

International Journal of Dental Science and Innovative Research (IJDSIR)

IJDSIR : Dental Publication Service Available Online at: www.ijdsir.com

Volume – 3, Issue – 4, August - 2020, Page No. : 16 - 23

Short dental Implants: Treatment option for atrophic ridges

¹Dr. Nitin Sharma, MDS Prosthodontics and Crown & Bridge, Himachal Pradesh University, Medical Officer Dental Zonal Hospital Mandi Himachal Pradesh, India

²Dr. Tarush Thakur, MDS Orthodontics and Dentofacial Orthopaedics, Himachal Pradesh University, Private Practitioner C/O Arch Dental Hospital 272/13, Sauli Khad, Mandi, Himachal Pradesh, India

³Dr. Aprajita Dogra, MDS Orthodontics and Dentofacial Orthopaedics, Himachal Pradesh University, Private Practitioner C/O Arch Dental Hospital 272/13, Sauli Khad, Mandi, Himachal Pradesh, India

Corresponding Author: Dr. Nitin Sharma, MDS Prosthodontics and Crown & Bridge, Himachal Pradesh University, Medical Officer Dental Zonal Hospital Mandi Himachal Pradesh, India

Citation of this Article: Dr. Nitin Sharma, Dr. Tarush Thakur, Dr. Aprajita Dogra," Short dental Implants: Treatment option for atrophic ridges", IJDSIR- August - 2020, Vol. – 3, Issue -4, P. No.16-23.

Copyright: © 2020, Dr. Nitin Sharma, et al. This is an open access journal and article distributed under the terms of the creative commons attribution noncommercial License. Which allows others to remix, tweak, and build upon the work non commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

Type of Publication: Review Article

Conflicts of Interest: Nil

Abstract

Background: Short dental Implants as a concept appeared in modern implant dentistry with an alternative treatment option for resorbed ridges as the other surgical treatments like ridge augmentation surgery, sinus lift in case of maxilla can be avoided.

Materials and method: Till present time different authors have defined the dimensions of short implants, however there is no specific definition. In the present study the various literatures available regarding the short implants were searched on the various available platforms like Google Scholar and Science Direct databases and manual search of the references concerning short implants were also carried out. The data collected was compiled and explained in this review article in the simpler form.

Discussion: The advantages of short implants over the regular implants, biomechanical aspects, indications and

clinical protocol for short implants are thoroughly discussed.

Conclusion: The patients with resorbed ridges are ideal individuals for choosing short dental implants as treatment option if the operating protocol is applied with perfection. The more invasive and complicated procedures like sinus elevation and ridge augmentation can be prevented.

Keywords: atrophic ridge, bone augmentation, short dental implants, sinus lift.

Introduction

The impalntology becomes most demanding discipline for the dentist and patients where restoration of the edentulous spans with insufficient residual ridges is desired.¹ The oral implants are also the most desirable treatment modality in situations such as restoration of defects resulted from oral congenital deformities, tumor surgeries or oro-facial trauma.² In previous times the operators preferably used

longer implants in all the situations as esthetics of the resulting prosthesis was not compromised and greater success rates were achived.³ Although in clinical situations such as lower alveolar bone height, insertion of an long dental implant is a challenging work as the inadequate bone height can results in the injury to anatomic structures like sinus in the maxillary bone and inferior alveolar nerve in mandibular bone, however in such situations different procedures like guided regeneration of bone, augmentation of bone, inferior alveolar nerve lateralization, bone grafting and elevation of maxillary sinus floor had been advocated by different authors.⁴ The limitations of the different surgical techniques like harvesting of autologous bone from other locations such as iliac crest and clavarian bone resulted in probability of higher morbidity, includes greater time and cost factor and involves complications such as perforation of the maxillary sinus, post operative infection and nerve damage.^{5,6} The prolonged surgical interventions should be avoided in patients for their medical issues or refusal due to psychological reasons.

The short implants with their introduction in the modern implantology offered less invasive alternative as a treatment modality for resorbed alveolar ridges where long dental implants cannot be placed, however there is no particular agreement between different authors regarding defining of short implant but still many authors suggested that implants with length less than 10 mm are classified in the category of short dental implants.^{7,8}

The main purpose of our present study is reviewing of previous researches concerning short dental implant for evaluation of their purpose in various clinical situations for restoration of the edentulous patients.

Material and Methods

Till date no particular definition exists to reveal the demarcation between short implant and long dental

© 2020 IJDSIR, All Rights Reserved

implant. The various researchers had suggested different dimensions specific for both these groups of implants. The searches were followed by us on the wide spectrum regarding previous studies published focusing on the topic of short dental implants utilizing various platforms available such as Google Scholar and Science Direct databases from the year 1997 to 2020. The search was carried out concerning following key words: 'atrophic ridge', 'bone augmentation', 'short dental implant' and 'sinus lift'. The articles reviewed included retrospective and prospective studies, review articles and randomized clinical trial studies carried out by different authors. The detailed data was collected and compiled in this review study concerning defining of the short implants, clinical implications, follow-up schedules and success and limitations of the short implants.

Historical Background

The previous researches done regarding short implants revealing their clinical implications, success rates and follow-up studies are summarized in Table1.

Table 1: Researches comparing success rate of short implants.

Researcher	Year	Study			
		Evaluated prolonged success			
Buser D et al ³	1997	of ITI non submerged			
		implants and conducted			
		through examination for 8			
		years of multi-center			
		prospective study			
		Conducted a clinical research			
Bhat O ⁹	2000	with Branemark implant			
		system in posterior maxilla			
		and suggested a marked			
		failure of approximately 17%			
		for 7 and 8.5 mm implants			

Page 1

		Evaluated multicenter		
Hermann et al ¹⁰	2005	examination of 487 implants		
		and revealed failure of 10%		
		for 10 mm and 21% for 7		
		mm of implants		
		Performed study determining		
Olate S et al ¹¹	2010	results of variation in		
		diameter and length on		
		implant failure		
		Reviewed why short implant		
Kiattavrncharoen	2014	should be used and		
S et al ⁸		concluded that success of		
		short implant ranges within		
		80% to 96% depending upon		
		different features and		
		protocol followed during		
		surgery		
		Reviewed when, where and		
Shah A K ¹²	2015	how short implants to be		
		utilized and concluded that		
		short implants as effective		
		alternatives than complex		
		surgical procedures		
		Conducted a study on novel		
Reich et al ¹³	2017	expandable short implants		
		where lower vertical height		
		of alveolar bone is present		
		and found successful stability		
		of short implants		
		Performed randomized		
Uehara et al ¹⁴	2018	control trial study with short		
		implants against long		
		implants in ridge augmented		
		with graft and revealed that		
		short dental implants are		

		potent options for
		rehabilitating atrophic ridges
		Reviewed about survival of
Papaspyridakos P	2018	short implant less than 6 mm
et al ¹⁵		in posterior jaw and
		concluded mean survival rate
		of 96% for such situations
		Conducted retrospective
Lorenz et al ¹⁶	2019	study to evaluate that short
		implants has any success in
		posterior maxillary region to
		avoid sinus augmentation
		surgery and found 100%
		survival rate after 5 years
		with absence of peri-implant
		infections

Discussion

S.N.

The treatment therapy for restoration of edentulous spans with dental implants should be such that the procedure should be economic and simpler to the patient and involve less duration of time. The short implants are the better alternative options in patients with decreased alveolar bone height as the complicated and costly invasive procedures like surgical ridge augmentation can be avoided.¹ Initially the short implants utilized were mainly the machined surface but with advancement of time the newer short implants with modified surface characteristics and advanced surgical approaches have enhanced success rates in cases involving short implants.¹⁷

Table 2: Merits of Short implants over regular implants

1.	More	economic	to	patient	and	involves	less
	duratio	on of time	in c	comparis	on to	the prolo	nged
	surgica	al procedure	es fo	or implan	it plac	cement ¹⁴	

Page -

Merits of Short implants over regular implants

2.	The overlay grafting of bone is not required for compensation of the reduced ridge height ⁷
3.	The fatal complications aroused during complex surgical procedures like maxillary sinus perforation due to trauma to Schneiderian membrane, bleeding, paresthesia due to inferior alveolar nerve, post-operative infection can be prevented ^{5,7}
4.	Short implant placement procedure is simpler for the operator as less osteotomy is needed at the insertion site and can be easily assessed for irrigation to prevent bone heating during procedure ⁵
5.	The positioning of load is improved with use of short implant osteotomy as basal bone beyond ridge is not always positioned in the alignment of missing tooth ^{7,14}
6.	In particular cases like cancer patients limitations such as poor healing after prolonged surgery the invasive interventions for ridge augmentation cannot be performed so short implants are the better alternative ⁵

Bio-mechanical aspects to be considered for short dental implants:

1. The diagnostic aspects includes:

I). Diameter of implant: Implant diameter as a parameter is important than length due to accumulation of higher stresses at crestal region in comparison to the apical region. The greater width of short implant provides greater primary stability as area of functional surface of an implant is increased at bone crest which results in subsequent distribution of the occlusal forces as important factor because it has been proved that occusal overloading resulted in failure of implant.^{1,5,18}

II). Quality of bone: This factor is the principle factor for the success of short implant.¹⁹

Table 3: Classification of bone density

Bone type	Details of bone
Type 1	Mainly consist of compact homogeneous
	bone ⁸
Type 2	Core of dense trabecular bone enveloped
	by thick compact bone ²⁰
Type 3	Thin cortical bone surrounding a core of
	dense trabecular bone ^{8,20}
Type 4	A low density trabecular bone enveloped
	by a thin layer of cortical bone ²⁰

Type 3 and type 4 bones resulted in greater failure of short implants as the factors including implant length and poor quality of bone get added for the cumulative results leading to failure of an implant.

III). Crown: Implant ratio: The report of consensus conference suggested the for successful fixed prosthesis there should be 9 to 12 mm space between residual bone and opposite arch tooth.²¹ The prosthesis with greater height lead to greater chance of restoration fracture due to greater forces on the resulting restorations. The ratio of 1:1.5 is most desirable whereas ratio of 1:1 in case where natural tooth is present as abutment.²² However according to studies conducted by different authors suggested that greater success of implant is achievable when crown implant ratio is 2 and loss of bone around implant is not found with this increase of crown implant ratio.^{23,24,25}

IV). Number of implants placed: Insertion of more implants in an edentulous span available resulted in marked rise of functional surface area which opposes the occlusal forces.⁷

V). Absence of cantilevers: The cantilevers resulted in magnification of forces in proportion to crown height. This resulted in six various rotational points on an implant therefore removals of such cantilevers are favorable for biomechanical aspects of implant and successful therapy.^{1,7}

VI). Different implant thread design: Carle E Misch²⁶ suggested that increased surface area of an implant resulted from:

- a. Number of implant thread: When greater numbers of threads are present in unit implant length in one axial plane resulted in greater implant surface which contact the surrounding bone.
- b. Thread depth of implant: The implants with deeper threads resulted if greater implant surface area.
- c. Shape of thread: The implant thread design with square shape resulted in availability of greater implant surface area with respect to other designs like v shaped threads and reverse buttress designs of implant threads.

VII). Surface characteristics of implant: The modification of implant surface lead to success of short implants. Different authors suggested that implant surface modification achieved by subtractive procedures such as acid etching, blasting, oxidation and additive procedures like spraying of titanium plasma, calcium phosphate layering, hydroxyapatite deposition resulted in rough surface inducing excess implant surface accessible for osseointegration and increases the surface wettability.^{27,28,29}

2. The surgical aspects include:

I). 2- step surgical procedure: In case of insertion of short dental implants 2 stage surgical procedure should be followed to provide enhanced primary implant stability in healing phase. The time period between surgery and implant loading should be approximately 4 to 6 months in maxillary bone and 2 to 4 months in mandibular bone.³⁰ II). Altered surgical procedure: The greater primary implant stability can be attained by elimination of countersink drill in the regular drilling procedure. The osteotomy of softer bone must be carried out in low quality bone however last bone should be drilled using tapered drill size.⁷

3. Prosthetic factors include:

I). Implant-abutment inter connection: External hex connection leads to increased crestal loss of bone as compared to taper connection as the internal hex interconnection within the implant and abutment resulted in the wider disbursement of forces as compared to that of external hex interconnection.^{31,32} The platform switching increases the volume of the bone at the crestal level, repositioning of papilla in esthetic level, lowers mechanical stress at crestal bone level and increases the blood supply to surrounding tissues where narrow interdental space is present.⁶

II). Incisal guidance: The biomechanics of implant should resemble that of natural tooth abutment to accommodate greater biting forces especially in posterior maxillary and mandibular regions. The incisal guidance in anterior teeth removes the unnecessary lateral forces to posterior teeth during lateral excursion movements.⁷

III). Splinting of short implants: Splitting multiple short implants resulted in greater surface area for support of prosthesis and induces lower force implants, abutment screws and surrounding bone.^{1,7}

Indications for short implants:

- 1. In restoring highly resorbed mandible with four short implants supporting the overdenture or six short implant supporting fixed partial denture.⁵
- In restoration of maxilla with two short implants in distal region where there is sinus proximity along with

long implants in permaxillary region supporting overdenture prosthesis.^{5,7}

3. In lower jaw when there is proximity to mental foramen and mandibular canal.⁵

Clinical protocol for placement of short dental implants: The ideal protocol as revealed by the Nisand and Renourd Table 4: The protocol for placement of short dental implants (2014)³³ for the insertion of short implants was based upon different factors such as alveolar bone quality, height and habits of patient such as smoking, previous record of periodontal diseases and other systemic involvements. The protocol for short implant placement is briefed in different situations in the following (Table 4).

Height of Alveolar Bone	Quality of Bone	Quality of Bone
mm	type (I, II, III)	type (IV) Patient history i.e.
		smoker, periodontal diseases
	Marilla	
	Maxilla	
Less than 5 mm	Sinus elevation	Sinus elevation
5 to 6 mm	Short-Implants	Sinus elevation
More than 6 mm	Short-Implants	Short-Implants
	Mandible	
	Quality of bone	
	type (I, II, III, IV)	
Less than 8 mm	Advance surgical procedures	
	r	

More than 8 mm

Short-Implants

Conclusion

The present study includes the different previous reviews concerning short implants utilization in implantology indicating there certainty and security. The patients with resorbed ridges are ideal individuals for choosing short dental implants as the treatment modality for restoring edentulous spans if operating protocol is applied with perfection. The complicated advanced surgical procedures like sinus elevation and alveolar bone augmentation with overlay graft placement can be avoided. However more researches should be carried out aiming aspects which should be followed by the operator for success of short dental implants and there distinction over the regular implants for even restoring facial defects resulted from trauma, tumor surgeries and other abnormalities.

References

 Shetty S, Puthukkat N, Bhat SV, Shenoy KK. Short implants: A new dimension in rehabilitation of atrophic maxilla and mandible. J Interdiscip Dentistry 2014;4:66-70.

- Huang W, Wu Y,Zou D, Zhang Z, Zhang C, Sun J, et al. Long – term results for maxillary rehabilitation with dental implants after tumor resection. Clin Implant Dent Relat Res 2014;16:282-91.
- Buser D, Merickske-Stern R, Benard JP, Behneke N, Hirt HP, et al. Long term evaluation of nonsubmerged ITI implants. Part 1: 8 year life table analysis of a prospective multi-center study with 2359 implants. Clin Oral Implants Res 1997;8:161-72.
- Shilpa BS, Vasudevan SD, Bhongade ML, Baliga V, Pakhare VV, Dhadse PV. Evaluation of survival of 8 mm length implants in posterior resorbed ridges: A pilot study. J Indian Soc Periodontol 2018;22:334-9.
- 5. Haridas AV, Deepika PC. Short dental implants: Does size really matter?. J Dent Implant 2014;4:158-60.
- Lombardo G et al. Cumulative Success rate of short and ultrashort implants supporting single crowns in the posterior maxilla: A 3-Year retrospective study. Int. J. Dent. 2017;1-10.
- Jain NGulati M, Garg M, Pathak C. Short implants: New horizon in implant dentistry. J. Clin. Diagnostic. Res. 2016;10:ZE14-ZE17.
- Kiattavorncharoen S, Boonsiriseth K, Min K, Suriyan N, Wongsirichat N(2014). Why short implant?. J. Med. Med. Sci. 5(4):97-101.
- Bahat O. Branemark system implants in the posterior maxilla: clinical study of 660 implants followed for 5 to 12 years. Int J Oral Maxillofac Implants. 2000;15:646-53.
- Herrmann I, Lekholm U, Holm S, Kultje C. Evaluation of patient and implant characteristics as potential prognostic factors for oral implant failures. Int J oral Maxillofac Implants. 2005;20:220-30.
- Olate S et al. Influence of diameter and length of implant on early dental implant failure. J Oral Maxillofac Surg. 2010; 68:414-419.

- Shah AK. Short implants- when, where and how?. J Int Clin Dent Res Organ. 2015;7:132-7.
- 13. Reich et al. Novel expandable short dental implants in situations with reduced vertical bone height technical note and first results. Int J Implant Dent. 2017;3(46):1-11.
- Uehara PN et al. Short dental implants (< 7 mm) versus longer implants in augmented bone area: A meta – analysis of randomized controlled trials. Open Dent J 2018;12:354-64.
- 15. Papaspyridakos P et al. Survival rates of short dental implants (≤6 mm) compared with implants longer than 6 mm in posterior jaw areas: A meta analysis. Clin Oral Impl Res. 2018;29(Suppl.16):8-20.
- 16. Lorenz J et al. Short implants in the posterior maxilla to avoid sinus augmentation procedure: 5 – year results from a retrospective cohort study. Int J Implant Dent 2019;5(Suppl.3):1-7.
- Renouard F, Nisand D. Impact of implant length and diameter on survival rates. Clin Oral Implants Res 2006;17 Suppl 2:35-51.
- Bathiya A, Pisulkar SK. Digital occlusal analysis using T scan: Its role, mechanism, accuracy and application. Medical Science 2020;24(105):2826-34.
- Tawil G, Younan R. Clinical evaluation of short, machined-surface implants followed for 12 to 92 months. Int J Oral Maxillofac Implants. 2003;18:894-901.
- 20. Makary C, Rebaudi A, Mokbel N, Naaman N. Peak insertion torque correlated to histologically and clinically evaluated bone density. Implant Dent 2011;20(3):182-191.
- Misch CE, Goodacre CJ, Finley JM, Misch CM, Marinbach M, Dabrowsky T et al. Consensus conference panel report: Crown – height space

guidelines for implant dentistry – part 2. Implant Dent 2006;15:113-21.

- 22. Shillingburg HT Jr, Hobo S, Whitserr LD, Jacobi R. Brackett SE. Fundamentals of fixed Prosthodontics.
 3rd ed. Chicago, IL: Quintessence Publishing:1997.p.89-90.
- 23. Blanes RJ, Bernard JP, Blanes ZM, Belser UC. A 10year prospective study of ITI dental implants placed in the posterior region. II:Influence of the crown-toimplant ratio and different prosthetic treatment modalities on the crestal bone loss. Clin Oral Implants Res 2007;18:707-14.
- 24. Rokni S, Todescan R, Watson P, Pharoah M, Adegbembo AO Deporter D. An assessment of crown-to-root ratios with short sintered poroussurfaced implants supporting prosthesis in partially edentulous patients. Int J Oral Maxillofac Implants 2005;20:69-76.
- Schutle J, Flores AM, Weed M. Crown –to-implant ratios of single tooth implant-supported restorations. J Prosthet Dent 2007;98:1-5.
- 26. Misch CE. Short dental implants: a literature review and rationale for use. Dent Today.2005;24:64-68.
- 27. Buser D, Schenk RK, Steinemann S, Fiorellini JP, Fox CH, Stich H. Influence of surface characteristics on bone integration of titanium implants. A histomorphometric study in miniature pigs. J Biomed Mater Res 1991;25:889-902.
- Smith DC, Pillar RM, Chernecky R. Dental implant materials. I. Some effects of preparative procedures on surface topography. J Biomed Mater Res 1991;25:1045-68.
- Pillar RM. Overview of surface variability of metallic endosseous dental implants: Textured and porous surface-structured designs. Implant Dent 1998;7:305-

- Galvao FFS, Almeida-Junior AA, Faria-Junior NB, Caidas SGFR, Reis JMSN, Margonar R. Predictability of short dental implants: A literature review. RSBO. 2011;8:74-80.
- 31. Castro DS, Araujo MA, Benfatti CA, Araujo Cdos R, Piattelli A, Perrotti V et al. Comparative histological and histomorphometrical evaluation of marginal bone resorption around external hexagon and Morse cone implants: an experimental study in dogs. Implant Dent.2014;23:270-76.
- Maeda Y, Satoh T, Sogo M. In vitro differences of stress concentrations a short communication. J Oral Rehabil.2006;33(1):75-78.
- Nisand D, Renourad F. Short implant in limited bone volume. Periodontal 2000.2014;66:72-96.

14.