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An In Vivo Comparative Study between Primary Stability of Dental Implant in D3 and D4 Bone with different Implant Designs

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ABSTRACT

Purpose: The purpose of the study is to assess the difference in primary stability and insertional torque in D3 and D4 bone densities in relation to conical and tapered cylindrical conical implant designs. Implant designs, commonly available as conical tapered thread design presented a similar survival rate in D1 and D2 bone but questionable results were there in D3 and D4 bone. But while placing tapered cylindrical conical implants in D3, D4 bone presented better primary stability and insertional torque upto 40+ N with excellent stability.

Material and Methods: (5-5) Patients simulating D3 and D4 bone as per cbct report were clinically selected. Group 1 with conical design and Group 2 with tapered cylindrical design, implant was placed using torque adjusting wrench. Osteotomy site was prepared as per drilling protocol for selected diameter and length of implant used. After achieving different primary stability in both groups torque values were recorded even for reverse rotational test respectively.

Results: An intergroup comparison revealed difference in torque values via placing implants with conical and tapered cylindrical designs in same sites in maxillary arch in same quadrants respectively.

Conclusion: Tapered cylindrical design exhibited better higher insertional torque and better stability as compared to conical designs. Therefore, before placement of dental implant in D3 and D4 bone one should always consider the design of the implant being selected when the placement is indicated in maxillary arch.

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Introduction

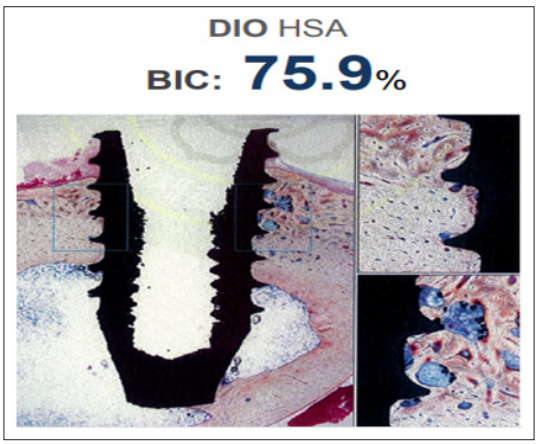
Osseointegration is defined as a direct structural and functional connection between ordered, living bone and the surface of a load-carrying implant. The Branemark method, using commercially pure titanium implants and a strict surgical protocol, is well documented 3As long as the surgical protocol is meticulously followed, consistent and predictable results can be obtained. As per my studies in clinical practice placing dental implants has been one of the most quick, efficient, and successful treatment modalities in recent dental practice with excellent prognosis seen in follow up. While placing dental implants on various patients I realized that there were some difficulties seen in follow up of my implant practice, although two stage surgeries were done in which first stage included assessment, investigation and placement of dental implant in both immediate and delayed placements. Eventually what I realized in second stage protocols that during uncover while placement of healing abutments few patients reported with slight pain in removing the cover screw placed over implants and placement of healing abutment. These implants were mainly of selected cases where both immediate and delayed placements were done in respect to maxillary arch there was a shocking evidence seen clinically that these implant designs were pure conical in shape, the primary stability was jeopardized and what I got on the day of placement means clinically while doing both with flap and flapless approaches the torque values received on the day of placement and the torque values assessed on the day of uncover drastically reduced eventually leading to compromised stability in second visit when patient was called for placement of healing abutments in order to proceed for prosthetic approaches for the delivery of either temporary prosthesis or final. This clinical response was recorded chairside which raised questions to approaches while placement of dental implant in maxillary arch. Osseointegration of dental implants is obtained in the vast majority of instances. However, there may be a need to analyse the rate of osseointegration relative to the anatomical location of implant placement. osseointegration occurring from 78% in the posterior maxillae to 100% in the anterior mandible. The purpose of this article is to quantify the rates of osseointegration of dental implants in the anterior and posterior parts of maxilla [1-3].

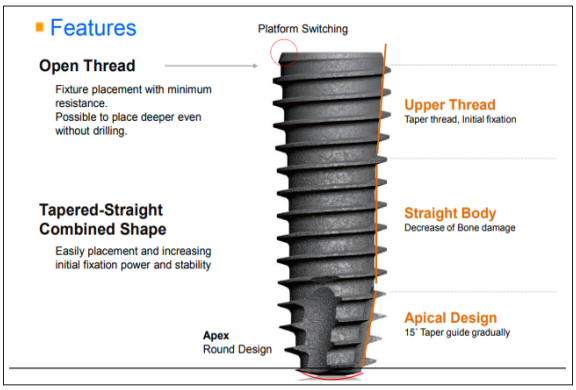
Change in sequence of drilling protocols as per diameter and length selected were 5/10 which is a patent and a universal size used by most of the clinicians in day-to-day practice, I chose last drill used

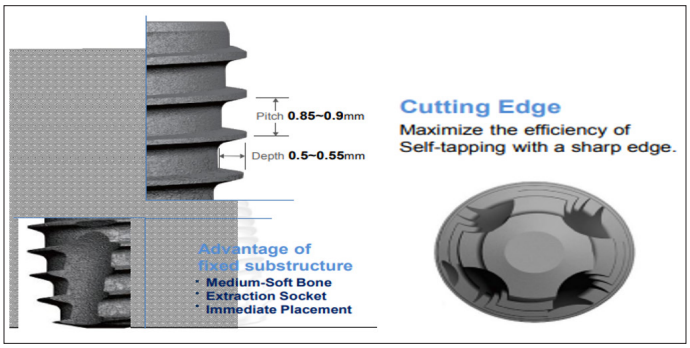
was 4.2 mm in Adin / bio line to 4.0 mm to even 3.8 mm diameter when 5/10 mm of implant size was indicated to be placed. Even after choosing a lower limit of drilling sequency I found some better primary stability to dental implant being placed chairside in both flap and flapless a bit torque values were increased so I felt that this might lead to enhanced primary stability in first visit and during the second visit I will not counter such clinical issues as decreased primary stability and mild pain response by the patient on chairside experience by the patient, it is to be kept in mind that the design of the implant chosen was again pure conical by bio line in most of the cases. Now the question arises what the patient's desires is a tooth to be replaced and what the clinician desires is the best clinical outcome to the placed implant and delivery of the prosthesis. While encountering mild pain while unscrewing cover screw and healing cap then left the case with an additional waiting period of 2 months. After additional 2-3 months this issue was overcome but again the wait time and the promised made for delivery of the prosthesis was increased as PRIMARY STABILY WAS QUESTIONABLE therefore what I assessed that this issue can be resolved by increasing the waiting Period in maxillary arch from 3 months to 5-6 months in both delayed and immediate placements.

Materials and Methods

A total of 20-25 patients (15 females, 10 males) were treated with 20 fixtures. Ages ranged from 25 years to 60 years. All were in reasonably good overall health and were treated as out patients with local anaesthesia during fixture placement. Implant shape (Tapered vs Cylindrical) influence survival of dental implants placed in maxillary arch. As per clinical study survival of implants placed in anterior and posterior maxilla was assessed. Adin harpoon physio-dispenser, bioline, I-fix and dio-navi implants and respective kits were used. Titanium (Ti-grade 5) implants were selected. Anterior as well as posterior sites of maxilla were included. Age: 25 to 60 years of male and females. Systemically healthy, nonsmokers. Total implants placed in maxilla were 50+ of mixed designs among which 5-5 of both designs were compared. Implant design selected were conical and tapered cylindrical. Dia: 3.75-5 mm and length 5 – 13 mm. Follow up: 2 – 36 months. Patients with pre-existing comorbities and non-complying implant placement protocols were excluded. (5-5) Patients simulating D3, D4 bone as per cbct report were clinically selected. Group 1 with conical design and Group 2 with tapered cylindrical design. Implant was placed using torque adjusting wrench and surgical driver. Osteotomy site was prepared as per drilling protocol for selected diameter and length of implant used. After achieving different primary stability in both groups torque values were recorded respectively.



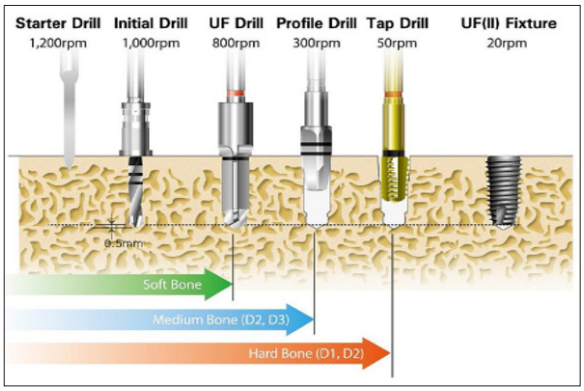




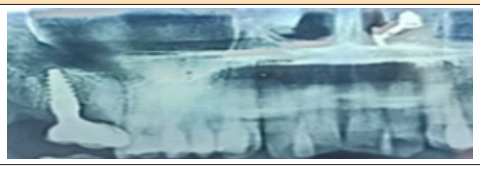
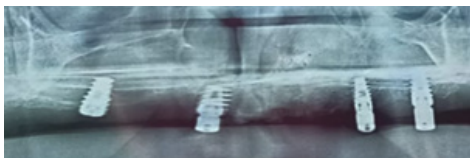
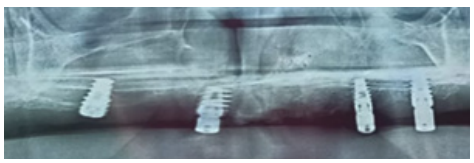
Drills used to Place Conical and Cylindrical Implants

Drills used to place Conical Implants

The Magical Sequence

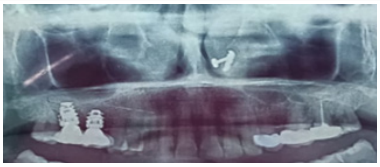
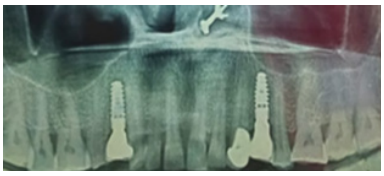
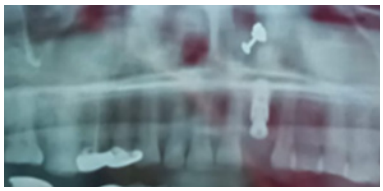


Group 1 (Conical Design)
Table 1:

Quadrant	Radiographic Appearance	Implant Design	Torque values Achieved
1st 17 Immediate Placement		Conical	(17)=25+Ncm.
1st 11 Immediate Placement		Conical	(11)=28=Ncm.
2nd 25 Ndelayed Placement		Conical	(25)=30+Ncm.
2nd 26 Delayed Placement		Conical	(26)=25+Ncm

Group 2 (Tapered Cylindrical Design)

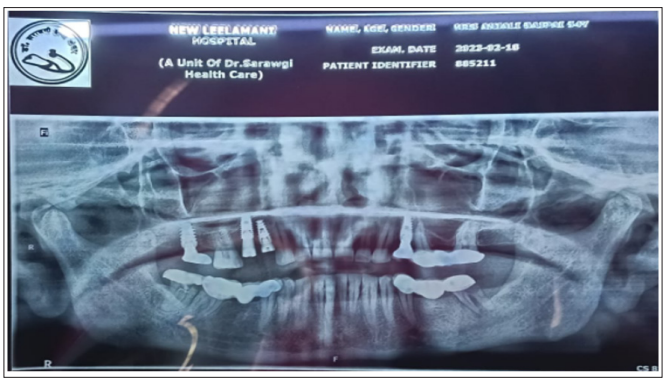
Table 2:

Quadrant	Radiographic Apperaeance	Implant Design Used	Torque Values Acheived
1st,11,15 Immediate Placement		Tapered Cylindrical	(11)= 40+Ncm. (15)= 47+Ncm.
1st 17- Delayed Placement		Tapered Cylindrical	(17)=38+Ncm
2nd 24 Delayed Placement		Tapered Cylindrical	(24)=43+Ncm
2nd 22-Immediate Placement		Tapered Cylindrical	(22)=48+Ncm

Case No 1

Case No 3

Case No 2



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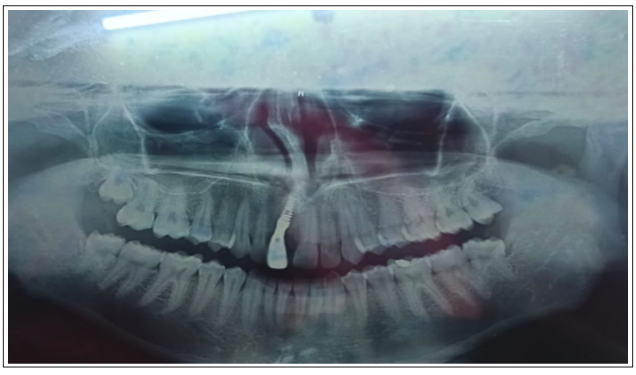

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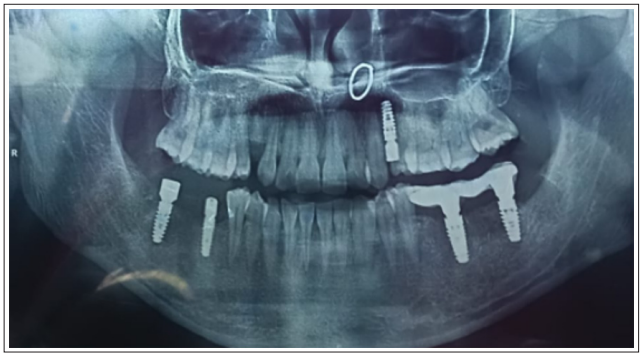
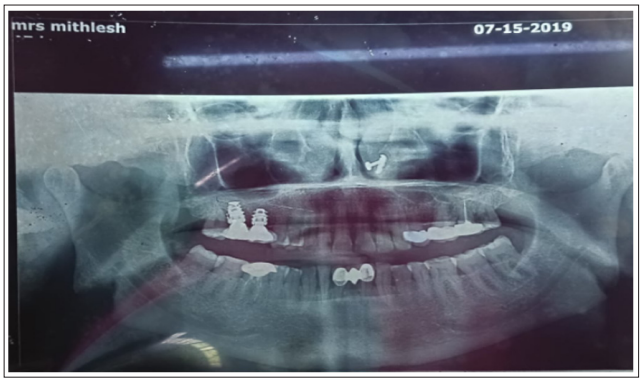


Case No 6

Case No 7



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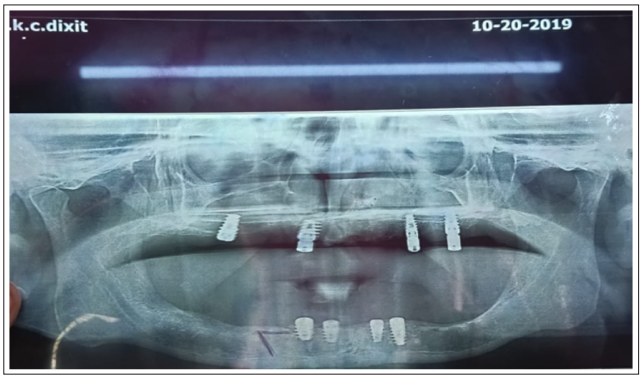

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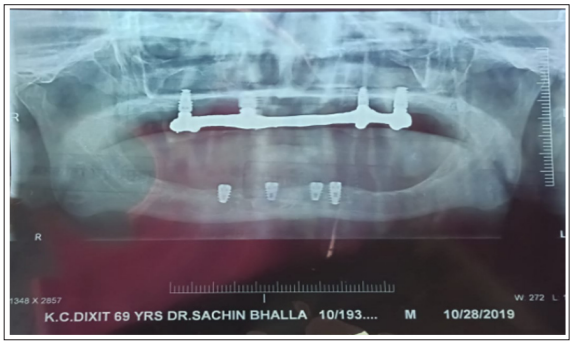
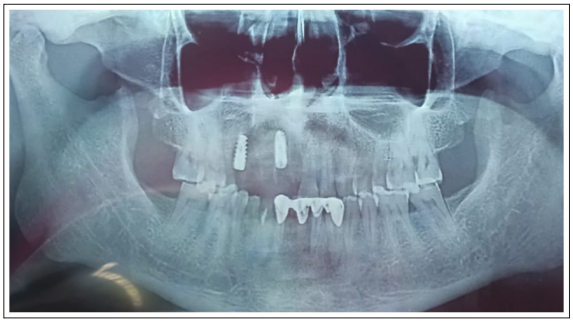


Case No 10

Case No 11



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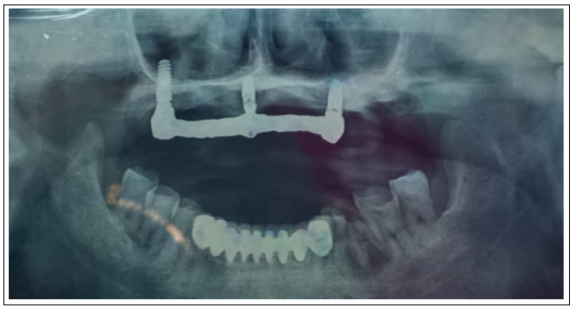

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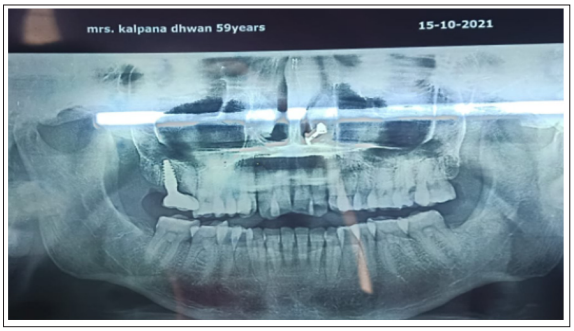

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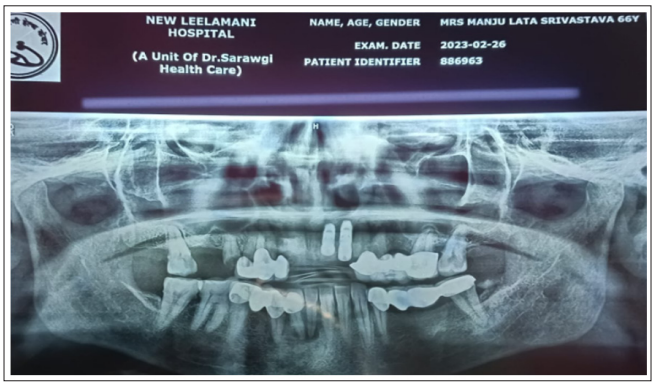

Results

The fixtures were placed according to the protocol established for tissue integration four surgeons were involved in the clinical treatment. Their clinical experience ranged from none to more than 8 years experience. All fixtures, abutments, and cylinders were made by dio navi and bioline. At placement, the surgeon recorded the position (tooth number) and the size (length and diameter) of the fixtures. Intergroup comparison revealed difference in torque values via placing implants with conical and tapered cylindrical designs in same sites in maxillary arch in same quadrants respectively. Five studies were included. The number of patients included ranged between 4 and 25 participants. The mean follow-up period of implants ranged between 2 to 36 months. Implants were placed subcrestally in anterior as well as posterior maxilla. Implant relation to soft tissues torque and loading protocols. Gingival biotypes were assessed. Through SRP was performed if indicated. Maintenance of oral hygiene was advocated. Implants were placed subcrestally and submerged in all placements. Torque values were recorded via torque adjusting rachet as well as values as beeped on display of physio dispenser. Follow up on 4th/ 7th/21stday, 3-6 months and 1 year was done using practo calling software.

Discussion

This study showed an overall osseointegration rate of 95.4%. This is well within the findings reported by a significant number of authors on chairside data. Quantitatively more fixtures were lost in the maxilla than mandible when conical designs were preferred initially. This difference is consistent with other reports favourable maxillary osseointegration rates have been related to unfavourable hone quality and quality of the maxillae relative to the mandible. Primary stability is result of compression of bone tissue in lateral direction and clamping of bone between threads and collar in an axial direction. Exhibited 2 strong points: 1- Stimulate osseointegration. 2-Otimized design for immediate loading. The results of this study show a trend in osseointegration rates when comparing anterior and posterior segments of the maxillae. Anterior maxillary fixtures tend to obtain osseointegration more predictably than posterior fixtures. The present study showed significant differences in osseointegration by location in both jaws, particularly in the maxilla.

Conclusion

Tapered cylindrical design exhibited better higher insertional torque and better stability as compared to conical designs. Therefore, before placement of dental implant in D3 and D4 bone one should always consider the design of the implant being selected when the placement is indicated in maxillary arch.

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