Implant Systems Used in a Teaching Hospital - A Retrospective Analysis

Research Article

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Abstract

Introduction: Dental implant therapy is one of the best treatment modalities for restoration of the missing teeth. It's been available as a treatment option for more than over thirty years. There are many types of implant systems available and clinicians are facing the dilemma of choosing an implant system from a large number of options. The main goal of modern dental treatment is to restore the patient's normal function, speech, esthetics, as well as health.
Aim: The aim of this study was to evaluate the different types of implant systems used and most commonly employed implant systems in replacing the missing teeth among the patients attending a teaching institution.
Materials and Methods: Case records of patients who underwent implant placement were retrieved. A total number of one thousand one hundred and twenty eight implants were placed in five hundred and eighty five patients with a mean age of 39.9 ± 12.5. Descriptive statistics such as frequency, percentage and chi square test was done for association.
Results: The common implant site was found to be mandibular posteriors. There were three implant systems used namely, Equinox, Nobel Biocare and Straumann; under nobel biocare and straumann there were different types of implants used. Majority of the implants placed were from the nobel biocare system 45.12%. Association between age, site of implant placement with implant systems showed statistical significance(P<0.05) while association between gender and implant systems did not show any statistical significance(P>0.05).
Conclusion: Within the limitations of this study, the most common implant system used to replace the missing teeth of the patients who attended a teaching institution was found to be Nobel Biocare, in which male patients were mostly treated with dental implants and mandibular posterior teeth were the most common site of implant placement.
Clinical Significance: Nobel biocare is the most preferred implant system in the hospital where a majority of the patients were males.

Keywords: BIC; Implant; Implant Surface; SLActive; TiUnite.

Introduction

Patient's need for prosthesis is determined by functional, esthetic, psychological, and social impacts due to tooth loss. Location of absent tooth, age, gender, function, discomfort, and dissatisfaction with appearance and financial factors influence the treatment needs and the choice of prosthesis to replace the missing tooth/ teeth [1]. In such conditions, the role of the dentist is very important regarding the choice of the replacement of the teeth. There are various treatment modalities available for the replacement of the teeth. The main goal of modern dental treatment is to restore the patient's normal function, speech, esthetics, as well as health. [2-5].

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People have been trying to recreate lost tooth structures for ages [6]. Implants are traceable to early Egyptians and South Central American cultures and with all the developments in material and biological science we have come a long way [7]. Improvements in both the quality and quantity of the implant biomaterial are the reasons for this treatment modality being practiced abundantly today. In history, the Mayans used volcanic glass, shaped such as a tooth root and animal shells as implant biomaterial to perform immediate implantation of a lost tooth [8-10]. The first modern xenogenic material used in implantology was gold and this was used in 1809 by the Italian dentist Maggiolo who placed the implant immediately after extraction whose root shape matched the tooth socket [11].

Dental implant therapy is one the best treatment modalities for missing teeth. It has existed as a treatment option for more than thirty years now. The popularity of this treatment option increased with the introduction of the concept of osseointegration [12-14]. Enhancement of implant design surgical protocols and surface characteristics subject implant as a procedure that is secure and highly predictable. The mean success rate and mean survival rate of implants are 89.7% & 94.6% respectively, after more than 10 years [15]. Dental implants are basically biocompatible metal anchors surgically positioned in the jaw underneath the gum to support an artificial crown where natural teeth are missing. The bone grows in and around the implant creating a structural support that's strong [16]. Today, the titanium materials are considered to be the most biologically compatible materials to vital tissue. As more types of implant systems have become available, clinicians are facing the dilemma of choosing an implant system from a large number of options for multiple clinical situations. Dentists may choose their implant system based on many factors, like, scientific based evidence, financial considerations, implant related factors and manufacturers related factors.

Various studies have been conducted under our institution, like in vitro studies [17], surveys [18, 19], clinical trials [20-28] and reviews [29-31]. We are focussing now on retrospective studies, hence, the aim of this study was to evaluate the different types of brands of implant systems used in Saveetha Dental College & Hospitals.

Materials and Methods

This was a retrospective study which was conducted at the Department of Implantology,Saveetha Dental College ,Chennai. Clinical data of patients who underwent surgical placement of implants between June 2019 to March 2020 were retrieved from the Dental Information Archiving Software (DIAS), which is a database of over 86000 patients. The ethical approval for this study is obtained from the ethical committee (ethical approval number SDC/SIHEC/2020/DIASDATA/0619-0320). The collected data was cross verified using photographs, reviewed by another investigator and was subject to data analysis. A total of one thousand one hundred and twenty implant sites were included in this study.Variable such as age, gender, implant site and implant system were recorded.Incomplete , censored and repeated data were excluded from the study.

Statistical Analysis

Data was analyzed using SPSS software (IBM SPSS Statistics, Version 24.0, Armonk, NY: IBM Corp). Descriptive statistics were used for the data summarization and presentation.Chi-square test was done to evaluate the association of variables. p value<0.05 was considered to be statistically significant.

Results

From the analysis of the data collected, it is seen that the total number of implants placed were 1128 implants among 585 patients with a mean age of 39.9±12.5. The number of implants placed were more among males (n=346) than females (n=239) comparatively.

Association between gender and implant systems did not show any statistical significance (P>0.05) as seen in table 1 while association between age, site of implant placement with implant systems showed statistical significance (P<0.05) as seen in figure 1 & figure 2. The common implant site was found to be mandibular posteriors as seen in figure 2. There were three implant systems used namely, Equinox, Nobel Biocare and Straumann; under nobel biocare and straumann there were different types of implants used and their distribution and majority of the implants placed were from the nobel biocare system 45.12% as seen in figure 3.

Discussion

Dentists have many different implant systems to choose from and therefore, scientific based evidence available on the implant system is a very important criteria for the selection of a particular implant system. Many manufacturers claim that their implant system is the best but often it is not clinically examined and only a few of the manufacturers do clinical trials on their products. Unless dentists carefully select their implant systems and handling of the materials, they are at risk of being held liable for patients suffering any defects in material during treatment. Both locally and internationally, the factors influencing the choice of implant may vary.

From this study we can see that the most commonly used implant

Table 1. This table represents the association between gender distribution and implant systems. It shows that most no. of implants were placed among males(n=625) and among the systems, Nobel biocare was common among both Males(n=282) and females(n=227). This association showed no statistical significance where, P=0.789 (P>0.05).

Gender	IMPLANT SYSTEMS			Total	Chi square value	P Value
	EQUINOX	NOBEL BIOCARE	STRAUMANN			
Male	98	282	245	625		
Female	72	227	204	503		
Total	170	509	449	1128	0.474	0.789

Figure 1. This bar graph represents the association between age distribution and implant systems, where X axis represents the age distribution of the patients and Y axis represents the no of patients. From this graph it is seen that the Nobel Bio-care (Green) system had a higher rate of percentage among the age group 41-50 years i.e., 12.15%, while straumann (Red) was higher among the age group 31-40years, 11.44%. From this graph we can infer that nobel biocare(Green) was the most commonly used implant system among all the age groups except for the 31-40years age group where the straumann (Red) system was used. This association showed statistical significance at the level of 5%, with Nobel biocare being used the most. variation where, **P=0.017 (P<0.05).**
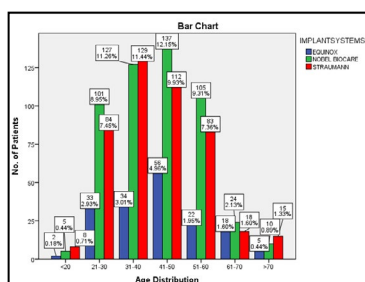

Figure 2. This bar graph represents the association between the site of implant placement and the implant systems, where X axis represents the site of implant placement and Y axis represents the no of patients. From this graph we can infer that the nobel biocare system (Green) had a higher rate of percentage among mandibular posteriors with 25.09% and it was commonly used among all the sites except for maxillary anteriors where the Straumann system (Red) was commonly used with a percentage of 6.38%. The equinox system (Blue) was generally not used among the anterior region where maxil-lary anterior had 0.53% and no implants were placed in the mandibular anterior region. The equinox system(Blue) had a comparatively lesser percentage rate even in the posterior regions when compared to the Nobel Biocare system(Green) and Straumann system (Red). **(Chi-square value=53.518,P=0.000).**
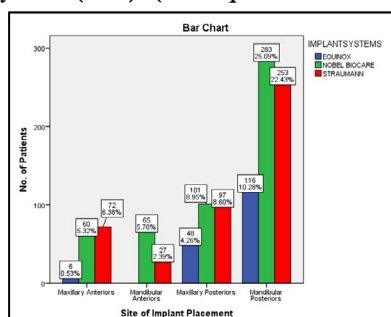

Figure 3. This bar graph represents the various types of implants placed, X axis represents the percentage of patients with implants and Y axis represents the different types of implants. From this graph we can infer that the most common type used among the patients was Nobel Biocare Conical connection(30.67%) (Pastel green) followed by Straumann Roxolid SLActive (26.68%) (Red) and Equinox(15.07%)(Blue).
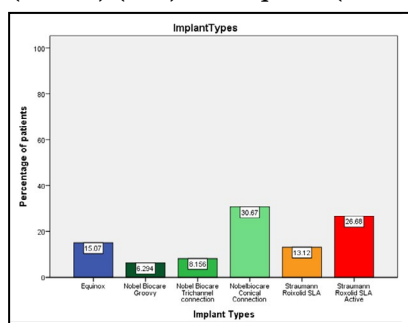
system was Nobel biocare followed by Straumann and Equinox systems. The literature also indicated the preferential use of par-ticular implant systems such as Nobel biocare and Straumann due to its various advantages over the other systems [32, 33]. The cur-rent basis for implant treatment protocols is early osseointegra-tion followed by early loading of implants [34]. Enhancement of bone to implant contact (BIC) interface is an important param-eter that affects speed of osseointegration [35]. Various studies compared hydrophobic and hydrophilic implant surfaces having the same microtomography and concluded osseointegration was enhanced and a better response was seen by hydrophilic surfaces than hydrophobic surfaces [36]. Surface chemistry that promotes

hydrophilicity and not micro surface topography has shown to accelerate implant osseointegration and increase BIC. From our study it is seen that hydrophilic implants are used compared to hydrophobic implants i.e., Nobel biocare > straumann implants. The TiUnite implant surface seen in Nobel Biocare active, was first introduced on the Brånemark System in 2000. This shift from machined to TiUnite surface resulted in a clear decrease in early failures, especially in areas with poor bone density. TiUnite is a high-performance implant surface that enhances osseointegra-tion [37] even under the most challenging conditions [38, 39]. It is characterized by a moderately rough, thickened titanium oxide lay-er with high crystallinity and osteoconductive properties leading

to faster bone formation. The TiUnite surface has been proven to help maintain implant stability achieved at placement during the critical healing phase [40] and anchorage in the surrounding bone, compared with machined implants [41]. TiUnite surface implants can therefore play an important role in helping clinicians meet patient demand for immediate teeth. As seen in figure 3, in case of different types of implants under nobel biocare system, nobel biocare conical connection was most commonly used which was followed by straumann roxolid SLActive under straumann system. The straumann roxolid SLActive implant is a hydrophobic surface implant, this implant offers advantages within the first month of tissue integration compared to the other implants [42, 43].

The association of gender with the implant system was analysed and the results were statistically not significant (p value > 0.05) as seen in Table 1. A majority of the implants were placed among the male patients when compared to females. Association between age and implant systems showed statistical significance (p value <0.05) as seen in Figure 1, with the age group 41-50 years with highest number of implants placed, although Nobel Biocare was commonly used among the different age groups, the Straumann system had a higher rate (11.44%) among the age group 31-40 years. We can infer that implant placements have increased as age increases up to the age group 41-50yrs after which it has a gradual decrease in implants, this may be due to various factors such as inadequate height, width of the edentulous site or periodontal disease.

Figure 2 shows the association between implant site and implant system shows statistically significant results(p value<0.05). In both maxillary and mandibular posteriors, the Nobel Biocare system was the most commonly preferred system which was then followed by Straumann and Equinox systems. The most common site of implant placements was done in the mandibular molar region, among the various implant systems the Nobel Biocare system was mostly placed in mandibular posterior region with 25.09% and Straumann system was commonly used among the maxillary anterior region with 6.38% rate while equinox system was generally lower than the other two systems comparatively. The wide use of the Nobel Biocare system among most of the implant placement sites coincided with various studies in which they concluded that it was their choice of implant system in most of the patients. In a study done by Chang et al.,[44] it was concluded that the Nobel Biocare system expressed better results than the Straumann system in type IV cortical bone. Most of the stress distributions were concentrated on the top of cortical bone for all of the models, especially under non axial loads. And this maybe one of the reasons why Nobel Biocare system was widely used in this institution, and it was mostly preferred by dentists to place these implants in mandibular anteriors which have a bone type of D1(dense cortical bone) or D2 (dense to porous cortical bone with dense trabecular bone).

The study was geographically limited and predominantly consisted of the South Indian population. Data which were unclear were excluded thereby reducing the sample size. To ascertain the results of this study and to increase the level of significance, the sample size and the geographic area of coverage should be extended to at least most parts of South India. Conducting a multicentered study with extended geographic area and wide range of population in the future can help us obtain better results.

Conclusion

Within the limitations of this study, the most common implant system used to replace the missing teeth of the patients who attended Saveetha Dental College was found to be Nobel Biocare, in which male patients were mostly treated with dental implants and mandibular posterior teeth were the most common site of implant placement.

Clinical Significance

Nobel biocare is the most preferred implant system in the hospital where a majority of the patients were males.

Acknowledgement

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