

Original Article

Prevalence of Teeth Replacement Options Among Partially Edentulous Libyan Patients In A Multi-clinic Center in Benghazi: A War-time Cross-Sectional Study

Rabie M El huni ^a

ABSTRACT

Introduction: What is the best replacement option for my compromised/missing tooth?

The answer to this question, among our patients, varied considerably based on multiple factors including patient health and desire, prognosis of the natural teeth, service cost, dentist experience, availability and quality of the laboratory product, applicability of the offered option, and duration needed to finish the chosen job.

Aim of the study: Is to determine the prevalence of selecting dental implants, among given teeth replacement options, by partially edentulous Libyan patients in a multi-clinic private center in Benghazi.

Materials and Methods: This study was conducted at Sama Dental Center. All implant placement and restoration procedures were done by the same prosthodontist. Subjects were eligible for inclusion if they were partially edentulous and seeking definitive teeth replacement options. The study consisted of 170 patients (33 men and 137 women) ranging in age from 18 to 78 years.

Results: A total number of 85 patients opted for dental implants (50%) (*P. value* 0.079) for whom 147 fixtures were integrated to replace 161 missing teeth. 56 of the patients chose removable partial dentures (32.9%), while fixed partial dentures were used to replace 31 missing teeth in 29 patients (17.1%) utilizing 47 natural abutments.

Conclusion: Within the limitation of this study, there is an increasing interest in implant treatment option among partially edentulous Libyan Patients. Furthermore, evidence-based data may guide the dental practitioners' confidence to offer the optimal treatment available to patients.

Key words: Dental Implants, prevalence, tooth replacement, partial edentulism.

INTRODUCTION

The maintenance of the natural dentition, in high function and acceptable esthetics, remains the primary goal of any dental therapy. Prosthetic restorations, on the other hand, cannot compete with natural teeth in terms of biomechanical, physical, and sensorial properties ⁽¹⁾. Some of the main advantages of a tooth compared to an implant -

supported restoration are the proprioception and the adaptation under mechanical forces mediated by the periodontal ligament ^(2,3).

However, the maintenance of a tooth presenting some pathologic conditions may be associated with unfavorable consequences, such as the lack of function or the extension of an odontogenic infection to craniofacial anatomic spaces.

Worldwide, dentists and patients are usually confronted by the practical question of: should offending teeth be saved and restored, extracted without any replacement, or extracted and then replaced by implants, fixed bridges, or removable appliances?

The answer to this question, among our patients, varied considerably based on multiple factors including patient health and attitude, prognosis of the natural teeth, service costs, dentist experience, availability and quality of the laboratory products,

^a University of Benghazi Faculty of Dentistry, 23rd July Rd, Benghazi, Libya.

Correspondence:

Rabie M El huni. BDS, MS, Advanced Education in Implant Dentistry.

Assisting lecturer, Head of Department of Prosthodontics, University of Benghazi Faculty of Dentistry.

23rd July Rd, Benghazi, Libya

Email address: Rabedent@gmail.com

applicability of the offered options, and duration needed to finish the chosen job.

Tooth Extractions

The epidemiology of tooth loss has been reported down through the ages but reasons for tooth loss have been investigated only relatively lately ^(4,5). The rate of extractions per patient, and per dentist, had decreased across the well-developed countries over the past three decades ⁽⁶⁾. In the Middle East, a number of cross-sectional studies have been conducted from a convenient sample at faculties and public and private practices. Dental caries was consistently observed as the key reason for tooth extraction at over 55% of tooth extraction scenarios in Libya ^(7,8).

Root Canal Treatments

Most patients come to our center when they have severe toothache. When examined, this pain might be caused by damaged teeth pulps or faulty previous endodontic treatments.

The decision regarding preserving an infected tooth that requires a root canal treatment, or retreatment, can be of great importance in terms of planning the overall treatment of the dentition.

All over the world, endodontic treatments have very high success rates ⁽⁹⁾. Healthy endodontically treated teeth serve patients years after treatment, those teeth help patients chew efficiently and enhance their enjoyment of life ⁽⁹⁾. Through endodontic treatments, along with appropriate restorations, endodontists provide patients with a cost-effective way to keep their natural teeth for a lifetime ⁽⁹⁾.

However, there are several reported factors that have been shown to influence treatment longevity. These factors include the presence of periapical radiolucency ⁽¹⁰⁾, which can be considered as an indication for retreatment ⁽¹¹⁾. Further surgical intervention with non-healed periapical pathosis, like granulomas and cysts, might be mandatory to enhance the prognosis of compromised teeth ⁽¹²⁾.

Dentist experience also plays a major role in the success rates of R.C.Ts. Patients concerns about R.C.Ts may be well handled by endodontic specialists, thus increasing the overall service price ⁽¹³⁾.

Rotary, versus manual, preparations of root canals helped general practitioners to speed up the steps of the procedure but a higher cleaning capability was reported with the manual technique ^(14,15).

In addition, choosing the appropriate restoration may require a full coronal coverage; specially

with posterior multi-rooted teeth upon which high occlusal loads are applied.

Removable Partial Dentures

Prosthetic advantages of immediate acrylic removable partial dentures made them transitionally satisfactory (Figure 1). They can be easily fabricated a head of tooth loss, low costs, less time consuming, in addition to their ability to splint remaining periodontally weakened teeth and to replace missing tissues to provide facial support.

However, this satisfaction usually lasts for a couple of weeks before most patients desires get to a higher level. The use of removable dentures may lead to a sense of patient insecurity, reduced chewing capacity and taste and low self-esteem ^(16, 17).

Patients with R.P.Ds know a little about the advantages of using cast metal over acrylic ones. Both options are the same to our patients because of the need to remove the appliance during cleaning, and every night to permit tissue relaxation period. In fact, shortage of well-trained prosthodontists and laboratory technicians, lack of facilities and consumable materials, high casting prices, in addition to applicability of other treatment options have led to reduced demands for cast metal R.P.Ds.

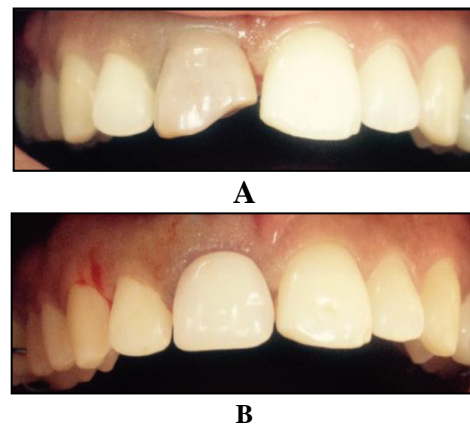


Figure 1: A. A photograph of discolored tooth #8 due to root resorption and pulpal necrosis. B. The tooth in A being extracted and replaced using immediate acrylic R.P.D.

Fixed Partial Dentures

Preparing intact teeth to replace others are somehow invasive to most of our patients. The decision of selecting F.P.Ds over R.P.Ds might be influenced by patients' desires to have stable prosthesis. These treatment options require anterior and posterior abutments of acceptable periodontal health. F.P.Ds are highly indicated for replacing teeth if anticipated abutments need, or have, huge

occlusal restorations or have been previously prepared. The fact that F.P.Ds can be fabricated during shorter time, when compared to implant supported restorations, provide patients with a highly successful option time-wise.

Some patients ask for F.P.Ds because of their misperception to dental implants. It is a common claim that arches receiving dental implants contribute to the occurrence of illness and disease in the body.

Money-wise, a metal ceramic fixed-fixed bridge that replaces a single missing tooth costs approximately the same price as an implant supported crown. In terms of longevity, biological and technical complications such as caries, periodontal impairment, loss of retention, and material fracture may exhibit risks for teeth supported F.P.D failures (Figure 2) ⁽¹⁸⁾.

Despite the high survival rates of the less invasive resin bonded bridges (R.B.Bs), technical complications like debonding and abutment caries are frequent. This means that a substantial amount of extra chair time may be needed after the incorporation of R.B.Bs ⁽¹⁹⁾.

Dental Implants

Dental implants are worldwide dentists' most successful option for replacing missing teeth in modern dentistry ⁽²⁰⁾. The number of patients seeking implant treatment is increasing continuously year by year ⁽²¹⁻²³⁾.

Thus, dental implants have become a valuable option in comprehensive treatment plans for both edentulous, and partially dentate patients ⁽²⁴⁾.

Compared to other places in the world, the application of dental implants in Libya was relatively late. The introduction of this discipline was provided through product-training courses offered by implant selling companies ⁽²⁵⁾. Consequently, implant dentistry was available to the public through a small number of dentists who had attended single courses abroad.

However, high success rates of implant supported prostheses and wealth of information on the rehabilitation performance of dental implants provided Libyan dentists practicing implant placements with confidence and clinical applicability (Figure 3 and 4).

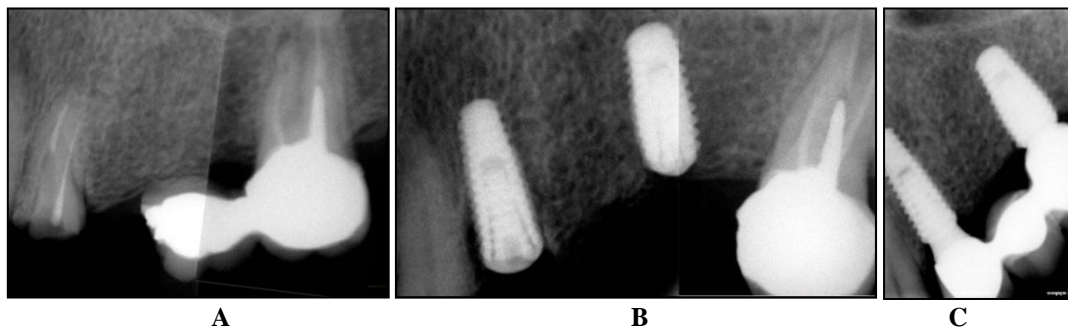


Figure 2: A. A failed 4-unit fixed-fixed bridge replacing teeth #13 and 14. B. Bridge was cut mesial to retainer on #15, implants placed at #14 and immediately at area of RR #12. C. Implant supported 3-unit bridge 6 months after delivery.



Figure 3: The case shown on figure 1 opted for an implant supported crown to replace missing tooth #8



Figure 4: A peri-apical radiograph showing an implant supported crown at area of missing tooth #3 six months after delivery.

The aim of this study is to determine the prevalence of selecting dental implants, among given teeth replacement options, by partially edentulous Libyan patients in a multi-clinic private center in Benghazi during the war year of 2015.

MATERIALS AND METHODS

This study was conducted at Sama Center for Dental Services during 2015. Three dentists participated in this study, two of which are prosthodontists and one is a general dental practitioner. Subjects were eligible for inclusion if they were partially edentulous and seeking definitive teeth replacement options. All patients had undergone intraoral and radiographic examination before any treatment was applied. Preoperative assessment included careful evaluation of pathologic conditions and overall dentition prognosis that could alter the decision regarding the offered treatment plan.

Patients who chose to have dental implants signed on consents written in Arabic to explain the whole procedure and to give an idea about possible risks. This research study has been conducted in full accordance with the World Medical Association Declaration of Helsinki.

Implant option was not considered for patients with poor oral hygiene or those with uncontrolled medical issues like diabetes mellitus or osteoporosis, history of chemo-radio therapy, or for those who smoke more than 5 cigarettes a day.

Temporary and immediate R.P.Ds preceding implant-supported prostheses were not counted in this study. Implants used were either MegaGen implants (AnyOne, Gyeongbuk, South Korea) or DIO Implants (SM, Dio Corporation, Busan, Korea).

RESULTS

The study consisted of 170 patients (33 men and 137 women) ranging in age from 18 to 78 years. A total number of 85 patients opted for dental implants (50%) (*P. value* 0.079) 11 of which were male patients and 74 were females (Figure 5).

147 fixtures were integrated to replace 161 missing teeth. 101 implants were placed in the maxillary arch (68.7%) and 46 in the mandible (31.3%) (Table 1).

56 of the patients chose removable partial dentures (32.9%), while fixed partial dentures were used to replace 31 missing teeth in 29 patients (17.1%) utilizing 47 natural abutments.

Within the study period, only one cast metal R.P.D was used to replace a Kennedy class III partially edentulous maxillary arch.

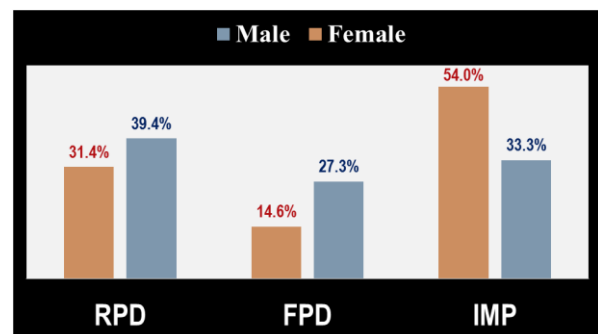


Figure 5: A histogram showing percentage of choices for male and female patients.

DISCUSSION

The population of our cross-sectional study is somehow area specific. Our patients exhibit higher socioeconomic statuses when compared to patients attending dental clinics in other areas of the city of Benghazi. However, most of Benghazi people have gone through difficult times financially during the war time. Large parts of the city were evacuated and people have been displaced leaving their homes and belongings. Many banks were closed because of their proximity to battle fields, and value limited withdrawals, in open banks, left people of different assets short of major utilities.

The year of 2015 was dramatic to the dental implant profession. Two of implant placing practitioners, who were longer in duty, have been lost from the practice field in Benghazi.

Pts.	Gender		Implants	Positions		Missing teeth	Diameter		Length		Placement		Prostheses	
	M	F		Max.	Mnd.		Mini=2	Nrr.=94	Regular	Short <10mm	Imm.	Conv.	Single	Splinted
85	11	74	147	101	46	161	Reg.=31	Wide=20	139	8	9	138	74	71
													Cantilever 2	

Table 1: Total number of implants with their positions, lengths, diameters, methods of integration, and types of prostheses.

In our center, the option of dental implants has become more chosen than F.P.Ds and R.P.Ds among medically ensured patients during the years of 2013 and 2014 (Unpublished Data). Insurance plans were either covering 100% of dental procedures or offering covered patients the option of spending 3000 Libyan Dinars (L.D) annually on teeth replacement protocols. These plans have increased the number of patients seeking dental services in general, among which dental implants.

The price of a single implant supported crown, in our center, ranged between 850–1000 L.D during the year of 2015. This price was expected to be higher in 2016 due to the daily raising dollar prices. However, higher prices could be always anticipated as a limitation with all dental treatment options not only dental implants.

In addition to high costs, limitations to dental implants also included poor health history, lack of bone quality or quantity or both. In areas displaying severe resorption and bone height reduction, like posterior maxilla and mandible, special surgical protocols might have been needed to overcome the problem of close proximity to vital structures, this refers to pneumatized maxillary sinuses and inferior dental canals. Another approach involves the integration of shorter implants of wider diameters.

Surgical protocols employing bone grafting and reconstruction, as well as, inferior alveolar nerve transposition are options for standard long implants rehabilitation treatments, in those areas. Although bone grafting and sinus augmentation procedures evidenced a high success rate, ⁽²⁶⁾ they have demonstrated unpredictable complications (Figure 6) ⁽²⁷⁾.



Figure 6: An orthopantomograph showing a case of failed implant supported restoration with one implant displaced into left maxillary sinus.

Implant displacement/migration in the paranasal sinuses, resulting from wrong planning or surgical inexperience, have been reported sporadically in the literature (Figure 7) ⁽²⁸⁾.

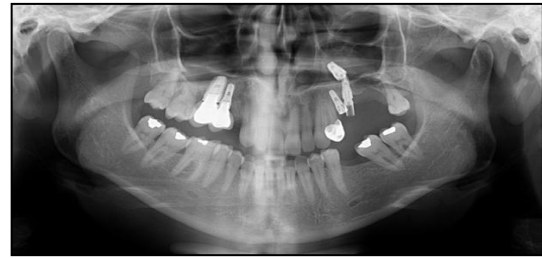


Figure 7: An orthopantomograph showing a case of failed implant supported restoration with one implant displaced into left maxillary sinus.

Jung et al reported the risk of maxillary sinus complications in implants which penetrated the bone and mucous membrane of the sinus floor at 2, 4, and 8 mm extensions. After 6 months, radiographic and histologic examinations did not show any signs of pathologic findings in the maxillary sinus of the 8 study dogs ⁽²⁹⁾.

On the other hand, An intentional perforation of the Schneiderian membrane using a 2mm twist drill at the time of implant placement and protrusion of the implant up to 3mm beyond the sinus floor did not alter the stability and outcome of dental implants, one year post-restoration. This resulted with minor complications ranging from epistaxis to sinusitis, which are manageable ⁽³⁰⁾.

Many patients were unable or unwilling to undergo advanced surgical manners due to several reasons, among them: high cost, long duration, need for multiple surgical procedures, and poor general health ⁽³¹⁾. Also, inferior alveolar nerve transposition procedure presents a greater risk of paresthesia ⁽³²⁾. Short implants use is preferably a safe option for rehabilitating resorbed edentulous ridges (Figure 8) ⁽³³⁾.

Many authors have compared the success rates of short to long dental implants. Results varied. Winkler and Nisand have approved that short implants are more likely to fail than long implants, both at the second stage surgery and prosthetic stage, due to unfavorable load to anchor stress distribution ⁽³⁴⁾.

However, surgical-prosthetic planning measurements as: splinting, similar crown/implant ratio, reduction of the occlusal table, and lack of cantilevers, have favored the biomechanics and increased treatment predictability of short implants (Figure 9) ⁽³⁵⁻³⁷⁾.

It was part of the goal of this study to highlight most of the important factors affecting patient-dentist decision to extract or preserve a tooth.



Figure 8: A missing tooth #14 is being replaced by 5.3 \varnothing x 8 mm implant.

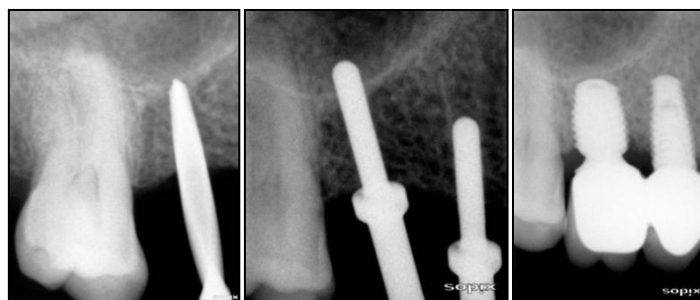


Figure 9: A + B. accidental perforation of right maxillary sinus during implant placement. C. the same case on A six months after insertion of splinted crowns.

These factors have to be weighed and analyzed before a decision is made. An individual tooth's fate is often influenced by the final overall treatment plan that involves the whole dentition. There are no absolutes or universal rules that can be applied to every case. Clinicians may make a sound clinical judgment by referring to a decision-making chart, but it is important to understand its limitations and the random involvement of some risk factors⁽³⁸⁾.

The experience and clinical criteria, along with the common sense of the professional, are still the most important tools available to be used as a guide in deciding what properly fits each and every patient.

The findings of our study reflect the high percentage of partially edentulous Libyan patients seeking dental implants as their choice for teeth replacements despite the local unrest. This percentage could be higher in case of political stability and financial growth. Looking at the significant number of female patients, in comparison to males, choosing dental implant guides the investors to target women attention by advertisements.

Compared to most dental schools in USA and Europe,^(39, 40) where single-tooth implant restorations are performed at the predoctoral levels, Libyan dental schools do not incorporate implant dentistry into their clinical programs. Challenges include deficiency in adequately trained faculties and the lack of support from implant companies. Providing

demonstration models and prosthetic components at discounted costs can lead to offering the implant option for lower prices, thus helping to convince patients attending dental schools to go through this experience.

CONCLUSIONS

Within the limitation of this study, our findings could help to recognize the increasing interest in implant treatment option among Libyan Patients. The study results highlight the importance of establishing structured academic programs to teach implant dentistry at undergraduate and postgraduate levels. Furthermore, evidence-based data may guide the dental practitioners' confidence to offer the optimal treatment available to patients.

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REFERENCES

1. Jacobs R, Bou Serhal C, van Steenberghe D. The stereognostic ability of natural dentitions versus implant-supported fixed prostheses or overdentures. *Clin Oral Investig.* 1997 Jun;1(2):89-94.
2. Dorow C, Krstin N, Sander FG. Experiments to determine the material properties of the periodontal ligament. *J Orofac Orthop.* 2002 Mar;63(2):94-104.

3. Melsen B. Tissue reaction to orthodontic tooth movement – A new paradigm. *Eur J Orthod*. 2001 Dec;23(6):671-81.
4. Aida J, et al. Reasons for permanent tooth extractions in Japan. *J Epidemiol*. 2006 Sep;16(5):214-9.
5. Argerholm D. Reasons for extraction by dental practitioners in England and Wales: a comparison with 1986 and variations between regions. *J Dent*. 2001 May;29(4):237-41.
6. McCaul LK, Jenkins WM, Kay EJ. The reasons for the extraction of various tooth types in Scotland: a 15-year follow up. *J Dent*. 2001 Aug;29(6):401-7.
7. Byahatti S.M. and Ingafou M.S. Reasons for extraction in a group of Libyan patients. *Int Dent J*. 2011 Aug;61(4):199-203.
8. Hassan A.K. Reasons for tooth extraction among patients in Sebha, Libyan Arab Jamahiriya: a pilot study. *East Mediterr Health J*. 2000 Jan;6(1):176-8.
9. Elemam R.F. and Pretty I. Comparison of the success rate of endodontic treatment and implant treatment. *ISRN Dent*. 2011;2011:640509. doi: 10.5402/2011/640509. Epub 2011 Jun 15.
10. Imura N, Pinheiro ET, Gomes BP, Zaia AA, Ferraz CC, Souza-Filho FJ. The outcome of endodontic treatment: a retrospective study of 2000 cases performed by a specialist. *J Endod*. 2007 Nov;33(11):1278-82. Epub 2007 Sep 19.
11. European Society of Endodontology. Consensus report of the European Society of Endodontology on quality guidelines for endodontic treatment. *Int Endod J*. 1994 May;27(3):115-24.
12. Frank AL, Glick DH, Patterson SS, Weine FS. Long-term evaluation of surgically placed amalgam fillings. *J Endod*. 1992 Aug;18(8):391-8.
13. Alley BS, Kitchens GG, Alley LW, Eleazer PD. A comparison of survival of teeth following endodontic treatment performed by general dentists or by specialists. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 2004 Jul;98(1):115-8.
14. Barbizam JV, Fariniuk LF, Marchesan MA, Pecora JD, Sousa-Neto MD. Effectiveness of manual and rotary instrumentation techniques for cleaning flattened root canals. *J Endod*. 2002 May;28(5):365-6.
15. Ahlquist M, Henningsson O, Hultén K, Ohlin J. The effectiveness of manual and rotary techniques in the cleaning of root canals: a scanning electron microscopy study. *Int Endod J*. 2001 Oct;34(7):533-7.
16. Zlatarić DK1, Celebić A. (2007) Factors related to patients' general satisfaction with removable partial dentures: a stepwise multiple regression analysis. *Int J Prosthodont*. 2008 Jan-Feb;21(1):86-8.
17. Akeel RF. Effect of the quality of removable prostheses on patients' satisfaction. *J Contemp Dent Pract*. 2009 Nov 1;10(6):E057-64.
18. Tan K, Pjetursson BE, Lang NP, Chan ES. A systematic review of the survival and complication rates of fixed partial dentures (FPDs) after an observation period of at least 5 years. *Clin Oral Implants Res*. 2004 Dec;15(6):654-66. Review.
19. Pjetursson BE, Tan WC, Tan K, Brägger U, Zwahlen M, Lang NP. A systematic review of the survival and complication rates of resin-bonded bridges after an observation period of at least 5 years. *Clin Oral Implants Res*. 2008 Feb;19(2):131-41. Epub 2007 Dec 7. Review.
20. Esposito M, Murray-Curtis L, Grusovin MG, Coulthard P, Worthington HV. (2007) Interventions for replacing missing teeth: different types of dental implants. *Cochrane Database Syst Rev*. 2007 Oct 17;(4):CD003815. Review. Update in: *Cochrane Database Syst Rev*. 2014;7:CD003815.
21. Sonoyama W1, Kuboki T, Okamoto S, Suzuki H, Arakawa H, Kanyama M, et al. Quality of life assessment in patients with implant-supported and resin-bonded fixed prosthesis for bounded edentulous spaces. *Clin Oral Implants Res*. 2002 Aug;13(4):359-64.
22. Brunski JB. In vivo bone response to biomechanical loading at the bone/dental-implant interface. *Adv Dent Res*. 1999 Jun;13:99-119.
23. Verbal information at the ITI meeting in May/2013 that was held at Straumann warehouse Andover, MA, USA.
24. Greenstein G, Cavallaro J Jr, Tarnow D. Dental Implants in the Periodontal Patient. *Dent Clin North Am*. 2010 Jan;54(1):113-28. doi: 10.1016/j.cden.2009.08.008
25. Oraltronics 2002 Educational Program. Multiple Implant Concepts. Tripoli/Libya.
26. Tasoulis G, Yao SG, Fine JB. The maxillary sinus: challenges and treatments for implant placement. *Compend Contin Educ Dent*. 2011 Jan-Feb;32(1):10-4.
27. Chiapasco M, Felisati G, Maccari A, Borloni R, Gatti F, Di Leo F. The management of complications following displacement of oral implants in the paranasal sinuses: a multicenter clinical report and proposed treatment protocols. *Int J Oral Maxillofac Surg*. 2009 Dec;38(12):1273-8.
28. Regev E, Smith RA, Perrott DH, Pogrel MA. Maxillary sinus complications related to endosseous implants. *Int J Oral Maxillofac Implants*. 1995 Jul-Aug;10(4):451-61.
29. Jung JH, Choi BH, Zhu SJ, Lee SH, Huh JY, You TM, et al. The effects of exposing dental implants to the maxillary sinus cavity on sinus complications. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 2006 Nov;102(5):602-5.
30. Nooh N. Effect of Schneiderian Membrane Perforation on Posterior Maxillary Implant Survival. *J Int Oral Health*. 2013 Jun;5(3):28-34.
31. Lim TJ, Csillag A, Irinakis T, Nokiani A, Wiebe CB. Intentional angulation of an implant to avoid a pneumatized maxillary sinus: a case report. *J Can Dent Assoc*. 2004 Mar;70(3):164-8.
32. Juodzbalys G, Wang HL, Sabalys G. Injury of the Inferior Alveolar Nerve during Implant Placement: a Literature Review. *J Oral Maxillofac Res*. 2011 Apr 1;2(1):e1.
33. Arlin ML. Short dental implants as a treatment option: results from an observational study in a single private practice. *Int J Oral Maxillofac Implants*. 2006 Sep-Oct;21(5):769-76.
34. Winkler S, Morris HF, Ochi S. Implant survival to 36 months as related to length and diameter. *Ann Periodontol*. 2000 Dec;5(1):22-31.
35. Galvão FFSA, Almeida-Júnior AA, Faria-Júnior NB, Caldas SGFR, Reis JMSN, Margonar R. Predictability of short dental implants: a literature review. *RSBO*. 2011 Jan-Mar;8(1):74-80.
36. Tawil G, Aboujaoude N, Younan R. Influence of prosthetic parameters on the survival and complication rates of short implants. *Int J Oral Maxillofac Implants*. 2006 Mar-Apr;21(2):275-82.
37. Misch CE, Steignga J, Barboza E, Misch-Dietsh F, Cianiola LJ, Kazor C. Short dental implants in posterior partial edentulism: a multicenter retrospective 6-year case series study. *J Periodontol*. 2006 Aug;77(8):1340-7.
38. Avila G, Galindo-Moreno P, Soehren S, Misch CE, Morelli T, Wang HL. A novel decision-making process for tooth retention or extraction. *J Periodontol*. 2009 Mar; 80(3): 476-491.
39. Petropoulos VC, Arbree NS, Tarnow D, Rethman M, Malmquist J, Valachovic R, et al. Teaching implant dentistry in the predoctoral curriculum: a report from the ADEA Implant Workshop's survey of deans. *J Dent Edu*. 2006 May;70(5):580-8.
40. Afsharzand Z, Lim MV, Rashedi B, Petropoulos VC. Predoctoral implant dentistry curriculum survey: European dental schools. *Eur J Dent Edu*. 2005 Feb;9(1):37-45.