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Small Diameter Implants- A Literature Review

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Abstract
Complete dentures is a very well-known and the most commonly used technique for edentulous patients, however in recent times implants are the new upcoming and promising alternative to complete dentures. It provides with better stability and retention. In spite of all these benefits many edentulous patients are resistant to undergo implant treatment due to fear of surgery and cost price. Taking into considerations of these issues, this paper reports the review on Small Diameter implants which were done in the past 20 years. The aim of this review article is to 1) find out that the survival of implant is dependent on flap or flapless approach 2) find out survival of narrow diameter implants 3) to find out if there is any co relation between the survival and length of the of SDIs.

Introduction

Tooth loss is a very common dental finding, especially in the elderly. According to WHO edentulism impacts many individuals and in some cultures edentulism affects the community too. Thus, this increases the need for finding newer and newer methods and techniques of implant placement. In spite of the fact that dentures are the traditionally used treatment of line for edentulous patients, many elderlies have problems in using it as it a very patient complaint method. Dentures also do not have better retention as well stability which restricted the patients from chewing on any hard food, causes accumulation of food, requires proper cleaning of the denture, if not done can lead to fungal infections like candida etc. frequently the problems occur with mandibular dentures as it is affected by the tongue movements, lips and the cheeks. Even the patients who are able to wear the maxillary denture easily have seen to struggle with mandibular dentures (Muller et al. 2001).

Better retention is provided by the implant overdentures as compared to conventional dentures which reduces the difficulties in function (Meijer et al. 2004). There is seen a reduction in the ridge resorption around the implant, reduction in bone loss, pain, denture instability and improved masticatory efficiency and ability (Polzer et al. 2010). Other than these advancements many reports have shown that implants have an impact on psychosocial parameters like self-image, speaking and satisfaction (Cibirka et al.1997; Wismeijer et al. 1997; Awad et al. 2000; Thomason et al. 2007).Based on the ratings obtained by the patients on satisfaction and quality of life related to oral hygiene and health, mandibular overdentures are an effective treatment as compared to the conventional denture treatment according to the results from a recent meta-analysis of clinical trials on implant overdentures (Emami et al. 2009). Mc Gill Consensus statement and the York Consensus statement have declared the mandibular two implant overdenture is contemplated as " the first choice standard of care for edentulous patients" (Feine et al. 2002; Thomason et al 2009).

Obstacles in placing the implants

Many obstacles are there in placing the implants. The high cost of the implant placement treatment id one of the obstacles, and the edentulous patients are unwilling to or are unable to pay for the treatment (Owen, 2004; Narby et al. 2008; Carlsson and Omar, 2010). According to the reports 10 % of the world population is edentulous out of which only 1.7% have undergone implant treatment (Carlsson and Omar, 2010).

As reported by the studies, the cost of surgery is one of the obstacles in implant placement, other important obstacles are the fear of surgery. Most of the patients who are edentulous belong to the age group of people more than 65 years of age. These elderly patients are anxious about any of the surgery (Kiyak et al. 1990). A prospective study was done in a group of edentulous patients who were more than 65 years of age were given free implant for overdentures, out of all the patients less than two third of the patients accepted the treatment, rest rejected it. The commonest reason why the patients rejected the treatment was fear of surgery (43%) (Walton and MacEntee, 2005). This obstacle was to be seriously considered as even if the problem of financial barrier was cleared these patients still rejected the treatment. A study of 194 patients was done to see the major factors which can alter the decision to replace failed implants, apart from the cost the main reason that the patient avoided treatment was the fear of pain (Mardinger et al. 2008). A recent multicentre qualitative study of edentulous patients was done in the UK and Canada showed that fear of pain and complications following a surgery is a main reason of the patients in declining the treatment (Ellis et al. 2011)

Addressing the obstacles

We have seen that the major obstacles in treating edentulous patients with implants is cost and fear of surgery. Nonetheless, now what has to be done is to make this treatment more accessible and less fearful to the majority of the edentulous patients.

To address the obstacle of fear of surgery, what one can try is to avoid reflecting the flap. Traditional flap raising procedure becomes very uncomfortable for the patients during the surgery and also after the surgery as opposed to flapless surgery which doesn't involve raising of the flap and causes less trauma to the tissues. This minimally invasive technique of flapless procedure (not raising a flap) for implant placement will also reduce the time of surgery and subsequently its cost, therefore addresses to the two main obstacles in the placement of implants i.e., fear of surgery and cost. Larger the size of implant, greater will be the chances of failure of implant placement, thus smaller dimension of implant of course will less likely cause the failure of implant. Thus to determine whether SDI can be placed using flapless procedure, we decided to carry out a literature review to 1) find out that the survival of implant is dependent on flap or flapless approach 2) find out survival of narrow diameter implants 3) to find out if there is any co relation between the survival and length of the of SDIs.

Methods

Till August 2011 PubMed, Cochrane Database of Systemic Revies and EMBASE were searched to evaluate the use of small diameter implants. Keywords were used in the electric search. "Small diameter implant", "narrow diameter implant"' and "mini dental implant" were the keywords types in the electronic search, and also the searches were not restricted by the publication date. Manual search was done to get a list reference list of articles, reference lists of review articles and major implant journals like Clinical oral Implants Research, Clinical Implant Dentistry and International Journal of Oral & Maxillofacial Implants.

Inclusions of this review were studies that used 1) implants with a diameter of 3.5mm diameter or less 2) have a follow up duration of at least 5 months following the placement of the implants 3) study should be a randomized clinical trial, retrospective or prospective cohorts in human subjects 4) include data in respect to survival rate of the implants.

Exclusions of this review are 1) case reports, non-clinical studies explanation of techniques or manuals 2) mini-implants for orthodontic anchorage 3) animal studies 4) small diameter implants which were not meant for permanent use i.e., fixing of temporary crown and bridges.

Results

Forty-one studies in accordance with the above-mentioned criteria which were published between 1993 and 2011 using small diameter implants from a number of companies and surface characteristics that had a diameter of 1.8mm to 3.5mm and lengths of 8mm to 18mm. All in all, a total of 10,093 small diameter implants were placed in approx. 2762 patients. 26 studies used flap reflection technique for placing the implant and 6 studies used the minimally invasive flapless technique for placement of implant and 2 studies used both the techniques for placing the implants and the remaining studies the technique was not specified. Follow up duration differed from 5 months to 9 years. All screened studies reported a survival rate of 90% including 8 studies which reported a survival rate of 100%. 22 studies reported a survival rate of 95% to 99.9%. Small diameter implants with shorter length reported most of the failures (less than or equal to 13mm) (n=88) compared to longer SDIs (more than 13mm).

Discussion

Small Diameter Implants, Narrow Diameter Implants or Mini Dental Implants are the names which are used to describe implants with a diameter less than 4mm. SDIs were commercially introduced first time in the dental field in 1990 (Davarpanah et al. 2000). Since SDIs were commercially introduced many studies have been done, all of which are currently commercially available (Zinsli et al. 2004). Because of the limitations in the capacity of the alveolar bone many designs of small diameter implants have become commonly used in recent times (Olate et al. 2010). The two major advantages of small-diameter implants are 1) the advantage of applying less invasive surgical procedure when there is circumferential bone deficiency around the implants 2) one can place the SDI in a reduced interradicular spaces (Olate et al. 2010; Elsyad et al. 2011).
According to the current review the survival rate of small diameter implants and regular diameter implants is the same. The current study, most of the studies reported survival rate of 95-100% and none of the studies reported survival rates below 89%. In spite of the fact that reflecting flap gives a cleared visibility and accessibility, this is considered as invasive approach (Fortin et al. 2006). Reflecting the flap causes trauma to the tissue, pain and also bone resorption (al-Ansari and Morris, 1998; Oh et al. 2007). Minimally invasive flapless technique has been considered as the recommended technique for the placement of both small diameter Implants and regular implants. The benefits of using a flapless technique is that bleeding is minimized as well as the time for surgery is minimized (Becker et al. 2005; Casap et al. 2005; Komiyama et al. 2008). Also there is no negative impact on the survival of SDIs has been reported (Berdougo et al. 2010; Mueller et al. 2011). Pain and swelling was almost nil post operatively in flapless implant surgery, according to some studies (Casap et al. 2005). According to histological studies a flapless technique has lesser inflammatory complications and thus faster re epithelialization in comparison to flap reflection technique (Naert et al. 2002). With careful patient selection and treatment planning a high success rate can be obtained using this technique. According to this review no difference was found in the survival rate of the implants between studies using flapless and flap reflection techniques. But in this review only six studies were done using flapless technique. So more studies need to be done using flapless technique.

Conclusion

In this review we only found a few studies in which flapless placement of SDIs were carried out, but these studies suggested that a flapless approach gives a successful placement of SDIs. Alongside this finding we also were able to learn that SDI with a smaller length showed reduced success. However more studies needs to be done to get rigorous scientific evidence to support this theory. Taking into considerations the ever increasing price of the oral health care along with increase needs from the population with lesser incomes, a solution with low cost should be the priority of the government, funding agencies, academic institutions, researchers and industries.

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