoft Excel 2010 data spreadsheet was used for tabulation of parameters and later exported to the Statistical Package for Social Science (SPSS version 10.0) for Windows. Descriptive statistics were applied and, from the results, chi-square tests were applied at a level of significance of 5% ($P < 0.05$).

RESULTS AND DISCUSSION

The most frequently obtained primary stability value by clinicians was 30-40 Ncm, with 53.8% of the total sample of the study. It was observed that clinicians with four or more years of experience place more implants when compared to others with 69.7% of the total study sample. It was also observed that the optimum insertion torque value of 30-40 Ncm was frequently obtained by clinicians with four or more years of experience.

The success of an implant depends on various factors beginning with diagnosis and case selection up to prosthetic rehabilitation and maintenance. After an implant is placed in a selected site it must achieve primary stability; and is important because it plays a major role in bone healing by resisting micro-movement (Subasree *et al.*, 2016; Kannan and Venu-

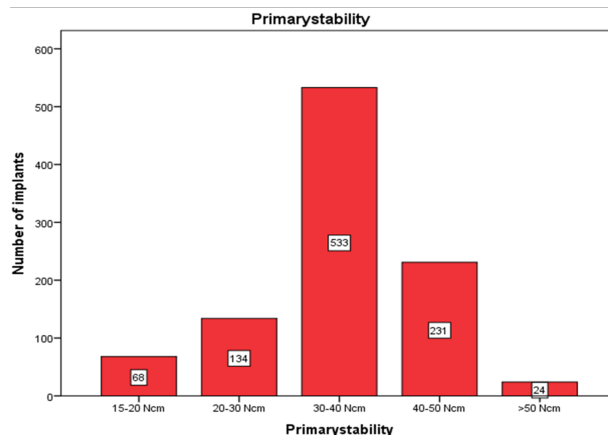


Figure 1: Bargraph depicting the most frequently obtained implant stability value across a scale of 15 Ncm to more than 50 Ncm.

gopalan, 2018).

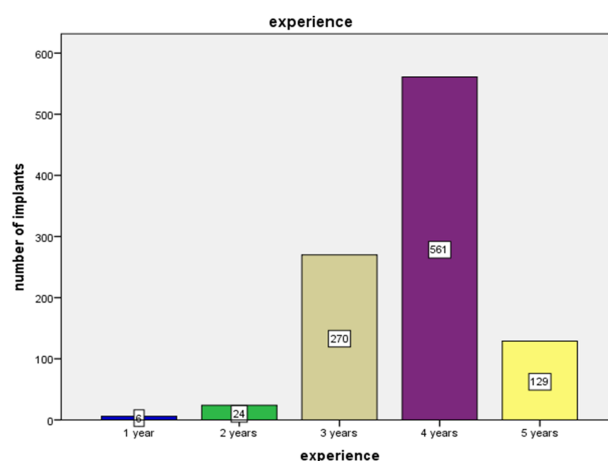


Figure 2: Graph depicting the clinical experience of operators who placed the implants on a scale of 1 to 5 years.

From this study, it was observed that the most frequent primary stability value was to be 30-40 Ncm with 53.8% (Tables 1 and 2, Figure 1). This finding is in agreement with findings reported by C J Venkatakrisnan (Venkatakrisnan, 2017), which revealed that the most optimum torque value is

35 Ncm and should not exceed 50 Ncm (Neugebauer *et al.*, 2006) considered insertion torque of 35 Ncm was optimum for immediate loading protocol. Duyck and associates Duyck *et al.* (2010) revealed that insertion torque above 50 Ncm could lead to higher peri-implant bone loss. Reports by (Ottoni *et al.*, 2005), suggest that a minimum of 32 Ncm insertion torque was necessary for implants to achieve osseointegration. When the insertion torque value was 20 Ncm, nine out of 10 implants failed in their study. Literature by Cunha *et al.* (2004) reported a mean insertion torque

Table 1: Table depicting the most frequently obtained implant stability value across a scale of 15 Ncm to more than 50 Ncm.

Primary Stability	Frequency	Percent
>50 Ncm	24	2.4
15-20 Ncm	68	6.9
20-30 Ncm	134	13.5
30-40 Ncm	533	53.8
40-50 Ncm	231	23.3
Total	990	100.0

Table 2: Table depicting the clinical experience of operators who placed the implants on a scale of 1 to 5 years.

Years of experience	Number of operators	Percentage
One year	6	.6
Two years	24	2.4
Three years	270	27.3
Four years	561	56.7
Five years	129	13.0
Total	990	100.0

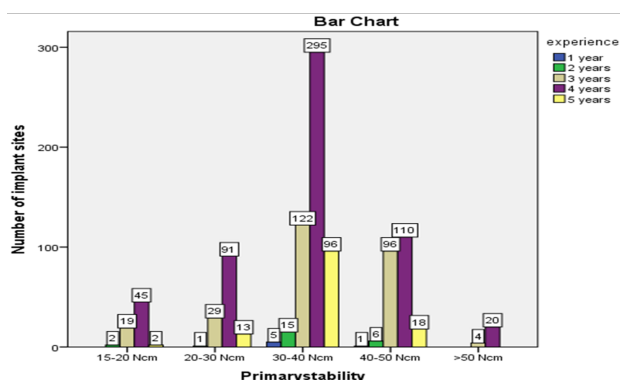


Figure 3: Graph depicting the clinical experience of operators who placed the implants and the insertion torque value they attained.

of 33.4 Ncm and 40.81 Ncm with two designs of implants. Another study by [Turkyilmaz and McGlumphy \(2008\)](#) had an average insertion torque value of 37.2 ± 7 Ncm in their study and failed implants had an average of 21.8 ± 4 Ncm. Reports by [Horwitz et al. \(2007\)](#) on insertion torque and Implant Stability Quotient (IQS) as measured by RFA, reveal a mean insertion torque value ranging between 36 and 41.60 Ncm. The reason for such findings in the study may be postulated because insertion torque higher than 50 Ncm has a higher incidence of peri-implant bone loss and causes bone 'die back'.

According to the present literature; implants were

frequently placed by operators with an experience of more than four years, with 69% of the total population (Figure 2). This may presumably be because of the difference in course requirements which is more for a masters student than an undergraduate student. In addition to this reason is the fact that as experience increases, confidence in their skills also develops.

Figure 1, The most frequently obtained primary stability value was 30-40 Ncm with 53.8%

Figure 2, It was observed that clinicians with four or more years of experienced place more implants when compared to others with 69.7% of the total study sample.

Figure 3, It was observed that clinicians with four or more years of experience attain the optimum insertion torque value of 30-40 Ncm. (chi-square test; $p=0.000$)

Table 1, The most frequently obtained primary stability value was 30-40 Ncm with 53.8%.

Table 2, It was observed that clinicians with four or more years of experience, placed more implants when compared to others, with 69.7% of the total study sample.

Primary stability value of 30 - 40 Ncm was mostly obtained by students with more than four years of experience ($p=0.000$)(Figure 3). This finding is in concordance with findings reported by various literature authors- ([Atsumi et al., 2007](#); [Geckili et al.,](#)

2014; Romanos *et al.*, 2020). According to these authors, as experience increased better primary stability was obtained by clinicians and thereby attributed to the improvement of implant success. The reason for such a finding may be because inexperienced clinicians overstress the bone due to lack of cautiousness which experienced clinicians have. Among surgical factors that influence osseointegration; implant bed preparation plays a vital role and is of clinical importance. Experienced clinicians are more precise and have better skills than those in their early learning curve who tend to establish a poor site preparation.

The limitations of this study include the following; since its a retrospective study, it cannot be generalized to a larger population, and the sample subjects was not available for direct examination. However, further studies in a similar subject should be carried out; since there's a lack of literature pertaining to clinicians experience and its influence on primary stability value.

CONCLUSION

Within the limits of the study, the implants were most frequently placed by students with four or more years of experience and the most frequent primary stability value observed was 30-40 Ncm. Insertion torque value of 30-40 Ncm was obtained by students with four or more years of experience.

Conflict of Interest

The authors declare that they have no conflict of interest for this study.

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