



Research Article

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Investigating Economic and Clinical Implications of Tooth Implant Supported Prosthesis among Patients and Practitioners

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ABSTRACT

The concept of dental implant is receiving more attention globally. Tooth implant is one of the most significant methods, which replaces the tooth in the natural way. Considering the economic and social factors, selection of appropriate treatment has now become difficult. Due to the use of different implant related materials, dental implant processes are found to be more cost-effective in comparison to the conventional methods. The study aims to systematically review previously done literature work and to analyze the association of economic and clinical implications of tooth implant support prosthesis (TISP). The current study has adopted qualitative secondary approach for data collection and analysis. The findings of this study showed evidence that tooth-implant prostheses are one of the efficient treating methods and has often undergone through failures due to different treatment factors. The study concluded that together with cost-effectiveness, the efficiency of treatment methods must be taken into consideration in the clinical practices.

Key words: *Economic and Clinical Implications, Patients and Practitioners, Prosthesis, Pooth Implant.*

INTRODUCTION

Dental implant acts as the common dental procedure that is usually undertaken during the cases of jaw or mouth injuries [1]. The idea of tooth implant supported prosthesis dates back to the early 1980s, when the splinting implant technology was introduced. However, by the time of late 1980s, other technologies such as screw retained abutment with an anti-rotational feature was introduced which ultimately turned out as a huge success in the dental implant supported prosthesis processes [2].

Dental implants are cost-effective alternatives in comparison to the conventional restoration, and it is also beneficial in regard of maintaining oral health quality of life. Both dentists and patients are inclined towards the method since it allows restoration of the affected teeth, without damaging the adjacent teeth [3, 4]. Whereas, other conventional methods including the fixed dental prosthesis (FDP) and computer-guided dental implants are costly [5, 6]. However, in multiple tooth replacement, the dental implants are initially costly but ensure massive improvement in oral health in comparison to any other treatment options. In addition, for edentulous patients, implants are better and reliable alternatives as compared to traditional ones. In order to get desired results, proper

treatment planning serves as an essential measure, as it ensures the successful treatment outcome. Moreover, the inclusion of applications that are computer-based, are proving out to be very beneficial in all fields [7].

Dental implants are beneficial in comparison to other traditional alternatives. However, when age-related changes occur in oral health in relation to the social, economic and other resources, certain complexities come forward especially among ageing population. Due to these factors; it is difficult to opt for simple treatments. Different challenges, and risks are often encountered due to the nature and variations in tooth implant prosthesis. With the need of dental implants among the ageing population, there are challenges that are associated with the changes in oral tissues due to age factor, which requires special attention [8]. In terms of clinical implications, computer-guided implant placement tends to overcome the errors that are usually encountered during implant osteotomies [9]. Whereas, Orentlicher, Horowitz and Kobren (2019) added that in most of the dental implants conducted through computed tomography, certain errors were identified.

Though the advancement is beneficial in clinical perspectives, certain techniques are extremely costly for patients. Several factors have been identified that contribute to the increase in treatment cost such as materials used for implants, patient's health, and number of implants being placed along with the type of prosthetic used to secure the implant. The cost further varies from one region to another. Also, despite its high success rate, it may result in certain risks, for instance; the healing process may take several months, patients complaining of weak chewing abilities and the occurrence of physical strain [10, 11].

The significance of tooth implant is that it replaces the missing tooth in the most natural way and offers independent support to bridges, crowns, and removeable dentures. Despite its various merits, scenarios differ from patient to patient. In many cases, patients are reluctant to pay high cost for the implants as it gets in the way of treatment. In terms of economic, social and other resources, it is at times difficult to opt for an appropriate treatment. Therefore, the study aims to systematically review previously done literature work and to analyze the association of economics and clinical implications in regard to tooth implant supported prosthesis (TISP).

LITERATURE REVIEW

Analysis of Economic Concerns in terms of TISP

Dental implant market continues to expand every year, despite of the recent economic downturn. There is a great involvement of dentist in placing restoration of dental implants; whereas, the dental implants are being placed within an extended range of clinical settings. The major risks faced by the dentists include; problem in complying with the training requirements, completion of initial phases of history and examination, ensuring appropriate indemnity, maintenance extensive clinical records, and recording of diagnosis procedure [12]. York et al. (2019) outlined that to reduce the cost of dental implants, dental laboratories are now working to produce their own components of dental implants. These components are further tested to ensure the quality of these newly developed products.

Ntolou et al. (2016) assessed the cost-effectiveness of dental implant in comparison with the fixed partial denture (FPD) to replace a single tooth [13]. With the help of meta-analysis, the survival rate of single-tooth implant was extracted. The data regarding the cost of implants was gathered through a survey. The results illustrated that the cost of single-tooth dental implant was US \$261 (clinic) to \$342 (hospital) and had a survival rate 10.4% higher. The analysis showed that the survival rate and initial treatment cost ensure the cost-effectiveness. The failure of dental implant and stress of complications associated with the treatment result in financial pressure for patient and reputation concerns for the doctor [12]. The study conducted by Ntolou et al. (2016) has shown that cost of maintaining molars with furcation involved molars is cheap as compared to the replacement of tooth with dental implants [13]. Initial as well as the follow up therapies tend to generate high costs, when peri-implantitis takes place.

Analysis of Clinical Implications in terms of TISP

The adequate transfer of specific implant positions to the patient's mouth is of great benefit to both the practitioner and patients. Therefore, it is important to consider the inherent complexity of materials and techniques utilized before conducting the implant procedure. Balshi et al. (2019) conducted a study to identify the clinical implications of the mandibular complete arch fixed implant supported prosthesis [14]. The study outlined that the given technique is one of the earliest and commonly used technique in the prostheses of implant dentistry. Despite its high usability, one of the major drawbacks of the technique is the long-term follow-ups ranging from 10 to 30 years.

Elani et al. (2018) conducted a study to identify the trends in dental implants between the period of 1999 to 2016, along with its projections in 2026 [15]. The study analyzed data from the duration between 1999 to 2016, obtained through 7 National Health and National Examination Survey. Absolute and logical difference between the 1999-2000 to 2015-2016 were calculated. The findings of the study indicated a significant increase in the adaptation of dental implants as a treatment method, with 0.7% in 1999 to 5.7% in 2015-2016. The highest preferences of the given treatment were found among patients aged between 65-74 years old. The study further concluded that the projection of dental implants till the year 2026 is expected 23% at least.

Ntolou et al. (2016) added that the application of computer assisted tooth implant surgery are complex as they require integration and maintenance of the structured data within the three-dimensional models. The conservative therapeutic approaches for maintaining teeth have been replaced by the severe intrusion of dental implants carried on in the everyday clinical practice.

METHODOLOGY

Qualitative secondary approach was used for data collection and analysis. A MEDLINE search was conducted keeping the publications from 1986 up to 2015 in considerations. The following terms were focused to make the search more relevant: “implants” and “economic”; “implants” and “implications”; “implants” and “clinical measures”, etc.. Once these articles were found, they were analyzed according to their relevance criteria.

The inclusion criteria for this study was provided as; the studies with minimum 5-year follow up, along with those where patients were thoroughly examined both clinically and radiographically beforehand. Furthermore, the publications that illustrated the findings for both economic and clinical implications and its impact on TISP were taken into consideration. The published articles were discarded due to various reasons. For instance;

1) the articles with mean observation period of less than 5 years 2) articles which did not target the clinical implications and economic impact of TISP 3) articles including those where surveys, reviews and case reports were not in compliance with the title or major perspective of the study.

Once the relevant articles were obtained, they were examined by two reviewers. In case of any disagreements, things were sorted out by the means of discussion. Re-evaluation was done to resolve any discrepancy in records from the reviewer’s end. A total of 5 studies were taken into account from where the relevant information was retrieved. In addition, the information about the initial costs of implants and the direct costs associated with the minor, major and adjustments were also extracted. The obtained information was reviewed to perform systematic review and meta-analysis. The evaluation was done based on meta-analysis. The type of data that was assessed for this study was in regard to the clinical implications and economic impact of the tooth implant support prosthesis among the practitioners and the patients.

RESULTS

The study mainly aimed to develop inventory of current literature regarding the economic and clinical implications of tooth implant supported prostheses, while analyzing and discussing the associated complications. Tooth implant supported prostheses has been considered as the best treatment option for the partially edentulous patients. This procedure requires proper selection of the treatment approach similar to every other dental practice [16]. Although there are many disadvantages of this method, the procedure is justified through its risk-benefit evaluation with proper attention being given to the patient requirements. The results are clinically significant as they support the tooth implant supported prostheses, with complete attention to the prudent guidelines.

The missing teeth are likely to be replaced by various modalities depending on the adequacy of bone support, desire of patients, condition of the oral cavity, and costing. A study conducted by Shenoy et al. (2013) has proved tooth implant supported prostheses as an efficient treating modality [17]. When the implant fails to osseointegrate or there is an anatomic limitation, the implant is connected to the remaining natural teeth. The main advantages of tooth implant supported prostheses include higher mechanoreception, splinting of a natural tooth to an implant, as well as additional support provided to the dentition. The restorative procedure connects teeth with the implant borders resulting in significant reduction in the total costs [18]. However, increased repairing costs and increased need of maintenance are the major disadvantages associated with tooth implant supported prostheses. The comparative analysis of different studies concerning the economic and clinical implications of tooth implant supported prostheses among the practitioners and patients are presented in Table 1.

Table 1: A Comparative Analysis of Different Studies

Author	Title	Methods/Conclusion
[8]	Implants for the ageing population	Dudley (2015) conducted a narrative review in order to discuss literature pertinent to the clinical implication of dental implants among aged populations. The results showed that the important predictors for the success of implant include the quality and quantity of bone mass. However, bone conditions are specified based on patient's age and tooth site.
[13]	Prognosis of Furcation Involved Teeth: Cost-Effectiveness over Implant Placement	This review analysis intended to study the cost-effectiveness of tooth implant supported prostheses and involvement of molars replacement with the dental implants. The results depicted that the dental implants are costly, regardless of the patient's risk profile. Further high costs are generated when periimplantitis takes place.
[17]	Tooth Implant Supported Prosthesis: A Literature Review	The study has reviewed biomechanical behavior of implant and the natural teeth. The results indicated that overload on implants results in marginal bone loss. However, there is no significant difference between the use of non-rigid connections and various types of connections utilized.
[19]	Meta-analysis of Failure and Survival Rate of Implant-supported Single Crowns, Fixed Partial Denture, and Implant Tooth-supported Prostheses	The study conducted MEDLINE search for selecting studies on tooth implant support prostheses. The results showed increased survival rates for tooth implant supported prostheses over a period of 5 years. Efficient planning of prosthetic rehabilitations depends on the successful tooth implantations.
Le et al. (2015)	The clinical success of tooth-and implant-supported zirconia-based fixed dental prostheses	The study has reviewed the current literature regarding the clinical performance of tooth implant supported prostheses. The results showed that most common reason for failure of these implants was veneering of materials. The frequent loss of retention is likely to occur in the fixed dental prostheses.

DISCUSSION AND CONCLUSION

The findings of the current study showed evidence that tooth-implant-supported prostheses are considered significant in the treatment of partially edentulous patients. Multiple clinical reports have included limited data set on tooth-implant-supported prostheses [20, 21]. A study conducted by Elsayed (2017), provided a comparison between failure and success rate of TISP in 18 patients [22]. However, the findings of the recent study determined neither prosthesis complexes nor implant failures in the connected as well as non-connected groups. Furthermore, implants tend to fail after four years in the tooth-implant connected with prosthesis group. This is due to the fact that those teeth were unable to sustain their attachment and support their function.

Moreover, Lemos et al. (2016) explored 160 patients with 220 standard fixed prostheses supported by teeth over a 5 years period [23]. Most of the prostheses were acrylic, while others were of ceramic metal. About 4% of the abutment teeth indicated crown cement failure, 11% periapical abrasion, and 1.6% required extraction. Among the crown cement failures in the tooth-implant-supported prostheses, few teeth indicated tooth intrusion. A Number of researchers attempted to explain the cause of such intrusion [24, 25]. Al-Omiri et al. (2017) postulated a mechanical binding theory mainly for intrusion, explaining that rebounding of the tooth is inhibited by binding the side walls of the attachment joint; thus, leading towards intrusive contact [26]. This generally happens when the insertion point is somewhat different from the axis of tooth.

Den Hartog (2017) investigated that single-implant crowns are greater in size and contributes to lower rates of complications i.e. 2.55 per 100 prostheses [27]. On the other hand, single-implant with FPD possess high rates of complications that is 9.30 per 100 prostheses. Ntolou (2016) presented that retaining furcation included molars by means of periodontal treatment tend to be more cost-effective as compared to implant-supported crowns which are found to be expensive. However, survival rates of both these treatments are investigated to be similar. Wilder (2016) also determined that the consequences of periodontal supportive treatment are effective, especially when given by specialists rather than practitioners; [28] while, this includes higher costs. Tonetti et al. (2017) argued that costs of the periodontal supportive treatment should not be taken into consideration, rather the effectiveness of the treatments must be evaluated in order to improve the quality of patient's life [29].

Based on the findings of the current study, it is concluded that using implants for the treatment of edentulous patients is highly effective. Tooth-implant supported prostheses are found to have certain failure rates due to different reasons. Therefore, the connection of teeth with the implants should be rigid in order to avoid tooth intrusion. In addition, the current study also concluded that economic factors alone cannot be taken into consideration; however, the effectiveness of a particular treatment for edentulous patients must be considered in clinical practices. Furthermore, significant considerations during treatment include the stability of implants, aesthetics and the extent of periodontal damage within the dentition that are important for effective outcomes.

The present study was limited as only little knowledge regarding the effectiveness of implant supported prostheses have been identified. To provide useful solutions, it is important to conduct a detailed study, focusing on the types of failures encountered among patients undergone through the given treatment. Cross-sectional studies central to the outlined issue will be of great benefit in terms of literary contribution and clinical perspective. The idea is crucial as it would assist clinicians in proposing some useful guidelines that are effective in increasing the treatment value of implant supported prosthesis.

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