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Message from the Editor's Desk

As a result of continued research in dental implant designs, digital planning software ,materials ,surgical techniques, and guiding systems, predictable success is now a reality for the rehabilitation of many challenging clinical situations. Continued high rate of success and perfection achieved with osseointegrated dental implants is the appropriate result of changes in traditional diagnosis and treatment planning of prosthetic restorations.

It is with great privilege and honor that I assume the position of Editor – in – Chief of Journal of Academy of Oral Implantology. The journal will focus on new clinical and scientific information that advances our knowledge towards Predictability and Perfection in Implantology. We intended to publish case reports, review articles, with main focus on original research articles. Our objective is to reach all the clinical practitioners and academicians who have knowledge and interest in research activities and new innovative procedures which helps us in updating our knowledge and improving our treatment. I request all to keep sending original research work articles and case reports for the next issues of JAOI.

I thank the authors for submitting their best clinical and scientific work. I also thank my editorial team, technical team, and well wishers for contributing towards the publication of this issue of JAOI.

Dr. Aman Arora
Editor-in-Chief

Message from the President's Desk

I count it an honor and a privilege to be a president of Academy of Oral Implantology and express my gratitude to all the members of the executive committee for their support.

The present era is the era of implants and dental implants should definitely make a successful impact on this generation. The academy of oral implantology helps to promote current innovative procedures, to maintain the highest standards of practice, exchange of scientific information and research.

It gives me immense pleasure to welcome you all for the **Spring Summit 2022, Academy of Oral Implantology (AOI-India)**. I am thankful to all the office bearers and members of different committees who have volunteered their time, talents and provided assistance to raise funds for organizing this event.

The fate of the journal lies in the submission of good quality scientific articles, adequate finances for publication and prompt editorship. I invite the members to send more articles for JAOI.

I congratulate Dr. Aman Arora and the entire editorial team for their painstaking effort and whole hearted dedication in taking out this journal.

Thanking you,

Warm Regards,
Dr. Aman Popli
President,
Academy of Oral Implantology

Message from General Secretary

Academy of Oral Implantology (AOI) is the academy of dental professionals who are dedicated to advance the science of oral implantology. AOI has provided a platform for introduction of various implant systems, exchange of expertise and promotion of innovative procedures.

Implant is the most exciting idea in modern dentistry. Modern dentistry aims at complete restoration of the stomatognathic system. Continued research in implant dentistry , diagnostic tools, treatment planning, implant designs, materials and techniques have made the rehabilitation of many challenging clinical situations, a reality.

In the recent decades, implant supported prosthodontic restorations have proven to be a reliable, predictable, and effective treatment modality and provide stability, excellent retention and improved masticatory efficiency.

The use of dental implants as the preferred method of tooth replacement continues to escalate worldwide and new forms of predictable therapy are required to satisfy the growing demand for ideal esthetics. The current trend to expand the use of implant dentistry will continue until every restorative practice uses this modality for support of both fixed and removable prosthesis on a regular basis as a primary option for all tooth replacement.

The Journal of Academy of Oral Implantology is an official publication of Academy of Oral Implantology. The aim of this journal is to advance the science and art of oral implantology, to promote the current innovative procedures in oral implantology and to foster research in the field of oral implantology.

Dr. Ajay Shrama

IMMEDIATE LOADING OF SINGLE IMPLANTS - CASE REPORTS

ABSTRACT

Extraction of a tooth means failure of a conservative approach which may give rise to the act of a reconstructive surgery i.e. delayed or immediate implant placement technique with either delayed or immediate loading. Immediate loading being a therapeutic option compensates the negative psychological effect of extraction. There are two main advantages of immediate loading, first is the biological effect which consists of the osseointegration of the implant, soft tissue architecture and the second is the imperative effect that is logical and consists of the subsequent reduction of the surgical and prosthetic stage in the shortest time. In this case report successful single immediate implant placements are done and followed up for 2 years.

Keywords: Immediate implant, immediate loading, osseointegration.

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INTRODUCTION

In short and long term dental implants are a viable solution for the restoration of single-tooth gaps, with high survival and success rates [1,2]. These days rapid and predictable restoration of function (mastication) and aesthetics is done by placement of an implant-supported single crown [3, 4].

For the success of a fixed implant-supported restoration, good biological integration is an essential [5]. In fact, a dental implant has to effectively integrate into the bone, in order to functionally support the prosthetic restoration [5]; and integrate with the soft tissues, which is a guarantee the maintenance of osseointegration over time, and essential condition for the aesthetic success of the rehabilitation [4–6].

In recent years, the aesthetic requirements of the patients have become increasingly important and difficult to satisfy [4–6]; furthermore, patients require a treatment that should be fast, minimally invasive, and of low cost [5].

New surgical and prosthetic protocols have been proposed and are gaining acceptance, to meet the modern needs of patients, which reduce the number of operating sessions (and with them the stress and costs for the patient): among them, there are the placement of implants in fresh extraction sockets [4, 7, 8] and the immediate prosthetic loading [9].

Immediately after the extraction of the nonrestorable and compromised teeth, placement of implant can reduce the number of surgical sessions (from two to one) with a reduction in the patients' stress and costs [4, 7, 8]. This strategy is compatible with the insertion of implants with a flapless technique (i.e., without having to raise a full-thickness, mucoperiosteal flap) and is therefore minimally invasive: this represents a further advantage of the method [8, 10]. Finally, some researchers believe that the correct three-dimensional (3D) positioning of the fixture can facilitated by insertion of an implant into a fresh extraction socket, with benefits for the emergence profile [4, 7, 8].

The immediate prosthetic loading is a viable strategy along with an aesthetic and functional benefit for the patient, who can avoid wearing uncomfortable removable dentures during the healing period. It reduce the time of treatment, placement of a temporary restoration immediately after the insertion of the fixture (within 48–72 hours after surgery) [9]. Placement of immediate provisional restoration involves benefits with respect to gingival tissues, which can be modeled around it immediately [4, 6, 11].

The aim of this prospective clinical study is therefore to present the clinical outcomes of single implants when placed in postextraction sockets of the anterior maxilla and subjected to immediate loading, except that in place provisionalization we have delivered retrievable final prosthesis within 48 hours of the extraction.

CASE REPORT 1

A 38 year old female patient came to our clinic with history of trauma 4 days back in upper front tooth region and mobile tooth segment were splinted by composites on affected and adjacent crowns by local dentist (Figure. 1).

Fig 1: Fractured tooth Splinted with composite

X ray revealed that there was a comminuted tooth fractured below middle third part of root (Figure. 2).

Fig 2: IOPA revealed fractured root at middle third

The patient was conscious about her aestheticsand wanted the earliest possible solution. Because of the inability of the patient to come back frequently, various options of the implant retained prosthesis were discussed, upon which patient gave consent forimmediate implant placement and immediate loading in fresh extraction socket.

Following administration of local anaesthesia, the fracture tooth was atraumatically removed with the help of periotomes (Figure. 3,4).

Fig 3: Atraumatic extraction using periotomes

Fig 4: Fractured tooth removed

The resulting extraction socket was evaluated for osseous defects. All four walls were found intact (Figure. 5).

Fig 5: Atraumatic tooth extraction without flap reflection resulted in well preserved bone and soft tissue architecture

The extraction socket was thoroughly cleaned. As there was limitation of time and resources, surgical template could not be prepared.

Certain factors which were important for the better prognosis of Immediate placement & immediate loading were :

1. Atraumaticextraction : Extraction has to be done in minimal invasive manner, both at hard & soft tissue levels so as to restore the natural esthetics in very short span of time. Therefore periotomes were skillfully used for the same.
2. Strategic implant placement is necessary to achieve adequate amount of primary stability : Insertion torque is the Key factor in deciding whether or not to load immediately. The implant should be well-anchored in the bone and able to withstand a torque minimum of 35 Ncm for the abutment screws securing etc .
3. Implant selection : Tapered-screw implant with enhanced or modified grooves, an osseo-conductive surface, and of sufficient length (a minimum of 10 to 13 mm).
4. Retrievable prosthesis : To compensate for any soft tissue recession, we might need to alter the crown at later stages & for that, we need to place screw hole to be lingually so that the crown can be retrieved, modified and placed back, if at all required.

Considering above mentioned points, Osteotomy was started in the fresh extraction socket. A periodontal probe was kept on the incisal edges from the lateral incisor of the same side to the central incisor of the other side. Osteotomy was started from the lingual side of the probe, so as to check the angulation of drills, which will result in favorable position of the screw hole in prosthesis. For achieving good primary stability, osteotomy was done around 2.5mm apical to the extraction socket to gain anchorage from nasal cortex. Length of the extracted root was around 11 mm (Figure. 6).

Fig 6: Strategic Osteotomy

Nobel biocare active implant measuring 4.5X13 mm in dimension was placed with insertion torque of 50 Ncm (Figure. - 7, 8)

Fig 7: Immediate Implant Placement

Fig 8: Insertion Torque more than 50 Ncm

Immediately after this implant level impression were made and healing abutment was placed (Figure.- 9, 10).

Fig 9: Open Tray Impression Coping

Fig 10: Healing abutment placed on day of surgery and after 48 hours

After 48 hours, stability of implant was measured by Osstell ISQ (Implant Stability Quotient) meter and 79 reading was obtained which states it to be highly stable (Figure. 11).

Fig 11: Implant stability Quotient - Osstell

Cement retained Porcelain fused metal crown was delivered with screw hole present on lingual side(Figure. 12, 13).

Fig 12: Showing uneventful healing with excellent soft tissue architecture

Fig 13: Screw retained crown delivered

Satisfactory final outcome was achieved in short span of 2days in a perceive manner.

Patient came back after 1 year for follow up. Clinical examinations revealed excellent soft tissue harmony. X-ray also relieved minimal amount of bone resorption around the implant (Figure.14,15).

Fig 14: Follow up after 1 year

Fig 15: X ray at the time of deliver and at 2 year follow up with minimal bone resorption

CASE REPORT 2

A young female patient came with the complain of pain in the upper front tooth since morning due to fall from the stairs. Being a doctor herself she consulted immediately. On oral examination oblique fracture line, extending from crown into root was seen with respect to that tooth with mobile broken fragment. Figure.16)

Fig 16: Pre-operative picture of patient

X-rays revealed fracture of upper right lateral incisor.(Figure. 17)

Fig 17: X-ray of the affected tooth

Patient wanted an immediate permanent solution so, was advised for extraction followed by immediate implant loading of that tooth. (Figure.18) For immediate restoration and better anatomic evaluation, CBCT was advised before implant procedure to evaluate bone volume and other parameters.

Fig 18: Tooth extracted

One Nobel biocare active RP implants were placed in good D1 bone and insertion torque of more than 45 NCM was achieved. (Figure.19)

Fig 19: Implant placement

Immediately ISQ was done, which showed very promising readings. (Figure. 20)

Fig 20: ISQ reading

Based on which on the same day implant level impressions were made. (Figure. 21 a,b)

Fig 21a, b: Implant level impression

Two days later, screw retained functional crowns were loaded. (Figure.22)

Fig 22: Screw retained crown

Patient was advised to maintain proper oral hygiene and strictly restrict to soft diet especially from left size.

Patient was recalled after 1 week, 1 month, 3 months and then after every 6 months and it was found that satisfactory soft and hard tissue architecture was maintained along with stable occlusion. (Figure.23)

Fig 23: Follow up for 2 years

DISCUSSION

Nowadays, patients are increasingly demanding and asking for early and immediate prosthetic loading protocols [9, 11]; in the same way, to reduce the times and costs of implant-prosthetic treatment, the invasiveness of the therapy, and the patient stress, immediate placement of implants in fresh postextraction sockets considered therapeutic option for the clinician, [4, 7, 8, 10].

Although the placement of immediate, postextraction implants and the immediate loading protocols can represent today predictable solutions, characterized by high rates of survival and success [7–10], but these methods are more challenging for the clinician when compared to more conventional protocols (such as the insertion of fixtures in fully healed edentulous bone ridges and the conventional, delayed loading after a period of 4–6 months of undisturbed bone healing) [7, 12]. To obtain adequate primary stability of the implant in extraction sockets can be difficult because postextraction alveolus is generally of larger size than the diameter of the implant. [1, 7, 12] and an insufficiently stable implant may have a mobilization and failure in the early months of healing, immediately after insertion [13, 14].

Initially in first two months following insertion, there partial loss of mechanical stabilization of the implant with bone remolding (resulting from the initial contact between the implant surface and the preexisting alveolar bone) occurs [13, 14]. An adequate secondary stabilization (or osseointegration) of the implant is not possible, if this remodeling is not effectively counteracted and balanced by an adequate and rapid deposition of new bone on the implant surface, which can increase the chances of failure [13, 14]. Some colleagues have suggested that to get a better primary stability in postextraction sockets, use of fixtures of larger diameter is the solution which is certainly feasible and viable in the posterior regions [15] but may even be counterproductive in the anterior regions (characterized by high aesthetic impact), where the contact between the implant and the delicate buccal bone plate must be avoided, so that the risk of an aesthetic failure can be prevented [8, 16–18]. Hence for better apical engagement of the fixture postextraction implants are stabilized via an apical preparation, that is brought 3-4 mm deeper than the alveolus. [7, 8, 17, 19, 20]. These surgical strategies are certainly of great validity, but use of an implant with a design (macrotopography) conceived to maximize the primary stabilization can get even better results [20,21, 22].

The reason for which Immediate loading is more and more appreciated and requested by the patients is because it reduces the duration of the implant-prosthetic treatment and the cost of therapy [9, 15]. Though immediate loading is a reliable procedure [9], there is no doubt that it could represent a potential risk for treatment failure [13, 14]. In fact, mobilization and failure of the fixture can be determined by uncontrolled forces which are exceeding the physiological limits, transmitted from the crown to the implant which can interfere at the bone/implant interface in the early healing processes [13, 14].

In our present study, the immediate loading of single implants installed in postextraction sockets and healed sites gave positive clinical outcomes, with high survival rates (100%: no implants were lost during the follow-up). The careful treatment planning and the care and attention devoted to compliance with the strict surgical protocols and prosthetic may explain the excellent results obtained here [23], with a low (4.8%) incidence of complications (no biological complications were reported.

CONCLUSION

There are an emerging need and demand for immediately loaded treatment solutions in the management of partial or total edentulism. The results obtained belief that the immediate implant loading is a good, reliable method that solves in very good conditions, both the functional and esthetic needs of an immediate postextractional implant.

Key points of the case report

1. Immediate implant placement and loading (within 48hours)
2. Increased patient compliance and acceptability
3. Economical and cost effective, as less no of visits and no provisional restoration material and cost.
4. Most biologically stable hard and soft tissue architecture and profile.
5. Strategic osteotomy, making prosthesis retrievable (for further changes if required)

Hence, immediate loading implant can be included in regular clinical practice if favorable soft- and hard-tissue components are available for achieving best esthetic outcome

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COMPARISON OF VARIOUS ATTACHMENTS FOR IMPLANT SUPPORTED RESTORATIONS ON FOUR IMPLANTS IN THE EDENTULOUS JAW – A CASE REPORT

ABSTRACT

The objective of the present case report was to test out different prosthetic restoration concepts for implant placement without augmentative measures on a single patient. On the basis of this procedure it was to be determined to what extent attachment systems are actually interchangeable without much effort. Locator®-like abutments and ball attachments were used for a removable prosthetic restoration; as a screw retained restorative option a composite-veneered bridge was fabricated and fixed on Multi abutments on an SLM manufactured cobalt-chrome framework.

Keywords: patient satisfaction, ball attachments, restorative options, reduced implant number, fixed implant supported restoration.

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INTRODUCTION

Partial or total loss of teeth is associated with reduced quality of life and psychosocial problems in most cases [1, 2]. In patients treated with conventional removable dental prostheses to replace missing teeth, gain in quality of life does not seem to be possible to the desired extent [3]. The replacement of missing teeth with implant-supported restorations is therefore a preferred treatment option, since the attachment of prosthetic restorations on implants leads to a higher treatment satisfaction than conventional mucosa supported restorative options [4-9].

This raises the central question as to which type of connection between implant and superstructure and which type of restoration (fixed vs. removable, or conditionally removable) is suitable depending on the patient situation, to achieve predictable treatment outcomes and long-term treatment success. Treatment success is defined not only from the point of view of the dentist; patient satisfaction, care ability of the new dental prosthesis as well as economic aspects must also be taken into account in the intended treatment outcome [10]. The success of a treatment obviously depends to a greater extent on how the patient perceives the treatment result from his point of view and not exclusively how the success of the therapy is defined and perceived by the practitioner [11].

A minimally invasive approach without extensive augmentation is in this context a treatment option favored by the majority of patients [4, 12]. It is of interest to what extent an implant restoration is actually possible in patients presenting bony alveolar process resorption without bone augmentation and how many implants are necessary to achieve a satisfactory rehabilitation.

Implant treatment therefore focuses on both objective functional parameters, such as the long-term rehabilitation of chewing and / or speaking ability, as well as patient-specific, psychosocial factors, such as improved quality of life and improved aesthetics [13]. In order to take the patient's preferences into consideration and at the same time not jeopardize the treatment success, a thorough communication between the dentist and the patient is essential [14, 15].

Despite good communication between the patient and the practitioner, it cannot always be ruled out that the patient's expectations regarding his prosthetic rehabilitation can not be met [16-18]. Therefore, it is appropriate to use implant systems that allow multiple treatment options simultaneously and are thus independent of the ultimate decision on the design of the supra structure and the type of fixation and that allow modifications of the original design of the prosthetic restoration during ongoing therapy [18]. In the case of a reduced budget, patients can initially be provided with a removable treatment option and thus be provided with cheaper care. If the patient's economic situation permits, the removable solution can be easily converted into a higher-quality, fixed prosthetic option. Conversely, this approach also has the advantage of being able to resuscitate patients with a removable implant-supported prosthesis as they age, which leads to a potential for increased loss of hygiene.

This fact has already been recognized by components manufacturers. For example, the company BEGO Implant Systems (Bremen, Germany) offers implant systems that can be equipped flexibly with different prosthetic abutment and connection systems.

Flexibility is especially important in light of the fact that no generally valid recommendations can be made from the currently available statements in the literature as to which therapy option for treatment with implant-supported restorations is the treatment of choice. The number of implants or the type of connection between implants and the superstructure do not seem to have an impact on oral quality of life, as a retrospective comparative clinical study has shown [19]. However, the results of another clinical study showed that this result is not universal with respect to the type of prosthetic connection. There, interforaminal implants placed in the lower jaw by means of bars led to a significantly better perceived oral quality of life than implants without bar connections [20].Additionally, number of implants and the type of prosthetic attachment had no influence on patient satisfaction.

The findings show that objective parameters, such as the success or survival rates of implants and prosthetic superstructures also do not seem to depend on the number of implants. In most clinical cases, the fixation of implant-supported supra constructions in the lower jaw, varying from minimally two [21] or a maximum of four to six implants, may be considered as a suitable and predictable treatment option [22-25].

In implant prosthetic and laboratory terms, having fewer implants has the advantage of facilitating parallel insertion on the patient and parallelization in the laboratory as well as fabrication of the superstructure is simplified.

The principle of using a reduced number of implants was implemented in the All-on-4® concept, which was already developed by Paolo Maló in the late 1990s. This procedure allows a minimally invasive approach to immediate restoration with fixed provisional or definitive dentures on a reduced number of implants. In the lower jaw, the interforaminal region can be considered as a preferable insertion site for this type of restoration, as there is usually the largest supply of bone and there is no risk of injury to the inferior alveolar nerve when placing implants.

The two proximal implants are inserted straight while the distal implants are inserted at an angle, in order to obtain the largest possible support polygon for the prosthetic superstructure. The inclination of the distal implants is then corrected with specially designed angulated abutments. The apparently small influence of the number of implants and the nature of the connection to the superstructure on functional and psychosocial parameters are also reported in two randomized clinical investigations by Krennmair et al. There, an improvement in patient satisfaction was also achieved in the stabilization of mandibular prostheses on only two implants. After one or five years on function no implant loss was observed [26, 27]. In the same studies, the type of connection between implant and prosthetic superstructure (ball attachment vs. locator) also had no influence on subjective patient preference or on objective implant-related clinical and radiographic parameters [26].

CASE REPORT

The objective of the present case report was to test out different prosthetic restoration concepts for implant placement without augmentative measures on a single patient. On the basis of this procedure, it was to be determined to what extent attachment systems are actually interchangeable without much effort. Locator®-like abutments (PS Easy-Con, BEGO) and ball attachments (PS BA, BEGO) were used for a removable prosthetic restoration. As a screw retained restorative option, a composite-veneered bridge was fabricated and fixed on Multi Plus abutments (BEGO), on a cobalt-chrome framework produced by means of selective laser melting SLM.

Initial situation

The 69-year-old male patient presented in our practice with the desire to be provided with an implant-supported restoration in the lower jaw. He had no systemic diseases, was a non-smoker and did not take any medications. The oral hygiene of the patient was average. He had the desire for an implant supported restoration, which should be minimally invasive and should be fixed on a reduced number of implants, without any augmentative measures. During the period of the last eight years he was restored with a removable partial denture, fixed by means of metallic clasp retaining elements on the only remaining tooth 33. Due to massive periodontal problems, the tooth was no longer worth preserving (Figs. 1 and 2). In the opposite jaw, the patient was provided with inadequate fixed crowns & bridges, which also should be renewed at a later date.

Fig 1 and 2: Initial panoramic radiograph & periapical radiograph of tooth #33.

Basically, it is assumed that in the case of a residual alveolar bone smaller than 5.0 mm in width in connection with implant treatment, bone augmentation measures have to be performed in order to obtain a sufficiently sized bone bed for the implants [28]. In the present case, the alveolar process in the region of the insertion sites of the implants barely met the requirements of implantation without additional augmentation measures. We decided in consultation with the patient for the extraction of the tooth 33 and for a subsequent implant-supported prosthetic restoration of the lower jaw on four implants in the canine and molar area on both sides without additional augmentation measures.

The quality of mandibular alveolar bone was considered D3 according to Misch classification [29-31]. Bone of level D3 belongs next to the second highest quality level D2 to the most commonly observed bone densities. In the literature it is described that in D1 and D4 bone the risk for early implant losses compared to the other two bone quality classes is increased [32]. Nevertheless, in view of the relatively limited amount of available bone, a two-step procedure with a delayed loading protocol and covered healing was chosen, to ensure sufficient implant stability in the alveolar bone over a healing period of several weeks. About three months post extraction of the tooth 33 surgical implant placement took place. Within this period, enough bone was formed in the area of the bony defect in tooth 33, so that implantation could also take place in this area (Fig. 3).

Fig 3: Initial situation, before elevating a mucoperiosteal flap for implant placement; healed #33 site

Surgical phase

Implant placement was performed under local anesthesia and under direct vision, with the formation of a mucoperiosteal flap. The open procedure was chosen as there was an advanced resorption of the bony alveolar process in the oro-vestibular direction, thus allowing a very good assessment of the bone contours and the quality of the bone as well as an implant positioning under direct vision [33-35]. BEGO Semados® RSX Implants with the standard diameters 3.75 mm (area #36 and #43) and 4.10 mm (area #46 and #33) were used. Implantation took place freehand according to the standard protocol of the manufacturer. All implants were placed epicrestally on the buccal aspect (Fig. 4).

Fig 4: Implants placed

Due to the good vertical bone supply, implants with a length of 11.5 mm could be used in the canine area and implants with a length of 10 mm in the posterior area; it was not necessary to angulate the posterior implants - as is usual with the classic All-on-4® method (Fig. 5)

Fig 5: Favorable implant angulation

Mucosa was sutured over the implants and the patient was instructed not to wear the prosthesis for a week. The one-week prosthesis course was prescribed to reduce the risk of mucosal perforation in the implant area and subsequent infection [36]. One week after implantation, the patient presented again for suture removal. Mucosa in the surgical area showed no signs of infection (Fig. 6).

Fig 6: Complication-free healing, 2 months after implant insertion

Fig 7: Healing posts in situ, two months after implant insertion

Prosthetic phase

After another 7-week healing period, the implants were uncovered and platform-shifting gingival formers were placed (Figure 7). Two weeks later, impressions were taken. After another two weeks, the patient's definitive prosthetic restoration was performed.

Prosthetic connection elements for removable reconstructions

For the attachment of implant supported removable prosthetic reconstructions in this case report ball attachments and Locator®-like Easy-Con abutments were used. Ball attachments consist of a spherical metallic male part (Fig. 8). The matrix is incorporated into the prosthesis and may be made of metal or plastic (Figure 9).The advantages of ball attachments for retaining removable restorations are good hygienic ability, reduced costs and reduced treatment time [7].

Fig 8: Intraoral condition after fixing the four ball attachments

Fig 9: Matrices for the ball anchors incorporated in the prosthesis base.

A relatively high repair liability due to retention losses is compensated by the fact that repairs in this system can be carried out very quickly and easily. However, due to their height, ball attachments require a sufficient intermaxillary distance, which can complicate the design of the prosthetic restoration, since the anchor has a correspondingly large vertical space requirement and the attachment extends far into the oral cavity. Another disadvantage is that ball attachments can be used only on axially and parallel placed implants. Retention is significantly reduced on implants deviating from angulation>15 degrees [7].

In this clinical case, implants were positioned approximately parallel, so that there were no major deviations of the implant axes (Fig. 10).There was ample intermaxillary space and we were able to provide the patient with a removable denture fixed to ball attachments. Clinical outcomes were very satisfactory for the clinician and the patient, both visually and functionally (Figures 11 and 12).

Fig 10: Relatively parallel positioning of the implants with small angular deviations

Fig 11: Cover denture prosthesis mounted on ball attachments in situ

Fig 12: Good aesthetic and functional result of the cover denture prosthesis

The Easy-Con system is also susceptible to repair, as the replacement of the polyamide inserts must take place due to retention losses [26]. Since the restoration height is significantly lower than with the ball attachments, the Easy-Con abutments can be used very well as attachments where reduced intermaxillary distance is available. Easy-Con abutments consist of a metal matrix integrated in the abutment. This consists of a raised, annular edge. The polyamide (nylon) male is placed on the annular abutment and retains its retention over both the outer surfaces and the inner surfaces of the metal ring (Figure 13). The denture base contains polyamide inserts (Fig. 14). Due to the material-related elasticity of the Easy-Con components, this system has a favorable resilience (self-aligning) and is able to adapt well to the movements of the superstructure during functional loading [7]. Compared to the ball attachment system, this design allows axial disparallelities between implants to be compensated up to a deviation angle of 40 degrees without loss of retention [37]. The patient was also successfully restored with a functional and visually appealing Cover denture prosthesis using the Easy-Con system (Fig. 15).

Fig 13: PS Easy-Con abutments in situ.

Fig 14: Easy-Con retention caps containing polyamide inserts are incorporated into the denture base.

Fig 15: Final removable prosthesis on PS Easy-Con abutments in situ.

No significant differences in clinical or radiographic parameters could be identified between Locator®-like abutments and ball attachments in a clinical study after a five-year period under functional loading [27]. In the case of ball attachments, more frequent prosthetic aftercare was initially required compared to Locator®-like abutments, but these decreased with increasing observation time and no longer differed in the frequency of self-aligning systems.

In a more recent in-vitro study, statistically significant differences in the retention behavior and stability of a cobalt-chrome prosthesis framework fixed on two implants were determined depending on the respective prosthetic attachment system, the force applied and the implant distribution. Highest retention and stability values were measured with ball-headed attachments, followed by self-aligning systems [38]. The further distal implants were placed, the higher retention and stability values were achieved in the anterior-posterior direction. When connecting Locator®-like abutments to four implants in the lower jaw using bars, lower crestal bone loss rates and reduced follow-up were found compared to simple Locator® system junctions on two implants [39]. The different effects on crestal bone resorption in this study were attributed to the stabilization effect through the bars rather than the type of prosthetic connection. In contrast, an older in vitro study showed that ball-headed abutments on implants lead to a better distribution of force in the lower jaw posterior region than bar connections [40]. In a clinical comparative study of the treatment of edentulous patients in the mandible using two implants and locators, magnetic attachments showed significantly lower peri-implant bone loss than locator attachments [41]. Based on the available evidence, it is not yet possible to make definitive statements on the influence of different prosthetic connections in implant-supported, removable dentures on the remodeling behavior of crestal bone.

Fixed implant-supported reconstructions

The third treatment option was a screw retained reconstruction attached to the MultiPlus abutment (Figs 16 and 17). The basis for the conditionally removable bridge was a cobalt-chromium framework (EOS, Electro Optical Systems, Munich, Germany) produced by means of selective laser melting. In our patient case, a very accurate fit of the metal framework could be achieved (Figure. 18). The framework was veneered using composite (anaxblend big block dentin and big block enamel, Anaxdent, Stuttgart, Germany) (Figures 19a and b). The screw channels were sealed with composites (EcuSphere-Carat, DMG, Hamburg, Germany) after the onset of the superstructure (Figure. 20). The final clinical outcome was very satisfactory for the patient as the reconstruction was very natural and aesthetic (Figure 21).


Fig 16: PS MultiPlus abutments in situ


Fig 17: Close-up of the PS MultiPlus Abutment


Fig 18: Good fit of the SLM cobalt-chrome framework


Fig 19a: Finalized composite veneered bridge.


Fig 19b: Composite veneered bridge in situ


Fig 20: Screw channels sealed with composite


Fig 21: Labial view of the implant-supported lower jaw bridge

It is important that patientsare intensively instructed in the oral hygiene and cleaning of the implant supported restoration so as not to jeopardize the long-term success. This is of great importance, because patients are often unaware that implants require more care than natural teeth [42]. If it turns out that sufficient oral care is not possible, other attachments can be used in consultation with the patient and existing implant supported restorations can be made removable again.

Removable implant supported cover denture restorations are apparently less well accepted by patients than fixed implant-supported restorations [11, 43, 44]. The increased acceptance of fixed implant-supported superstructures can be attributed to the modified design of the prosthetic replacement, as the fixed restoration is designed as a bridge, veneered with ceramic or composite material, and lacks the plastic extensions required in the cover denture solution. Improved aesthetics and wearing comfort of fixed bridges compared to cover denture prostheses obviously also lead to increased patient satisfaction [11, 43, 44]. However, oral hygiene procedures in fixed reconstructions are more difficult to perform by the patient than is the case with removable prostheses. However removable reconstructions appear to be more susceptible to repair than fixed dentures [45]. Regarding implant survival rates, in both fixed and removable supra constructions, there seems to be a significant dependency on the number of implants. A recent systematic review, including a meta-analysis, found that fixation of fixed reconstructions on four implants and removable dentures on two mandibular implants leads to higher implant loss rates than if more implants are used to stabilize the superstructures [46].

Retaining possibilities of the superstructure

Fixed implant supported restorations can either be cemented to the implants or screwed to the implants as conditionally removable dentures. While the cemented restorations can no longer be removed, the removal of conditionally removable prosthetic superstructures by the dentist is possible. Both principles of attachment are hotly debated and are part of many clinical studies and systematic reviews, the results of which are not uniform. In a systematic review, no differences in remodeling rates of crestal bone were found, depending on the type of fixation [47]. Also in terms of implant survival rates and prosthetic loss rates, no differences were found in a recent review [48]. Results of an earlier review point to the superiority of cemented superstructures in biological and clinical terms [49]. In contrast, in a recent systematic review of cemented total restorations, biological and / or technical complications were more commonly observed than with screwed full arch reconstructions [50]. However, screw retained ceramic supra-constructions had higher chipping rates of the veneers. In other systematic reviews, no differences in the survival rates of the implants and the superstructures depending on the type of fixation could be determined [48, 51]. It has to be taken into account that due to the sometimes very different study designs and in particular the different definitions of success parameters, a direct comparison of the two attachment types and evidence-based statements is currently not possible [52].

CONCLUSION

Ball type abutments, Locator®-like abutments and MultiPlus attachments enable a reliable and predictable prosthetic restoration on four implants.The fact that a minimally invasive approach to implant placement was chosen in the present case increased the patient's acceptance of the proposed implant therapy.The ability to target different prosthetic solutions with a reduced number of implants, depending on patient-specific factors, facilitates the implementation of patient desires, and allows redesign of the prosthetic solution even during ongoing therapy.

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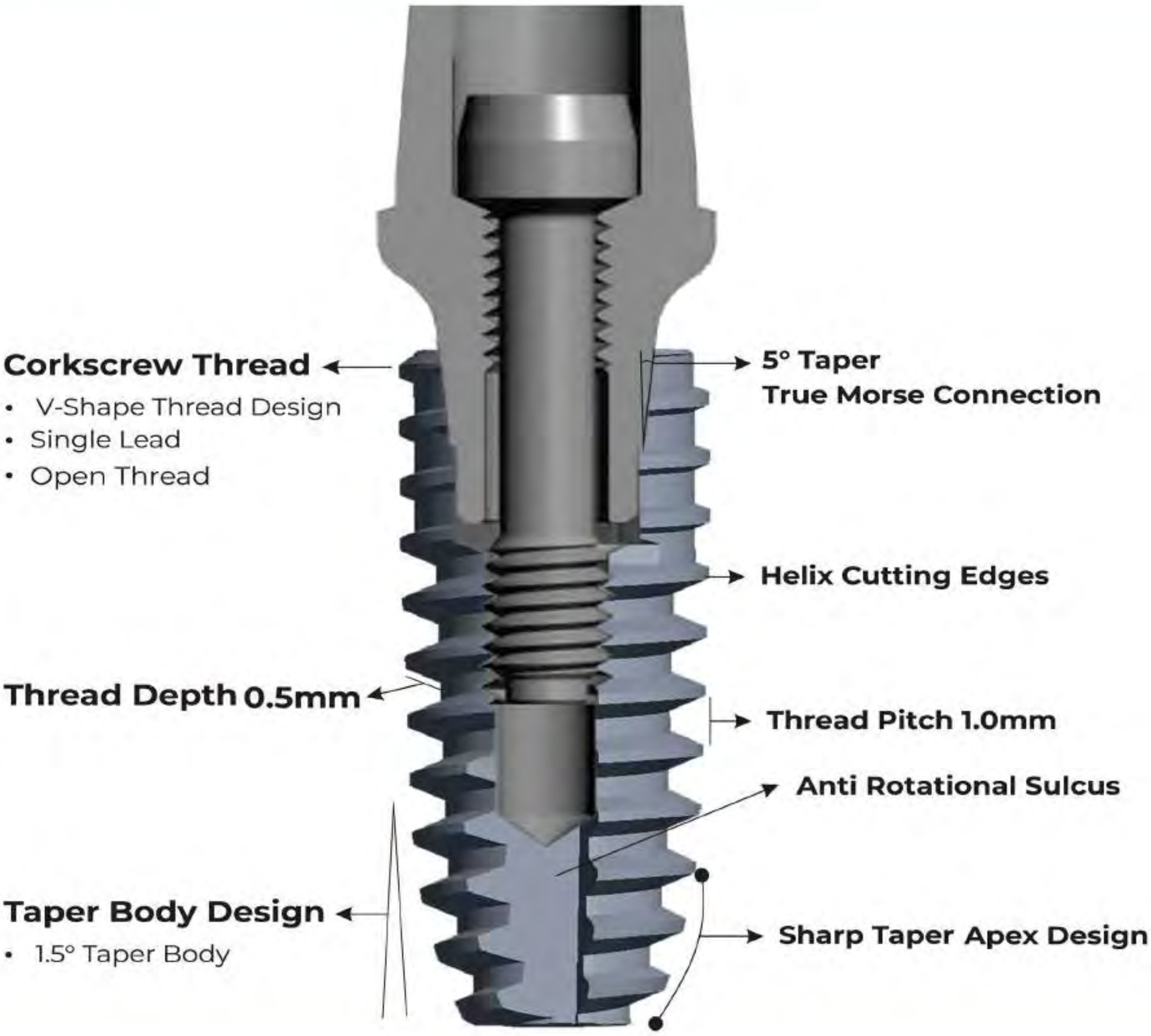

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A SIMULTANEOUS APPROACH; IMPLANT PLACEMENT AND GUIDED BONE REGENERATION IN MAXILLARY AESTHETIC ZONE – A CASE REPORT

ABSTRACT

Dental implants are considered as first treatment alternative for replacing a missing tooth. The bone quality and amount of bone available in anterior maxilla is often variable and commonly there is a deficiency of bone volume. Implant placement and its restoration becomes clinically challenging in such compromised ridges. Guided bone regeneration provides a conducive environment for successful placement of implants in such conditions. This article presents a case report of simultaneous approach of guided bone regeneration and implant placement in the maxillary anterior with narrow ridge defect. After six months of healing period implant was aesthetically restored.

Keywords: Block graft, dental implants, guided bone regeneration.

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INTRODUCTION

Anterior region is considered as the most common area of tooth loss, may be due to trauma or any congenital anomaly. This causes both functional as well as esthetic concern affecting the psychology and smile of the patient[1]. Dental implants are considered as the first line of treatment inrestoring missing teeth. Successful implant placement requires adequate alveolar ridge dimensions, which are essential to house the implant and provide esthetics and functions[2].

However, Implants are also being placed in compromised ridge or defective bone of various dimensions utilizing the various reconstruction techniques such as bone graft, guided bone regeneration (GBR)[3], orthognathic surgery or bone distraction[4]. Guided bone regeneration is a frequently used procedure for hard tissue reconstruction. There are two approaches of GBR in implant therapy: GBR at implant placement (simultaneous approach) and GBR before implant placement to increase the alveolar ridge or improve ridge morphology (staged approach). Simultaneous implant placement and grafting effectively minimizes treatment time without increasing complications or reducing success rate[5]. In this case, missing maxillary right central incisor was restored by placement of implant and simultaneous use of bone grafting for correction of minor dehiscence in the alveolar ridge. A two-staged implant surgery was performed. Implant insertion was done on first surgery and uncovering the implant and attaching a prosthetic abutment was done on second surgery after six months.

CASE REPORT

A 22 years old male patient reported to the Department of Prosthodontics, CODS, BPKIHS, Dharan, Nepal for the replacement of his missing right anterior tooth. The patient gave a history of trauma and loss of tooth 2 years back. There was no relevant medical history. Clinical intra-oral examination showed missing right central incisor (figure 1).

Fig 1: Pre-operative intra oral view showing missing right central incisor.

Diagnostic impressions were made of the maxillary and mandibular arch, and diagnostic casts were obtained. Pre-operative imaging with cone beam computerized topography showed adequate mesiodistal width and inadequate thickness of buccal plate in region of 11. The patient was explained about different treatment options. After discussing the pros and cons of each treatment options, the patient opted for implant placement with simultaneous bone grafting to establish horizontal width at the implant site. The patient signed a consent form before undergoing surgery.

Procedures

- Local anesthetic was administered in the area of the maxillary right upper central incisor. A mid-crestal incision and releasing incisions were made on mesial of 21 and on the distal of 12 with a size 15 scalpel blade.

- A full thickness flap was reflected towards the base of vestibule using a molt elevator.
- Due to the presence of inadequate buccal cortical plate, dehiscence occurred on vestibular side (figure 2).

Fig 2: Full flap raised showing dehiscence defect

- Implant sites was prepared with drills and implant was placed equicrestally with an initial torque of 35 N. (Figure 3).

Fig 3: Implant placement done wrt 11

- After decorticating the labial bone with hand instruments, the block bone graft (Bio-Oss, Geistlich Sons Ltd. Wolhusen, Switzerland) wax mixed with blood and perfectly adapted to maxillary wall without any gap and secured with barrier membrane (Periocol-GTR) (figure 5).

Fig 4: Placement of Block bone graft (Bio-oss).

Fig 5: Placement of Guided tissue barrier membrane.

- The flap was repositioned without tension and closure was done with nylon suture.
- After surgery, patient was kept on analgesic (paracetamol, 750mg every 6 hours for 4 days), an antibiotic (amoxicillin, 500mg every 8 hours for 7 days),and chemical plaque control (0.12% chlorhexidine gluconate rinse every 12 hours for 14 days).
- Patient was called after one week for suture removal. Second stage surgery was done after 6 months and revealed a well-integrated block graft that was incorporated into the surrounding cortical bone (figure 6). The implant head was exposed using a crestal incision and healing abutment was placed.

Fig 6: Well-formed cortical bone

- After two weeks, the implant analog was placed and final impression was made with rubber base impression material (figure 7).

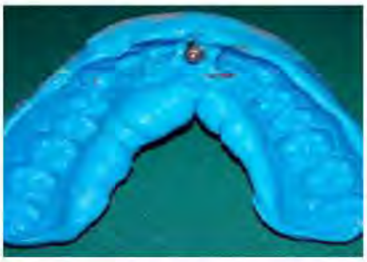

Fig 7:

- Implant abutment was screwed in patient mouth (figure 8) and complete seating of abutment to the implant fixture was confirmed with intra oral periapical radiograph (figure 9) and then temporary prosthesis was placed in patient mouth (figure 10).

Fig 8 and 9: Implant Abutment Placement

Fig 10: Placement of Provisional restoration

- Zirconia crown was fabricated and cemented in patient's mouth with resin cement (figure 11). Occlusion was checked and prosthesis was evaluated for esthetics and phonetics. Patient was happy and satisfied with prosthesis.

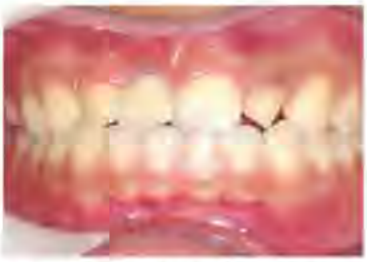

Fig 11: Intra-oral view after final prosthesis placement

- The patient was recalled every three months for one year to evaluate the periodontal status and condition of prosthesis.

DISCUSSION

Dental implants are considered as the first line of treatment in restoring missing teeth now days. Placing dental implants in the maxillary anterior region requires precise planning, surgery, and prosthetic treatment. During implant installation surgery, minor fenestration or marginal dehiscence sometimes occurs. Dehiscence defects may range from a very small lack of marginal bone to large areas of denuded implant surfaces and results in exposure of implant threads[2]. Such type of conditions can be restored by different technique such as Guided Bone Regeneration (GBR), onlay veneer grafting, inter-positional inlay grafting, ridge splitting technique and distraction osteogenesis[3-8].

Guided Bone Regeneration (GBR) is a technique in which bone growth is enhanced by maintaining the space and preventing soft tissue growth into the area utilizing either resorbable or non-resorbable barrier membrane and achieving the bone regeneration. It may be performed in conjunction with the placement of the implant or during a surgical intervention prior to implant placement. Concurrent bone grafting and placement of dental implants effectively minimizes treatment time without increasing complications or reducing success rate[3-9].

Absorbable collagen membranes are more frequently used for guided none regeneration (GBR). The membrane is made with a unique manufacturing process which creates a longer resorption profile suited to GBR procedures and provides excellent handling characteristics when hydrated—thus improving adaptability to various defects[9,10].

Here in this case, simultaneous bone grafting and implant placement was done. Bio-oss block grafting materials in implant sites have enhanced bone formation and Osseo integration in the dehiscence site. Excellent outcome with well-formed ridge and soft tissue dimension was obtained, which provided for restoration of implant in the aesthetic zone with optimal results.

CONCLUSION

Due to bone resorption after extraction, ideal placement of implants would be often impossible without prior hard and soft tissue augmentation. Simultaneous placement of bone grafts and implants shortens the treatment time without increasing complications or reducing the success rate. This case presents the successful restoration of the missing maxillary central incisor in a ridge with dehiscence, performed with two-stage implant surgery and simultaneous bone graft placement.

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A STEP BY STEP APPROACH FOR MONOLITHIC ZIRCONIA FULL ARCH IMPLANT SUPPORTED HYBRID PROSTHESIS

ABSTRACT

The use of full arch implant supported fixed prosthetics being utilized to treat patients who are edentulous or will become edentulous following extraction of the remaining teeth is increasing. With the introduction of monolithic zirconia use transitioned to this material for implant full arch hybrid prosthesis. Virtual design is utilized in conjunction with dental milling. An interim hybrid fabricated from acrylic with denture teeth can allow the patient to "test drive" the prosthesis verifying that they are happy with the esthetics and related function before committing to the final prosthesis. The model containing the implant analogs is scanned as well as a denture setup and the two images are combined in the software to create the design of the final prosthesis. This article will review the step-by-step to restore a full arch with a

Keywords: Hybrid prosthesis, full arch implant restoration, monolithic zirconia, virtual design, Cad/Cam milling

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INTRODUCTION

Clinically, the use of full arch implant supported fixed prosthetics being utilized to treat patients who are edentulous or will become edentulous following extraction of the remaining teeth is increasing. Treatment options are fabrication of either a cemented prosthesis or one that is screw retained. Those screw retained hybrid bridges have benefits over their cemented counterparts and are frequently selected as the treatment option.

Over the past decade dental materials available for those implant supported hybrid prosthetics have changed.[1,2] In the past these were fabricated from denture teeth fixed to a metal frame with denture acrylic. Typically over time, which varied by patient, they would demonstrate wear of the plastic denture teeth and the potential for tooth pop off of the prosthesis. To combat those issues some practitioners and labs were providing cast or later milled metal frameworks that either ceramic was fired to or individual crowns were fabricated and luted to, providing a more durable prosthesis. But, with the underlying frame shadowing from the metal the resulting esthetics were often not optimal. With the introduction of monolithic zirconia available as a large puck which could be milled, use transitioned to this material for implant full arch hybrid prosthesis.[3]

Initial concerns with the use of zirconia as the frame without metal reinforcement focused on comparable strength to metal substructures. Comparative three-dimensional finite element analysis comparing frameworks for hybrid prosthesis that were fabricated of monolithic zirconia and milled titanium found that stress generated was not significantly influenced by the framework's material. This found that the use of a framework in zirconia has biomechanical behavior similar to that of a titanium framework.[4] As monolithic zirconia is a hard material that resists fracture under function, the concern has been to wear of natural and composite antagonists over time. Clinically acceptable wear has been reported and use in a full arch will not lead to excessive wear of the opposing arch.5 Zirconia stabilized with yttrium oxide exhibits high flexural strength with fracture toughness. Zirconia framework damage has rarely been encountered, however, veneering porcelain fractures are the most common technical complication in implant-supported zirconia restorations. Therefore, the use of a monolithic prosthesis eliminates the potential of ceramic chipping that may be found with ceramics layered to the zirconia frame.[6]

Virtual design is utilized in conjunction with dental milling.[7] The model containing the implant analogs is scanned as well as a denture setup and the two images are combined in the software to create the design of the final prosthesis. Yet, there are some potential problems with this approach and the orientation of the prosthesis to the implant position may not match completely. This can be avoided by creating an interim hybrid from acrylic with denture teeth that can be scanned before return to the practitioners office. The practitioner can then insert this interim prosthesis verify the esthetics and occlusion before having the lab fabricate the final prosthesis. An additional benefit of this approach is the patient can "test drive" the prosthesis verifying that they are happy with the esthetics and related function before committing to the final prosthesis.[8]

CASE REPORT

A male 63 year old patient presented with the complaint of mobility on the remaining maxillary teeth, missing mandibular anterior teeth and expressing a desire to eliminate the removable partial in the maxillary arch with an improvement in his esthetics and function. Additionally, the patient reported difficulty eating due to poor intercuspation of the teeth and feeling of social embarrassment related to his smile. Review of his medical history noted only high blood pressure which he was controlling with physician prescribed medication. A panoramic radiograph was taken to evaluate the condition of the remaining dentition and identify availability of bone for implant placement. (Figure 1)

The remaining maxillary teeth consisted of the right lateral through the left canine, with each of those teeth presenting with grade 1+ mobility and periapical pathology noted on each of them. The patient indicated the posterior maxillary teeth had been extracted a number of years ago and he had been wearing a partial denture to replace them. Bilateral enlargement of the maxillary sinus was noted with insufficient available crestal height to accommodate implants. The mandibular central incisors were missing as were all mandibular molars, with no mobility or apical pathology noted on the remaining mandibular teeth. The patient indicated he had been wearing a mandibular partial denture but wished to eliminate any removable prosthetic as one of his goals of seeking treatment.

A treatment plan following analysis of the clinical condition and the patients expressed treatment goals was formulated consisting of bilateral sinus augmentation, extraction of the maxillary remaining teeth, placement of eight implants after sinus graft healing and restoration with a monolithic zirconia fixed hybrid prosthesis was purposed. Regarding the mandibular arch, a natural tooth fixed bridge on canine to canine would replace the missing incisors and treat the incisal wear present on those teeth. Also recommended was placement of two implants in the posterior right and two in the posterior left with restoration utilizing individual crowns. The patient accepted treatment except for the mandibular posterior implants due to budgetary issues. Treatment would require a staged approach with use of a temporary maxillary standard denture which would help decide tooth position for esthetics and phonetics that would guide the final prosthesis. Impressions were taken as well as interocclusal records to allow the lab to fabricate the maxillary provisional prosthesis and sent to the lab.

The patient presented for the first surgical appointment and signed consent forms. Local anesthetic (4% Articaine with 1:100,000 epi, Dentsply Pharmaceuticals, York, PA) was administered to the upper left posterior and anterior maxilla. At the initiation of the surgical treatment, blood was drawn from the patient into glass walled red top tubes containing no anticoagulant. These were immediately centrifuged at 2,200 rpm for 3 minutes to create separation of the layers of the patients blood. For the purposes of creating "gummy bone", the yellow layer which is the plasma high in fibrin and platelets is used. This autologous blood concentrate was mixed with cancellous freeze dried bone (Osteolife Biomedical, Miami, FL) to create the required gummy bone and allowed to congeal in a sterile dish for several minutes.

Teeth 7-11 were atraumatically extracted after luxation with elevators and use of forceps. The extraction sockets were filled with the previously created gummy bone to preserve the osseous contours and closed with 4-0 PGA (Polyglactin 910) sutures (Osteolife Biomedical) in an interrupted pattern. A crestal incision was made with a #15 scalpel blade starting at the center of the left tuberosity and continuing to the 1st premolar area. A vertical releasing incision was next made at the anterior termination of the crestal incision on the buccal aspect of the ridge and a full thickness flap was elevated to expose the lateral aspect of the maxilla in anticipation for the sinus augmentation via a lateral approach. Access to the left maxillary sinus was achieved using the TOLA II lateral sinus augmentation kit (MedEquip Dental Supplies, Jupiter, FL) and the area below the elevated sinus membrane was packed with additional gummy bone to improve the crestal height to accommodate later implant placement. The flap was repositioned and closed with 4-0 PGA sutures in an interrupted fashion. The provisional maxillary denture was tried in and adjusted as needed and the patient dismissed. The patient returned a week later for augmentation of the right sinus and the same procedure performed on the left sinus was repeated on the right quadrant. All sutures were removed 2 weeks later and the absence of soft tissue inflammation was noted as well as coverage of the anterior sites with keratinized tissue.

The bilateral sinuses and anterior socket preservation were allowed to heal to accomplish graft conversion and maturation for five months. The patient presented and local anesthetic (4% Articaine with 1:100,000 epi) was administered across the entire maxilla. A crestal incision was made with a #15 scalpel blade starting at the right tuberosity to the left tuberosity with no releasing incisions and the crestal bone was exposed by flap elevation. Osteotomies were created to accommodate ImplantVision implants (MedEquip Dental Supplies, Jupiter, FL)

and were placed as follows; #2- 4.2 x 10, #3- 4.2 x 10, #5- 3.2 x 10, #8- 3.2 x 8, #9- 3.8 x 8, #12- 3.2 x 10, #14- 4.2 x 10 and #15- 4.2 x 10mm. The flap margins were reapproximated and secured with 5-0 PGA sutures (Osteolife Biomedical) in an interrupted fashion. The interior of the provisional denture at the crest was relieved and soft relined over the implant sites with Coe Comfort tissue conditioner (GC America, Alsip, IL) and the patient dismissed. The patient returned for suture removal 2 weeks later and soft tissue demonstrated a lack of inflammation.

The patient returned at 5 months post implant placement and a panoramic radiograph was taken to evaluate implant healing and the grafting. (Figure 2) Local anesthetic was administered and a tissue punch was utilized to expose the cover screws on the implants. The cover screws were removed and healing abutments placed in each implant. The soft lining material was removed from the provisional denture and the interior was modified to seat passively over the healing abutments and a new Coe Comfort tissue conditioner was placed into the denture.

Fig 1: Radiograph of the patient as he presented with remaining teeth in maxilla demonstrating bone loss and periapical pathology and missing lower central incisors.

Fig 2: Radiograph after healing completed following bilateral sinus augmentation placement of implants to support a full arch hybrid prosthesis.

The patient presented at 4 weeks implant exposure to initiate the restorative phase of treatment. (Figure 3) Bilateral mental blocks was performed with local anesthetic and the canines and lateral incisors were prepared bilaterally for the planned 6 unit fixed bridge and an impression was taken of the mandibular arch. The lower bridge was temporized. Healing abutments were removed and closed tray impression abutments were placed into each of the implants and a duplicate of the provisional denture was modified to fit over the impression abutments and a bite was taken of the denture in occlusion with Futar bite registration material (Kettenbach USA). The duplicate denture was removed and VPS adhesive painted on the interior of the prosthesis and the relieved areas were filled with heavy body Panasil VPS impression material (Kettenbach USA, Huntington Beach, CA) with light body Panasil expressed around the impression abutments intraorally and the denture was reseated and the patient guided into the occlusal bite previously taken. Upon setting, the impression in the duplicate denture was removed intraorally and the healing abutments reinserted. The impression in the duplicate denture would allow the lab to mount the casts and fabricate a prosthesis for try in.

The lab three weeks later returned a screw retained acrylic full arch interim prosthesis. (Figures 4 and 5) Healing abutments were removed, the try-in prosthesis was inserted and fixation screws tightened. The patient was shown a mirror and indicated he was happy with the esthetics. Radiographs were taken to verify fit and mating of the interim hybrid prosthesis. (Figure 6) The screw access holes were filled with a cotton pellet and Cavit (3M/ESPE, St. Paul, MN) was placed. The provisional bridge was removed from the mandibular teeth and a high translucency zirconia monolithic bridge (GC Initial, GC America) which had been milled was tried in to verify fit and esthetics. The bridge was then luted with G-Cem LinkAce® (GC America) a self-adhesive resin cement. The margins were tack cured with a curing light and excess cement removed marginally. Occlusion was checked and adjusted where needed.

Fig 3: Removal of the maxillary denture that was overlaying the healing abutments placed after implant exposure following soft tissue healing period of 4 weeks.

Fig 4: Occlusal view of the screw retained full arch hybrid prosthesis on the master model that was fabricated based on the full arch provisional denture and open tray impression taken of the implants.

Fig 5: Lateral view of the maxillary full arch screw retained provisional hybrid prosthesis on the master model.

Fig 6: Radiograph to verify seating of the temporary screw retained prosthesis which will be used to verify occlusion, function and esthetics for a period of 3 weeks before initiation of the final maxillary prosthesis. The lower missing incisors have been replaced with a fixed tooth borne bridge.

The patient was allowed to use the interim hybrid for a period of 3 weeks to confirm the occlusion and verify the esthetics met the patients expectations. The lab was notified no modifications were needed and they could proceed with the final maxillary prosthesis. They had previously scanned the interim acrylic hybrid on the model and would use that to virtually create the final zirconia monolithic hybrid. (Figure 7, 8) Screw access holes would emerge on either the lingual aspect of the teeth or through the occlusal surface of the posterior teeth placing them in non-esthetic areas. (Figures 9-11) The bridge following design was milled from GC Initial high translucency zirconia. Following milling, stains (GC Initial®Spectrum Stain) were brushed on to the areas that would represent the teeth to create natural looking effects and eliminate a monochromatic look. The gingival aspect had gingival tone coloration (GC Initial®IQ Lustre Pastes NF Gum Shades) applied to the zirconia to create a natural effect and esthetics. (Figure 12, 13) Glaze was applied over the entire prosthesis and fired. Metal inserted were luted into the connector aspect on the tissue side of the prosthesis with G-Cem LinkAce® and allowed to self-cure. Excess resin was cleaned from the interface and the bridge was returned to the office for insertion.

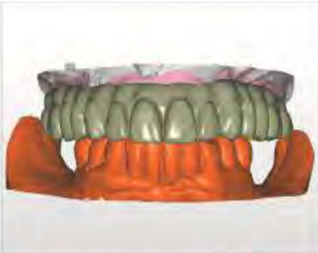

Fig 7: Scan of the interim hybrid prosthesis in occlusion with the lower arch as observed from the buccal in the software.

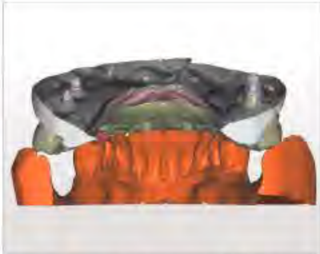

Fig 8: Scan of the interim hybrid prosthesis in occlusion with the lower arch as observed from the buccal in the software.

Fig 9: Virtual planning of the maxillary screw retained hybrid prosthesis that will be fabricated of monolithic zirconia showing the projected screw access holes in non-esthetic areas.

Fig 10: Virtual view of the planned zirconia hybrid prosthesis showing projected screw access holes in non-esthetic areas (occlusal of the posterior and lingual of the anterior).

Fig 11: Virtual planned zirconia hybrid prosthesis with screw access holes on the occlusal and lingual in non-esthetic areas.

Fig 12: Finished milled monolithic zirconia full arch hybrid prosthesis following pigmentation of the gingiva aspects and staining of the teeth with glazing of the entire prosthesis.

The patient returned and the provisional acrylic hybrid was removed intraorally and compared extraorally with the zirconia monolithic hybrid demonstrating identical tooth positions and esthetics that was approved by the patient following his wearing the trial prosthesis. (Figure 14) Soft tissue following removal of the acrylic screw retained hybrid demonstrated healthy non-inflamed gingival cuff at each implant. A multi-abutment at the right canine-premolar implant was placed to correct the emergence angle and place the screw access in a non-esthetic location. The multi-abutment had been placed when the acrylic hybrid was initially inserted. (Figure 15) The zirconia full arch hybrid prosthesis was seated on the maxillary arch and fixation screws tightened to manufacturers recommended torque. (Figure 16) Periapical radiographs were taken to verify complete mating of the prosthetics with the implants without any misfit at the connectors. (Figure 17) Screw access holes in the zirconia monolithic full arch hybrid were then filled with PTFE (plumbers) tape and then filled with Filtek composite (3M/ESPE) to seal the access openings. (Figure 18) Occlusion was checked and no adjustments were required. The resulting prosthetics met the patients initial expressed goals, providing esthetics with a return to function with a stable prosthesis. (Figures 19-20) The result was a natural appearing smile returning the patient to a more youthful look. (Figure 21)

Fig 13: Tissue side view of the finished zirconia monolithic hybrid prosthesis with metal copings luted into the prosthesis so that connection to the implant connectors will be metal to metal. Note the shape of the prosthesis where it will contact the tissue is shaped to prevent food accumulation and allow patient hygiene.

Fig 14: Comparison of the final zirconia monolithic hybrid prosthesis (top) with the acrylic provisional hybrid prosthesis (bottom) mimicking the esthetics and occlusion established in the screw retained provisional.

Fig 15: Soft tissue following removal of the acrylic screw retained hybrid demonstrating healthy non-inflamed gingival cuff at each implant.

Fig 16: Zirconia full arch hybrid prosthesis seated on the maxillary arch and fixation screws tightened to manufacturers recommended torque.

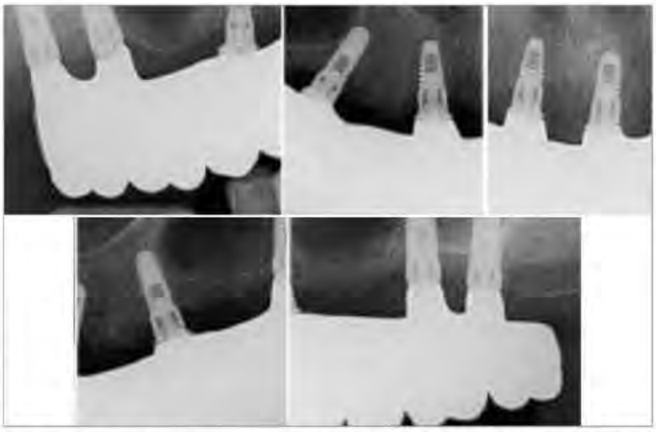

Fig 17: Periapical radiographs were taken to verify complete mating of the prosthetics with the implants without any misfit at the connectors.

Fig 18: Screw access holes in the zirconia monolithic full arch hybrid have been filled with PTFE (plumbers) tape and then filled with Filtek composite to seal the access openings.

Fig 19: Buccal view of the patient in occlusion between the maxillary zirconia monolithic hybrid prosthesis and the lower arch.

Fig 20: Lateral views of the patient in occlusion between the maxillary zirconia monolithic hybrid prosthesis and the lower arch.

Fig 21: The patient smiling in occlusion between the maxillary zirconia monolithic hybrid prosthesis and the lower arch demonstrating a natural esthetic final result.

CONCLUSION

Prosthetic material advances have provided materials that are more esthetic without the use of a metal substructure that provide sufficient strength to allow for their use in full arch implant hybrid prosthesis. These monolithic zirconia ceramic materials may be colored following milling to replicate nuances in tooth shading as well as present as gingival tissue. Cad/Cam milling of the prosthetics out of a monolithic materials allows for a stronger prosthesis without the potential of chipping as no overlaying ceramic is present. Virtual design of these prosthesis can replicate a provisional hybrid prosthesis allowing the patient to test drive the esthetics and function before the final prosthetic is fabricated.

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TREATMENT OF CONGENITALLY MISSING MAXILLARY LATERAL INCISORS: AN INTERDISCIPLINARY APPROACH

ABSTRACT

Nowadays to replace congenitally missing lateral incisors in adolescent patients, implants are commonly used. Mostly, these restorations are challenging for the orthodontist, surgeon, and restorative dentist as sometimes space across the alveolar crest is too narrow to permit the surgeon to place the implant or the root apices of the adjacent central incisor and canine are in close proximity. In many cases the ridge thickness could be inadequate and require augmentation but when the orthodontist opens the space, the papilla heights are adversely affected. Therefore Flapless computer-guided implant surgery is recommended in these kind of cases. This case report presents the treatment of a patient with congenitally missing maxillary lateral incisors using dental implants with guided implant surgery along with orthodontic treatment and restoring lower peg shaped incisor with componeers.

Keywords: Implants, Cone beam computer tomography (CBCT), Componeers

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INTRODUCTION

Tooth loss in the anterior region is commonly the result of a traumatic injury or a congenital anomaly. Maxillary lateral incisor is the most common congenitally missing anterior tooth. Several options are available which include removable dental prostheses, conventional fixed dental prostheses (FDPs), resin-bonded FDPs, orthodontic repositioning of canines to close the edentulous space and implants.[1-5]

However, the use of endosseous implants has become the treatment of choice for restoring patients with congenitally missing maxillary lateral incisors. Endosseous implant therapy can restore such patients with an acceptable esthetic and functional outcome as well as an enhanced clinical prognosis and patient satisfaction.[6,7]

The orthodontic phase must achieve several clinical criteria before the initiation of the implant surgical stage.[8,9] The occlusion must ensure a stable posterior intercuspation with ideal overjet and overbite. The anterior edentulous area has to be created to allow for sufficient space between an implant and the adjacent tooth, thereby allowing for stable crestal bone levels and ideal dental papilla formation.[10] In addition, this parameter allows for the establishment of the ideal width proportion of the maxillary lateral incisor to its adjacent central incisor. This relationship is referred as the "Golden Proportion," which states that the width of the lateral incisor should be two-thirds the width of the central incisor.[11] Finally, orthodontic treatment should establish parallel or divergent roots to allow adequate space for surgical placement of endosseous implants.[4]

More recently, dental implantology has emphasized nature-like tooth replacement, minimally invasive surgical and restorative techniques, as well as time and cost efficiency.[12] Cone beam computer tomography (CBCT), is a combination of three - dimensional (3D) imaging tool and implant planning software, which ease the virtual implant planning defined by prosthetic and anatomical structural parameters.[13-15]

The term used for these kind of surgery is Guided implant surgery (GIS), which allows to transfer planned rehabilitation project directly into surgical field. These are mini-invasive surgeries which don't require the necessity to elevate a surgical flap. The advantages of guided techniques is to have a prefabricated fixed prosthesis at the time of surgery, based on planned implants position which is able to connect to newly inserted implants and easily achieve a functional and aesthetic immediate loading.[16]

The case presented in this article demonstrates a multi disciplinary approach for the treatment of class III malocclusion, congenitally missing maxillary lateral incisors, generalized spacing with peg shaped lower central incisors. The treatment plan included, orthodontic treatment for the maxillary permanent central incisors to correct the midline and to correct the generalized spacing. Endosseous implants were placed with guided implant surgery and restored in the ideal lateral incisor position with PFM crowns.

Lower central incisors were treated with componeers. The treatment was completed in about two year of period, and the patient demonstrated a stable orthodontic, functional, and esthetic outcome.

CASE REPORT

A 16 year old boy came with the chief complain of irregular teeth with spacings and unacceptable esthetics.(Figure. 1)There was no relevant past medical and dental history. On oral examination, it was found that patient is having class III malocclusion, upper lateral incisors were missing, lower central incisors were peg shaped and generalized spacing was present.

Fig 1: Pre-operative view of the patient

Patient was advised for OPG and lateral Cephalogram. (Figure. 2 and 3) OPG revealed that upper lateral incisors were congenitally missing.

Fig 2: Lateral Cephalogram of the patient

Fig 3: OPG of the patient

A proper treatment plan was discussed and advised to the patient. Orthodontic treatment was required for the space closure in lower arch and to correct the midline with the space management for implants in upper lateral incisor region. After almost an year of orthodontic treatment when alignment & leveling was done and space management for implant placement was secured. (Figure. 4 and 5)

Fig 4: Alignment and leveling started

Fig 5: Space management for implants for lateral incisors in upper arch with closure of space in lower arch

Guided implant surgery was planned as there was very less space and alveolar bone present in that area.(Figure. 6)

Fig 6: As CBCT showed very finite amount of bone 3 dimensionally. It was planned to place DIO navi implants (guided surgery)

With the help of Cone beam computer tomography (CBCT), as a three- dimensional (3D) imaging tool, DIO navi implant (3.0mm × 11.5mm) placement was planned .(Figure. 7 and 8)

Fig 7: 3D planning , positioning and selection of implants

Fig 8: 3D planning and setup of prosthesis

A very precise surgery with no flap raise was performed, with finite amount of bone present around the stents after surgery.(Figure. 9a,b)

Fig 9a,b: Implants in place measuring 3.0mm×11.5mm

After 4 months implant level impression was made (Figure. 10a,b and 11) and PFM crowns were delivered in conjunction with the debonding of brackets in both arches. (Figure. 12)

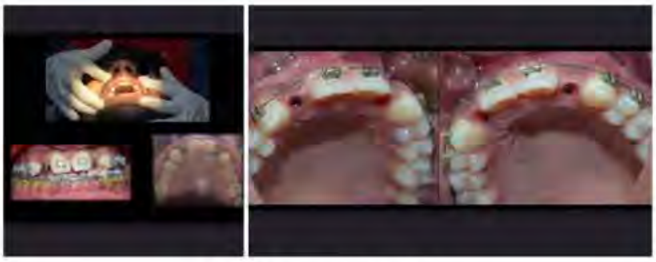

Fig 10a,b : After 4 months

Fig 11: Implant level Impression

Fig 12: PFM crown for upper lateral incisors and componeers on lower central incisors

Lower central incisors were restored with componeers. Patient was given essix retainer with proper oral hygiene maintenance instructions. Patient was completely satisfied with the treatment. (Figure. 13a and b , 14, 15a and b, 16)

Fig 13a,b: After treatment Frontal and lateral view

Fig 14: OPG after treatment

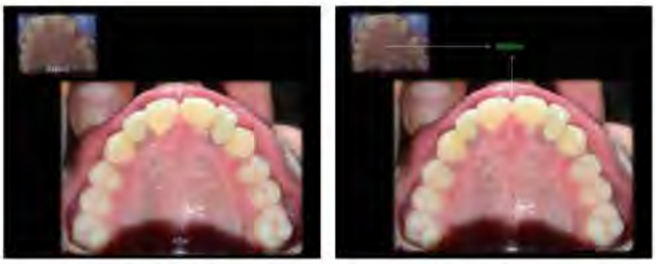

Fig 15a,b : After treatment upper occlusal view

Fig 16: After treatment lower occlusal view

1 year follow up was done, which showed stable occlusion & soft tissue architecture. (Figure. 17)

Fig 17: After 1 year follow up

DISCUSSION

Though, the use of dental implants in the esthetic zone is well documented in the literature, placing dental implants in the anterior maxillary area is considered to be the ultimate challenge for many dentists.[2-17,18] In few cases, the space over the alveolar crest is too narrow to permit placement of an implant.[19] Sometimes, the root apices of the adjacent central incisor and canine are in close proximity.[1,3] In some cases, ridge thickness may be inadequate, requiring soft tissue or bone augmentation.[18,20] In the present case the space as well as the alveolar bone was less.

The most important factor for esthetic treatment outcome is the placement of implants in a correct three-dimensional positionl.[5,18] To evaluate the alveolar bone the methods like conventional radiography, computed tomography, diagnostic bone probing, and bone thickness measurement with gauge are invaluable, three-dimensionally detection in the esthetic zone is preferred before surgery.[2,5,18] Nowadays, surgical guides fabricated using computer assisted design and computer assisted manufacturing (CAD/CAM) systems aid more precise and exact positioning of the implants during surgery.[21,22] Surgical navigation techniques may also be used in challenging situations.[23] Before implant placement in the esthetic zone, the quantity and quality of alveolar bone as well as soft tissues around the implant must be assessed carefully.[3] Horizontal and vertical bone deficiencies may cause esthetic complications.

To accommodate a standard implant in the maxillary lateral incisor area, there should be a minimum of 10 mm of inciso-gingival bone and a minimum of 6.0 mm of facial-lingual bone. Adequate space between the adjacent roots are required for implant. One to 2 mm of space is necessary between the implant and the adjacent roots.[9] Fortunately, the cervical diameter of maxillary lateral incisor is the most similar to that of the implant. In some cases where there is insufficient alveolar bone for implant placement, ridge augmentation may be needful.[3] However, in these cases using narrow-diameter implants is a treatment option rather than using standard-diameter implants.[19,24] These cases have alveolar bone available in maxillary lateral incisor areas in the mesiodistal and coronoapical dimension but there was deficiency in orofacial dimension. The patient refused to have bone augmentation procedures using either autogenic or synthetic bone grafts because of financial and patient related factors. Therefore, DIO navi implant (3.0mm × 11.5mm) diameter were used to compensate for horizontal alveolar bone deficiency.

Labial fenestration can be avoided by placing the implants off axis in labial direction. Implant position and restoration relationship should be based on the position of the implant shoulder, as it will influence the final hard and soft tissue response.[25]

CBCT is often associated with flapless implant insertion. Further confirmations of these observations were provided by Berdougo and co-workers (2010) which evaluated retrospectively 552 implants placed in 169 patients. They founded no statistically significant differences in the cumulative survival rate after 1 to 4 years of follow-up between implants inserted with flapless guided systems versus conventional open-flap implant surgery.[26] Same conclusions were reached by a systematic review published in 2012 in which were included 28 studies on computer-guided implant placement with a total of 4032 analyzed implants.[27] This case report tried to prove that guided placement had at least as good implant survival as conventional protocols, showing decrease pain and discomfort due to the use of flapless procedures atimmediate postoperative period.

CONCLUSION

This case reported successfully supported the use of CBCT, guided implant surgery and concluded that treatment was with less pain and discomfort which also showed stable occlusion & soft tissue architecture. Although there was a horizontal alveolar bone deficiency, the surgery was performed using narrow diameter implants giving excellent result with patient's satisfactory esthetic expectations.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflict of interest

There are no conflicts of interest

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ORAL SYSTEMIC LINK BETWEEN ANTI - DEPRESSANTS AND DENTAL IMPLANT FAILURES - A PROOF OF PRINCIPLE STUDY

ABSTRACT

Prevalence of debilitating diseases and the uptake of medicines steeply increases, as the population ages. Depression, a state of low mood affecting a person's thoughts, behavior, feelings and sense of well-being, is coming out as a threatening disease. Anti-depressants are the second most widely prescribed medications, thus it is important that the health-care providers understand the possible ramifications for patients taking these medications on other treatment modalities. Selective Serotonin Reuptake Inhibitors (SSRI's) such as- Celexa, Paxil, Lexapro, Prozac and Zoloft-are drugs designed to inhibit the reuptake of serotonin and boost its level to treat depression. Because of their unique effectiveness in depression treatment SSRI's have become the most widely used antidepressant all over the world, amongst other anti-depressants serotonin-norepinephrine reuptake inhibitors, SNRI's; tricyclic antidepressants, TCA's; atypical antidepressants and monoamine oxidase inhibitors, MAOI. Treatment with SSRIs has been associated with an increased risk of failure in osseointegrated implants. The frequency of antidepressant use is higher in patients who experienced implant failure (33.3%) compared with those who did not (11.3%).

Keywords: Depression, anti-depressants, Selective Serotonin Reuptake Inhibitors (SSRI's), osteogenic Differentiation, implant failure.

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INTRODUCTION

Increasing life expectancy of global demographical trends revealed an estimated increase in world population (Srinivasan et al 2017)[28], but as population ages, the prevalence of debilitating diseases and related intake of medications steeply increases (Collaborators, 2017)[28]. Even though implant supported rehabilitations have proven to be highly predictable over the years (Chappuis et al 2013[5]; Chappuis et al 2018[6]), systemic reviews describing the impact of disabling diseases on the predictability, have questioned the long term prognosis in such patients (Beikler and Flemming 2003; Bornstein et al 2009; Diz et al 2013; Donos and Calciolari 2014; Scully et al 2007)[28]. Such uncontrolled medical conditions often manifest at local or systemic levels and have been associated with increased risk of peri-implant tissue breakdown (Heitz-Mayfield 2009[9]; Lang et al 2011[9]; Lang et al 2004[17]; Monje et al 2017[19]).

Research proves that, these systemic diseases induce a low-grade systemic inflammatory condition associated with high levels of circulating pro-inflammatory cytokines that favor chemotaxis and activates monocytes, neutrophils and adipose tissue macrophages, which may ultimately contribute to the establishment of bone loss and peri-implant disease (Hill et al 2014[11]; Straub et al 2015[28]; Wei et al 2015[28]). In addition to uncontrolled systemic diseases itself, the systemic intake of medication such as thiazide, diuretics, beta blockers, anti-inflammatory drugs, proton pump inhibitors or serotonin reuptake inhibitors (SSRI's) have shown to further modulate bone metabolism (Abrahamsen and Vestergaard 2013[27]; Brater 1998[3]; de Vernejoul et al 2012[28]; Geusens et al 2013[28]; Haney & Warden 2008[8]; Vestergaard 2008[27]; Wiens et al 2006[28]) (Figure1). Thus a comprehensive assessment and understanding the patient's medical background is important to better understand the medication-specific side effects that influence bone metabolism (Insua, Monje, Wang & Miron 2017[12]; Kremers et al 2016[28])

ROLE OF ANTI-DEPRESSANTS IN OSSEOINTEGRATION

Depression is state of low mood that affects a person's thoughts, behavior, feelings and sense of well-being, it has become a threatening Global disease because of its high prevalence and associated public health problems (Murray and Lopez 1997[20]; Krishnan and Nestler 2008[16]). The World Health Organisation estimates more than 350 million people, worldwide suffer from depression. Evidently, anti-depressants are the second most widely prescribed medications, thus it is important that the health-care providers understand the possible ramifications for patients taking these medications on other treatment modalities.

Serotonin is a monoamine neurotransmitter in the brain that contributes to the feeling of well being and happiness (Krishnan and Nestler 2008[16]). Lower levels of serotonin or obstacles of its utilization can lead to depression (Krishnan and Nestler 2008[16]). Selective Serotonin Reuptake Inhibitors (SSRI's) such as- Celexa, Paxil, Lexapro, Prozac and Zoloft- are drugs designed to inhibit the reuptake of serotonin and boost its level to treat depression (Liu et al 1998[18]). Because of their unique effectiveness in depression treatment SSRI's have become the most widely used antidepressant all over the world (Tsapakis et al 2012[25]), amongst other anti-depressants serotonin norepinephrine reuptake inhibitors, SNRI's; tricyclic antidepressants, TCA's; atypical antidepressants and monoamine oxidase inhibitors, MAOI (Table 1).

Serotonin receptors can be found, not only in the nervous tissue but also in peripheral tissues such as, the digestive tract, blood platelets and bones; accordingly SSRI's can affect the function of the digestive, cardiovascular and skeletal system (Tsapakis et al 2012[25]). In bone metabolism serotonin regulates bone cells by signal transmission in osteoblast and osteoclast. Therefore SSRI's block bone cells resulting in a direct negative effect in bone formation (Diem et al 2007[7]; Yadav et al 2008[27]) and metabolism (Tsapakis et al 2012[25]) by increasing the osteoclast differentiation (Battaglino et al 2004[2]) and inhibiting osteoblast proliferation (Tsapakis et al 2012[25]). As a result SSRI's decrease bone mass and bone mineral density (Battaglino et al 2004[2]; Diem et al 2007[7]) at an annual deduction rate of point 0.60% to 0.93% (Diem et al 2007) increasing the risk of osteoporosis (Verdel et al 2010[26]) and osteoporotic fracture (Verdel et al 2010[26]) (Table 2).

CLASSIFICATION OF SSRI ASSOCIATED IMPLANT FAILURE

Osseointegrated implant failure is usually caused by failed osseointegration, peri-implantitis mechanical overloading or a combination of these factors (Tonetti and Schmid 1994[28]). Early failures, occurring weeks to a few months after implant placement often result from impaired healing, implant contamination or lack of mechanical stability. Late failures are frequently caused by peri-implantitis mainly occurring after 2 year follow-up, the failures caused by mechanical overloading usually occur after the loading time of 4 to 6 months.

Implants placed in SSRI users had favorable primary stability (torque:29.6NCm), acceptable bone quality and quantity, appropriate implant dimensions and good early healing, therefore the main reason causing implant failure by SSRI's was probably associated with problems in the mechanical loading of the implants. This is in agreement with previous in vivo studies demonstrating that serotonin plays an important role in the anabolic response of bone to mechanical loading (Sibilia et al 2013[24]). Wu et al 2014, indicate that SSRI's might cause bone mass loss by inhibiting the bone remodeling process triggered by mechanical loading. Accordingly, SSRI's might also be impairing bone remodeling around functional implants (Wu et al 2014[28]). SSRI's play a pivotal role on the osteoblast and osteoclast balance. As such, serotonin can regulate osteoclast activation and differentiation as osteoclasts derive from hematopoietic cell precursors (Battalino et al 200[42]). The activity of serotonin transporter and receptor is present in bone. Consequently SSRI's have demonstrated to have detrimental effect on bone mineral density and trabecular micro-architecture through their anti-anabolic skeletal effect (Kahl et al 2006[14]). Thus, it might be hypothesized to negatively influence the process of osseointegration.

MECHANISM OF ACTION

Osteocytes play a crucial role in bone turnover process, such as osseo- integration and are a major source of receptor activator of nuclear factor-kappaB Ligand in bone (O'Brien, Nakashima & Takayanagi 2013[22]), which is required for osteoclast differentiation and activation (Kong et al 1999[15]). Hence in case of medication induced destruction of osteocyte metabolic activities, adequate peri-implant bone remodeling in early stages of healing may be jeopardized. Furthermore the action of serum serotonin reuptake inhibitors (SSRI's) on certain receptors and serotonin transporters such as 5-HT1B, 5-HT2B OR H-T2C, may result in a direct detrimental effect on bone metabolism by increasing osteoclast differentiation which negatively impact the process of osseointegration.

REVIEW OF LITERATURE

A recent breakthrough at the University at Buffalo (UB), School of Dental Medicine. found a correlation between the use of SSRIs and increased risk of osseointegrated implant failure. The retrospective study analyzed 74 patients (41 women) who were 18 and older and received dental implants at the UB dental clinic between January 2014 and August 2014. The number of implants received per patient ranged between one and 11. The average implant failure rate is 5%. The study examined 490 patients (with a total of 916 dental implants) who were treated with dental implants between January 2007 and January 2013, 51 of which were using SSRIs. Out of the 94 implants on these 51 SSRI users, 10 implants failed, as opposed to 38 dental implants out of the group of 784 nonusers. In the end, the failure rates for SSRI non-users came to 4.6%, while SSRI users had a failure rate of 10.6%. The study concluded that treatment with SSRIs was associated with an increased risk of failure in osseointegrated implants. The frequency of antidepressant use was higher in patients who experienced implant failure (33.3%) compared with those who did not (11.3%).

The odds of implant failure among antidepressant drug users were about four times higher compared with controls (odds ratio [OR] = 3.93, 95% confidence interval [CI]: 0.61-25.51). Each year of antidepressant use was associated with a twofold increase in the odds of implant failure (OR=2.18, 95% CI: 0.68-7.02). Though the frequency of depression itself was not associated with implant failure.

In another preclinical in-Vivo study, the effect of SSRI's on osteoblast differentiation and bone regeneration in rats elucidated that SSRI medication significantly reduces osteogenic differentiation and mineralization with concomitant reduction of osteoblast marker genes including Alkaline phosphatase, Osterix and osteocalcin, indicating its putative impact on the regulation on bone metabolism (Nem et al 2016[27]). Hence, such cellular findings would be in concordance with the results obtained by Wu et al, 2014[28], who demonstrated that patients in taking SSRI's experience an increased risk of implant failures.

Researchers from McGill University in Montreal, Quebec, Canada, and East Coast Oral Surgery in Moncton, New Brunswick, Canada, who conducted a retrospective cohort study of patients treated with dental implants. The researchers examined records from 490 patients who received a total of 916 implants from January 2007 to January 2013. Eight hundred twenty-two of these implants were placed in 440 patients who did not use SSRIs, and 94 implants were placed in 50 patients who used SSRIs. After three to 67 month's follow up, it was found that 38 of 822 implants in the nonusers group had failed, for a failure rate of 4.6 percent. In the users group, 10 of 94 implants had failed, for a failure rate of 10.6 percent.

It was concluded that the frequency of antidepressant use was higher in patients who had failure33 percent, versus 11 percent in patients who did not take antidepressants and each year of antidepressant use was associated with twice the increased odds of implant failure(Verdel et al 2010[26]).

Another interesting study conducted a comparison of the type of antidepressants ;selective serotonin reuptake inhibitors, SSRI's, serotonin-norepinephrine reuptake inhibitors, SNRI's; tricyclic antidepressants,TCA's; atypical antidepressants and monoamine oxidase inhibitors, MAOI. Significant higher implant failure rates were observed in subjects were antidepressant users, while SNRI antidepressant users showed the highest implant failure among all the types of antidepressants. SSRI, SNRI, TCA antidepressants suppressed osteogenic differenciation while MAOI antidepressant stimulated there osteogenic differentiation (Table 3).

CONCLUSION

The odds of implant failure among antidepressant drug users, after mechanical loading, were about four times higher compared with controls. Each year of antidepressant use was associated with a twofold increase in the odds of implant failure. The effect of SSRI's on osteoblast differentiation and bone regeneration in rats elucidated that, SSRI medication significantly reduces osteogenic differentiation and mineralization with concomitant reduction of osteoblast marker genes including Alkaline phosphatase, Osterix and osteocalcin, indicating its putative impact on the regulation on bone metabolism.

A comparison of the type of antidepressants ;selective serotonin reuptake inhibitors, SSRI's, serotonin-norepinephrine reuptake inhibitors, SNRI's; tricyclic antidepressants,TCA's; atypical antidepressants and monoamine oxidase inhibitors, MAOI. Significant higher implant failure rates were observed in antidepressant users, while SNRI antidepressant users showed the highest implant failure among all the types of antidepressants. SSRI, SNRI, TCA antidepressants suppressed osteogenic differenciation while MAOI antidepressant stimulated there osteogenic differentiation.

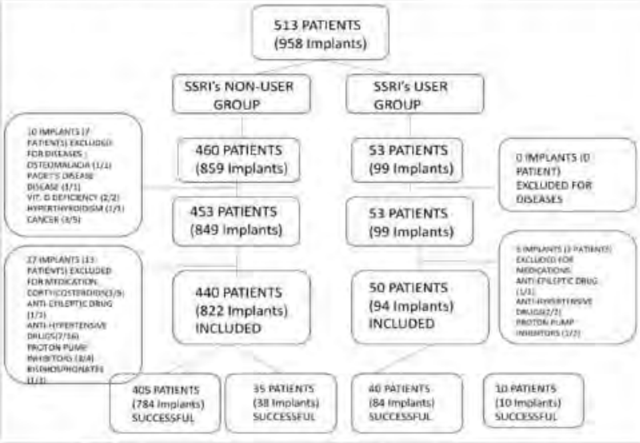

Fig 1: Systemic diseases and their impact on success or failures of dental implants.

Table 1:- Distribution of antidepressant prescription among the dental implant patients

Antidepressants	Brand & generic name	Prescription number
SSRI group (n=51)	Zoloft (Sertraline)	16 (14.9%)
	Celexa (Citalopram)	15 (14%)
	Prozac (fluoxetine)	7 (6.5%)
	Paxil (Paroxetine)	7 (6.5%)
	Lexapro (escitalopram)	6 (5.6%)
SNRI group (n=22)	*Effexor (Venlafaxine)*	*15 (14%)*
	Cymbalta (Duloxetine)	6 (5.6%)
	Pristiq (Desvenlafaxine)	1 (0.9%)
Atypical group (n=28)	Welbutrin (Bupropion)	19 (17.7%)
	Desyrel (Trazodone)	7 (6.5%)
	Remeron (Mirtazapine)	2 (1.8%)
TCA group (n=5)	Elavil (Amitriptyline)	5(4.6%)
MAO group (n=1)	Nardil (Phenelzine)	1(0.9%)

Table 2:- Effect of antidepressant users and healthy non-users on dental implant bone resorption and implant failure

		No failure	Failure	Failing	Total	Failure rate (%)	Failing rate (%)
Healthy		591	8	2	599	1.34	0.33
Antidepressants (ADs)		176	21	22	197	10.71	11.22
Types of ADs	*SSRIs*	105	3	2	*108*	2.78	1.85
	SNRIs	44	12	9	*56*	21.43	16.07
	TCAs	25	1	5	*26*	3.85	19.23
	MAOIs	2	0	0	*2*	0	0
	AAs	49	5	6	*54*	9.26	11.11
Systemic Disease		1162	35	0	1197	2.92	0

Table 3:- Dental implant failure association between antidepressant users vs. nonusers of antidepressants

	Failure	No failure	Total	Failure rate (%)	Risk ratio	Odd (95% CI)	P value (<0.05)	SD of dental implant failure (%)
No AD user*	43	1753	1796	2.39420935		1		0.706397
AD user	21	175	196	10.7142857	4.47508306	4.89 (4.35-5.44)	yes	4.330127
SSRIs	3	105	108	2.77777778	1.16020672	1.17 (-0.02-2.35)	no	3.099386
SNRIs	12	44	56	21.4285714	8.95016611	11.12 (10.41-11.82)	yes	10.74709
TCAs	1	25	26	3.84615385	1.60644007	1.63 (-0.39-3.65)	no	7.39207
MAOIs	0	2	2	0	0	0	no	0
AAs	5	49	54	9.25925926	3.86735573	4.16 (3.19-5.13)	yes	7.731228
Total	64	1928	1992	3.21285141				

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MULTI DISCIPLINARY TREATMENT OF NON - SYNDROMIC OLIGODONTIA : WITH IMPLANTS AND ORTHODONTICS

ABSTRACT

Restoration of occlusion in patients with missing dentition is a challenging situation as every case is unique in itself . There is a great apprehension involved in reconstructing deblitiated dentition due to widely divergent views concerning the choice of an appropriate occlusal scheme for successful full mouth rehabilitation.

This article will cover various concepts/philosophies used in a full mouth rehabilitation which will help the clinicians to select an appropriate occlusal scheme for individual cases.

Keywords: Oligodontia, severe hypodontia, non-syndromic autosomal-recessive-linked oligodontia, prosthetic therapy, pre-prosthetic orthodontic therapy, block bone graft, implants.

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INTRODUCTION

Dental agenesis and malformations are the most common human developmental anomalies causing significant esthetic and functional deficiency. It is classified based on the number of missing permanent teeth excluding the third molars. According to the 1996 consensus conference on oral implants in young patients, "Hypodontia" is defined as the congenital agenesis of one to five permanent teeth.[1] Schalk-van der Weide et al.[2] in their research defined "oligodontia" as the congenital absence of six or more permanent teeth, excluding the third molars. It is synonymously known as partial anodontia, selective tooth agenesis, multiple aplasia, or severe/advanced hypodontia. "Anodontia" refers to the congenital absence of all the deciduous and/or permanent teeth.

Oligodontia can be classified as an isolated non-syndromic oligodontia or those associated with a syndrome. Most frequently associated syndromes are hypohidrotic ectodermal dysplasia , Down syndrome, Wolf-Hirschhorn syndrome,[3] Van der Woude or lip-pit syndrome, ectodactyly-ectodermal dysplasiacleft lip/palate syndrome, Fried syndrome, Book syndrome, Rieger's syndrome, oto-palato-digital syndrome, Witkop's tooth-nail syndrome, oro-facial-digital syndrome Type I,[3,4] oculo-facial-cardio-dental syndrome, incontinentia pigment (Bloch-Sulzberger syndrome),[4] and holoprosencephaly.[4] Patients with associated systemic syndromes are diagnosed with having oligodontia-S.[5] When it occurs as a part of a syndrome, there are usually concomitant abnormalities in the skin, nails, eyes, ears, or skeleton. It is characterized by the congenital absence of the third molars (more frequently) followed by mandibular second premolar, maxillary lateral incisors, and maxillary second premolar. This pattern in which the teeth are missing is influenced by the gene affected and the type of mutation that occurs within a gene.

Complete congenital absence of dental follicles is considered to be the pathognomonic feature for oligodontia. Moreover, it is inherited as an autosomal dominant trait which is considered to be associated with the mutations of muscle segment homeobox 1 and paired box 9 (PAX9) genes.[4-7] All mutations of PAX9 identified till date have been associated with non-syndromic form of tooth agenesis.[7]

It has a wide variety of clinical manifestations. Residual teeth can vary in size, shape, form, rate of development and eruption. It is associated with the growth disturbances of maxillofacial skeleton resulting in the change of facial appearance. Thus, it affects the esthetics, function, and psychology of the patient, especially when the anterior teeth are missing. Thus, diagnosis and comprehensive management of oligodontia is a significant challenge to the clinicians.

The main aim of the present case was to recreate esthetic and functional rehabilitation .

Thus, the purpose of this article is to report a rare case of non-syndromic oligodontia where an esthetic and functional rehabilitation was achieved through orthodontic, surgical and prosthodontic intervention.

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CASE REPORT

A 24 year old male patient reported to the clinic for correction of unaesthetic facial appearance and spacing between upper front teeth. Complete medical and dental history was recorded along with radiographs and photographs. General examination revealed no other significant anomaly suggestive of any syndrome.

Fig 1 & Fig 2: Pre-operative extraoral photograph

Fig 3A: Pre-treatment right lateral view of teeth in occlusion

Fig 3B: Pre-treatment left lateral view of teeth in occlusion

Fig 4A: Pre-operative intra oral view of maxillary arch

Fig 4B: Pre-operative intra oral view of mandibular arch

Fig 5: Pre-operative frontal view of teeth in occlusion

Extraoral examination in frontal and lateral plane revealed a straight profile, competent lips, deep mentolabialsulcus.

Intraoral examination revealed that 8 permanent teeth were congenitally missing. The missing teeth included 12,14,15,35, 22,24,25 and 45. FIG 3&4. There were 4 retained deciduous teeth presenti.e55,65,75,85. Molar relation was class II on right side and class I on the left side respectively along with deepbite and 8mm of overjet. Study models and radiographs were recorded for the same.

Diagnostic records included study models, OPG, photographs. OPG substantiated clinical findings. FIG (6)

Fig 6: Orthopantomograph

Treatment Phase

Consisted of pre prosthetic orthodontics with following aims and objectives.

1 Space gaining in relation with anterior teeth.
2 Extraction of retained teeth 55, 65, 75, 85.
3 Correction of jaw relation by correcting the deep bite.
4 Rehabilitation of missing teeth with dental implants.

Orthodontic therapy was started after the accomplishment of a thorough oral prophylaxis. MBT brackets were bonded in upper and lower dentition. Initial alignment was achieved using 0.016 inch Niti wire. FIG 7A&B

Fig 7 A & B: Orthodontic treatment phase

After orthodontic phase of therapy was accomplished, retained deciduous teeth were extracted and implants were placed in the missing dentition region to improve mastication and appearance. Prosthodontic therapy was introduced to establish the lost vertical dimension.

Fig 8: Implant placement with respect to missing teeth

Since the bone quality and width at 12and22 was poor (FIG 9 A & B); therefore, horizontal ridge augmentation with onlay graft was planned to reconstruct adequate bone volume allowing proper implant placement, using bone harvested from the mandibular symphysis region. Bone block graft was fixed with titanium osteosynthesis screws after exposure of the deficient buccal bone region (FIG 10). Six months after surgery, screws were removed and dental implants insertion was performed in 12,14,15,22,24,25,35 and 45 region respectively under local anesthesia.

Two-staged method was used for implant placement, providing a 12-week period between two stages. Total of Eight implants were placed in the maxilla and mandible respectively. All implants were placed with their neck leveled with the crestal bone. The implant insertion torque value was approximately 45-50 N/cm for all fixtures.

Fig 9A: Knife edge ridge is well appreciated

Fig 9B: Flap raised in 22 region

Fig 10: Deficient buccal bone guttering of block bone graft could be seen

Fig 11A: Flap raised from symphysis bone region

Fig 11B: Block bone graft from symphysis region

Fig 12: Harvesting of block bone graft

In the mean time of 12 weeks comprehensive orthodontic treatment with Class II elastics and MBT brackets were used and space was gained. Twelve weeks after insertion, implant stability was verified and final impressions were taken. Definitive impression of the implants was made with a regular-viscosity polyester in a custom impression tray. Master casts were fabricated. Abutment selection was performed on the master cast, and superstructures were fabricated according to the diagnostic set-up. On account of the poor bone quality a conventional loading protocol was applied, allowing 12 weeks before delivery of the final implant-retained restorations. During this period, provisional removable prosthesis was installed over the implants. Screw-retained metal ceramic FPDs were fabricated with an occlusal scheme that provided simultaneous contact in maximal intercuspation and group function articulation. At delivery, abutment screws and superstructure screws were tightened with controlled torque (35 and 15 N/cm2, respectively), and a clinical remount was done to refine the occlusion. The access holes were filled with a light-cured composite resin. Oral hygiene instructions were provided to the patient. After tightening the retaining screws with the recommended torque, periapical radiographs were taken for the examination. One week later, the occlusion was re-adjusted and screw access holes were filled with the flowable resin.

Fig 13: Frontal view of the patient

Fig 14: Frontal view of teeth in occlusion

Fig 15A: Intra oral view of maxillary arch

Fig 15B: Intra oral view of mandibular arch

Fig 16A: Right lateral view of teeth in occlusion

Fig 16B: Left lateral view of teeth in occlusion

Fig 17: Post operative OPG showing implant placement with indirect sinus lift done in 15 and 25 region

CONCLUSION

Ridge augmentation with block bone graft turned out as a successful procedure as it is a necessity in many cases which present in clinical practice to facilitate adequate bone volume for implant procedure. The block bone grafting techniques described here has a predictable and efficient outcome .

After successful orthodontic treatment in case of oligodontia, Class I canine relationship was achieved though class II molar relationship could not be achieved. The desired goal was achieved by choosing the right treatment plan after addressing the chief concerns and desires of the patient. Our approach was a biologic and functional one, with the masticatory unit being considered as a functional, consolidated unit. All functional factors are interrelated, and in reconstructive prosthesis, proper regard for each aspect is essential if the restoration and maintenance of the health of the entire functioning organ are to be realized as Dentistry is a multi-speciality branch and such complex cases can be handled by proper treatment plan and intervention of all orthodontic and prosthetic surgery. The clinical report we have presented is a typical example of the required multidisciplinary treatment planning concepts necessary for successful rehabilitation of the patient.

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WARMED 5th GENERATION PRP AS A DERMAL FILLER FOR FACIAL REJUVENATION

ABSTRACT

Patients are increasingly seeking improvement in their facial esthetics to reverse the aging process that results in decrease in collagen leading to sagging skin, deeper creases and volume loss in the facial areas. The dentist may be the first healthcare provider that interacts with those patients who express unhappiness with facial aging during routine appointments or during treatment planning for dental treatment. Facial esthetic improvement can also enhance smile esthetics and improving the overall dental results esthetically. Usage of patient derived blood products as cosmetic fillers adds fibroblasts, stem cells and growth factors without the potential of allergic reactions reported with commercial products and at lower cost. This article will review a newer centrifugation process using the 5G protocol and how to create a plasma gel to be used to improve facial esthetics.

Keywords: Platelet Rich Plasma, PRP, facial esthetics, dermal filler, plasma gel, warmed PRP

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INTRODUCTION

Individual perception determines ones perception of beauty and cultural aspects as well as pressure from the media and society, including their peer groups affect ones self perceived attractiveness. In recent years contemporary aesthetics has undergone a paradigm shift in terms of social trends and patient requests. Beauty standards today are based on individuals in their twenties irrespective of the patients actual age.[1-3] Today's standard of beauty includes; higher more prominent cheeks, softer, more oval facial shapes and fuller lips.[4] While those cosmetic results might be fashionable in younger patients, most older females will likely seek more subtle improvements in their appearance focusing on health, vitality, and well-being.

Aging plays a factor in facial aesthetics related to loss of volume of tissue collagen combined with a decrease in tissue elasticity. This leads to deepening of facial creases and an increase in sagging skin and. These results are patient dependent, presenting in some individuals as more rapid appearing aging. These changes lead patients a desire to "turn back the hands of time" improving their facial aesthetics. One of the first signs of aging is thinning of the skin, specifically around the eyes, especially the area of the lower eyes. The result is the presentation of darkening of the skin in comparison to the adjacent areas or "bags" under the eyes related to both a decrease in the skins elasticity and a loss of volume under the skin. Additionally, aging signs include; cheek sagging leading to deepening of the facial folds, thinner lips resulting from loss of elasticity of the lips, forehead and frown lines between the eyebrows and creases at the corners of the eyes (crows feet). (Figure 1)

Improvement of facial aesthetics demand continues to increase both to correct what mother nature has provided and reverse the aging process. To meet these patient demands for facial rejuvenation and improvement to their facial aesthetics various commercial products have been in wide usage, thes include hyaluronic acid (HA) fillers, such as Restylane and Juvederm as well as calcium hydroxyl apatite products (Radiesse) or collagen based products. Hyaluronic acid[5,6] and calcium hydroxyl apatite fillers[7,8,] essentially are volume replacers designed to plump out the skin to replace lost collagen and eliminate the wrinkles by stretching the overlying skin. These products typically last 6 months before additional product needs to be placed to return to the volume that was initially achieved. There have been claims that these products stimulate collagen production, but the literature has scant references to support this contention.[9] Collagen based dermafill products have been widely used. Yet, are falling out of favor due to the shorter period they typically last once injected with service expectancy of 3-6 months before volume reduction requires additional material be injected.[10]

In recent years, utilization of autologous blood concentrates, such as platelet rich plasma (PRP), has expanded into use for facial aesthetic rejuvenation. As these products are derived from that individual patient blood, allergic reactions issues that may be encountered with commercial dermafill products are eliminated. Additionally, product cost per patient is greatly diminished making this a treatment a more affordable option for patients. Since the injected material contains the patients own fibroblasts, collagen and growth factors they are able to stimulate localized changes replacing those cells lost related to aging. The result, longer lasting effects reversing the aging process.[11-13] PRP injections for facial aesthetic improvement has reported biostimulation related to the growth factors and fibroblasts contained in the prepared material.[14-16] Those reported effects are cumulative, with increasing biostimulation with subsequent injections. Those effects last approximately 12 months after the first placement before decreases in volume are noted that will require additional injections.

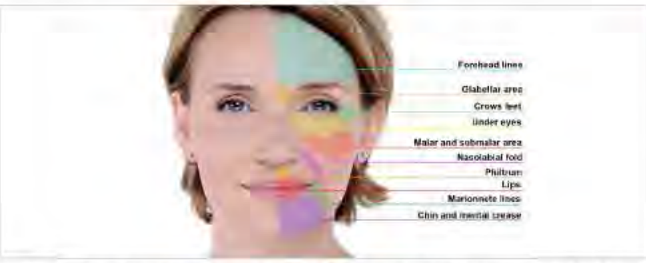

Fig 1: Facial areas that are treatable to with PRP to improve esthetics

Fabrication of PRP gel for facial aesthetics (The 5G Protocol):

Liquid PRP, has the factors desired for tissue biostimulation, in its fluid form, use for facial aesthetics is not ideal as it does not stay where injected dispersing laterally quickly. Conversion of the material into a thicker product in the form of an injectable gel allows better tissue bulking. retaining at the site after placement better than a liquid form.

Initiation of preparation of the platelet-rich-plasma begins with phlebotomy at the appointment that PRP will be utilized. The blood that is drawn is centrifuged to separate the hematological components. Centrifugation process using a single "spin" protocol that has been in wide use for all autologous blood concentrates, referred to as a 3rd generation protocol. To increase the benefits, the resulting products has been modified as a 5th generation (5G) protocol. The 5G protocol is a two "spin" protocol (centrifuged twice) resulting in an increase in platelets and growth factors present in the PRP which results in greater biostimulation at the placement site.

Blood is collected in six (6) 10 ml vacuum-loaded tubes with the addition of 10% sodium citrate as an anticoagulant (BD Vacutainer ® yellow cap) (Becton, Dickinson and Company, Franklin Lakes, NJ). Those tubes are immediately centrifuged in a conventional centrifuge, rotated at a centrifugal force of 150 RCF (relative centrifugal force) for 15 minutes. (Figure 2) The result is, red blood cells end up in the lower portion of the tube and a yellow portion containing plasma and platelets with a thin layer of leukocytes present between the two layers.

The yellow portion in the tubes is withdrawn with a syringe and placed into dry tubes, with no additives present in the tubes. These tubes are then centrifuged for 10 minutes at 300 RCF (2nd spin). (Figure 3) This results in the platelets accumulation at the bottom of the tube and plasma remaining above it in the tubes. Next, 50% of the yellow plasma is removed from the dry tubes with a syringe, this is the concentrated PRP plasma. (Figure 4) The stopper is replaced on the dry tubes and gently shaking the tubes resuspend the platelets in the remaining plasma. (Figure 5) This is then drawn from the tube via a syringe and the syringe is placed into a syringe warmer set at 75° C for 8 minutes (Figure 6) to obtain the fibrin albumin gel (also referred to as Plasma gel). (Figure 7)

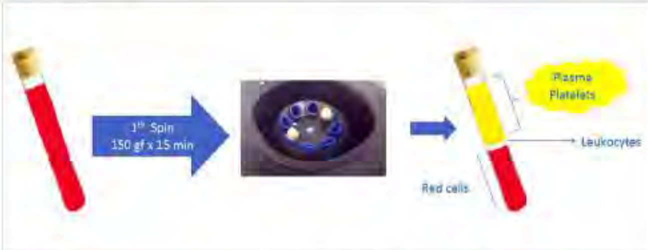

Fig 2: 5th generation preparation of PRP gel, step 1, blood in the tube is centrifuged for 15 minutes at 150 gf to create separation of the layers with plasma at the top (yellow layer) and RBC at the bottom.

Fig 3: 5th Generation preparation of PRP gel, step 2, the yellow plasma layer is withdrawn in a syringe and placed in a new tube and centrifuged for 10 minutes at 300 gf.

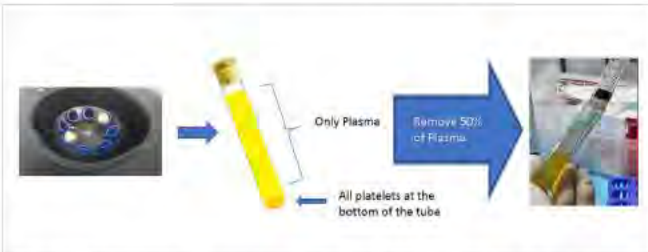

Fig 4: 5th Generation preparation of PRP gel, step 3, 50% of the plasma is withdrawn from the tube with a syringe.

Fig 5: 5th Generation preparation of PRP gel, step 4, what remained in the tube (plasma and platelets) is gently shaken to resuspend the platelets.

Fig 6: The syringe of withdrawn plasma is placed into the syringe warmer.

Fig 7: Syringes ready for preparation of the PRP Gel ready to use for facial placement (warmed plasma gel also referred to as fibrin albumin gel on left, PRP concentrated plasma on right)

Fig 9: When the Plasma gel and PRP concentrated have been completely mixed they will have a uniform appearance in the syringe and is ready for facial placement. This is a PRP Plasma Gel.

PRP gel utilization

After removal from the syringe warmer, the Plasma gel is too thick to use as is and is mixed with concentrated PRP plasma to improve injectability. The ratio of warmed fibrin albumin gel to PRP concentrated plasma relates to which facial area will be treated. When greater volume desired, a higher ratio of fibrin albumin gel to PRP plasma is required and a 1:1 ratio is desired. Larger volume areas such as the chin, jaw line and submalar area require the use of a 1:1 ratio. Facial folds and deep wrinkles found at the nasal labial folds, mental crease, marionette lines, forehead and gabella require less volume, with a 1:2 ratio being recommended. Although a volume increase is being sought for the lips, a 1:2 ratio is used to treat that area. Shallow wrinkles and when smoothing the area is desired typically found with crows feet or under the eyes, a 1:3 ration is utilized.

A syringe connector (Becton, Dickinson and Company) is attached to the fibrin albumin gel syringe to achieve the desired ratio and the syringe of concentrated PRP plasma to which the volume has been adjusted to match the desired ratio is connected to the other end of the syringe connector. (Figure 8) The plunger on the fibrin albumin gel syringe is depressed to transfer gel into the PRP plasma syringe. The PRP plasma syringe contents are expressed back into the fibrin albumin gel syringe. The process is repeated, back and forth until the two materials are completely mixed to yield a uniform gel. (Figure 9) As neither syringe will hold the full volume of both syringes, several passes back and forth are needed to completely mix the two contents with the end result being PRP gel in both syringes. The resulting material is referred to as PRP gel.

Fig 8: The material is sequentially pumped from one syringe to the other syringe to mix the two materials.

Each syringe has a needle placed on it and is ready to use for facial aesthetic treatment. The authors recommend labeling the syringes with the ratio, as multiple areas of the face will be treated at the appointment. This aids in the practitioner placing the correct ratio in each area during treatment with no syringe mix up.

Aesthetic facial treatment with PRP gel:

Following creation of the PRP gel treatment will require proper anesthesia application to minimize patient discomfort and optimize desired outcome.[17,18] Local anesthetic (2% Lidocaine with 1:200,000 epi or an equivalent) can be applied in the areas being treated. This is recommended when treating the lips, philtrum, nasolabial folds, mental area, glabella or marionette lines are these are vascular areas which have significant neural innervation. Topical anesthetic alone may be used in less vascular such as when treating crows' feet, under the eyes or in combination with local anesthetic. An effective topical can be formulated by a pharmacy from a mixture of Benzocaine 20%, Lidocaine 8% and Tetracaine 4% (BLT) providing a powerful, fast-acting topical anesthetic that is effective 15 minutes after application.

CASE REPORT

A female patient presented with a desire for facial aesthetics improvement, indicating she was unhappy about her thin lips, deep crease at the nasolabial folds and bags under her eyes. (Figure 10) Following examination, treatment recommended consisted of placement of PRP gel to widen the lips giving them a fuller appearance, make the philtrum more distinct,, fill in the nasolabial fold and eliminate the bags and dark areas under the eyes. Anesthetic was applied using topical anesthetic application followed by local anesthetic injections.

The PRP gel syringe needle was inserted into the philtrum on the right paralleling the philtrum with needle placement to just below the nostril. (Figure 11) As the syringe was slowly withdrawn PRP gel was expressed backfilling the area. This was repeated at the left philtrum making the area more distinct and prominent. Next, PRP gel was injected into the nasolabial fold on each side, filling the area at the crease to make that less distinct. (Figure 12).

Lip treatment was initiated requiring injections in several places to enhance that area. The upper and lower lips were treated by placement of PRP gel on the right side, left side and completed with filler placed in the center area of the lip. Needle placement is midway between the vermillion boarder and portion of the upper lip that contacts the lower lips with the needle path directed at the corner of the mouth on the right side with initial tissue entry adjacent to the lateral incisor/canine. (Figure 13) The closer to the oral cavity the needle path is placed the greater the resulting lip enhancement will result rolling the lip exteriorly, making the visible lip wider. Once the tip of the needle is positioned at the corner of the mouth, as the needle is slowly withdrawn, PRP gel is expressed. This process is repeated on the left side of the upper lip to. Next, the needle enters the upper lip midway between the vermillion boarder and contact with the lower lip at the same point as was used for the corner of the mouth but directed towards the midline. (Figure 14) PRP gel is expressed as the needle is withdrawn and the process is repeated on the opposite side of the upper lip to complete enhancement of the upper lip. The process is repeated on the lower lip starting with the lateral aspects of the lip (Figure 15, 16) and completed with the center of the lip (Figure 17)

The dark areas under the eyes and bags, were addressed next with injection of PRP gel to gain volume under the eyes, thickening the tissue eliminating the darkness and drooping of the skin. Care should be taken to avoid contact with the infraorbital foramen and the nerve it contains. Additionally, with proximity to the eye, care should be taken with position of the tip of needle in relation to the eyeball. Immediate results present in a more youthful appearance with fuller lips and elimination of the nasolabial creases and dark eye bags. (Figure 18)


Fig 14: Additional PRP dermal filler is placed to plump the area of the lip below the philtrum


Fig 15: The process is repeated on the lower lip placing PRP dermal filler from the corner of the mouth to the canine area of the lip


Fig 16: The lips next receive PRP dermal filler at the center portion of the lower lip to enlarge it.


Fig 17: PRP dermal filler is placed into the are under the eyes to fill the area that due to collagen loss and decrease in skin elasticity had lead to eye bages


Fig 10: Patient presented with desire to eliminate the bags under her eyes and improve her lips and definition of the philtrum area


Fig 11: Warmed PRP filler is injected into the philtrum bilaterally to make it more defined


Fig 18: Patient immediately following PRP dermal filler placement, demonstrating fuller lips with more defined philtrum and eliminate of the eye bags


Fig 12: Warmed PRP filler is injected into the nasolabial fold to eliminate the deep crease


Fig 13: Lip enhancement of the upper lip begins with placement of PRP dermal filler at the lateral aspect of the lip from the corner of the mouth to the philtrum.

CONCLUSION

Utilizing the 5G protocol, warmed PRP gel is a practical alternative to use of commercial dermafillers and may be used in place of Botox in some facial areas. Since, PRP gel is fabricated from the patients own blood, the potential for allergenic reactions that have been reported in some instances with commercial products is prevented. Concentrated growth factors, platelets and fibrin enhances rejuvenation of the tissue replacing those localized factors lost to aging. Additionally, treatment cost is reduced compared to use of commercially available dermafillers potentially making treatment affordable for a broader spectrum of patients.

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CURRENT TRENDS IN IMMEDIATE IMPLANT LOADING - A REVIEW

ABSTRACT

Loss of a tooth or teeth can be a traumatic experience for anyone. Following the loss of one or more teeth some patients may suffer real or perceived detrimental effects. Early loading has become more common with immediate implant placement after extraction of tooth. This article discusses in brief about the immediate loading of dental implants, its indications, contraindications, advantages, disadvantages and various aspects that can influence the prognosis of the treatment.

Keywords: Dental implants, immediate implant, immediate loading.

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INTRODUCTION

A healthy oral cavity is very important to maintain proper mastication, digestion, phonation, appearance, and psychological well-being. The loss of one or more teeth reason may adversely affect the oral health with an affected appearance being the most serious consequence for the patient and primary reason for seeking prosthodontic treatment.

Following the loss of one or more teeth some patients may suffer real or perceived detrimental effects. Tooth loss affects many attributes such as lack of confidence, avoidance of laughing in public, reluctance to form close relationship, especially when anterior teeth are missing.

Replacing a missing tooth or teeth can be achieved by either a removable dental prosthesis, fixed dental prosthesis or a dental implant. Each alternative has its own benefits and shortcomings. It is important to consider the patient's financial, medical, and emotional condition for the best treatment.

The goal of modern dentistry is to restore normal contour, function, comfort, esthetics, speech and health, regardless of the atrophy, disease, or injury of the stomatoganthic system. Dental implants are best suited to address all these problems.

A dental implant preserves the gingival mucosa and bone with no damage to adjacent teeth. Conventional procedure for an implant placement involves the extraction of the affected tooth, waiting 2–4 months for the extraction socket to heal, followed by insertion of the implant, and again waiting for 3–6 months for integration of implant with surrounding bone; after this it mandates a second surgery to expose the implant and to restore. Thus the patient has to wait 8-12 months for him to receive a restoration after the placement of an implant. Due to this shortcoming of the conventional technique, strategies were developed to substantially shorten the entire treatment by placement of implant immediately after extraction of tooth followed by immediate loading of implant with prosthesis.

CLASSIFICATION OF IMPLANT LOADING PROTOCOLS

Misch et al.[1], in 2004, offered several classifications of implant loading:

- **Immediate occlusal loading:** full functional occlusal loading of an implant within 2 weeks of placement.
- **Early occlusal loading:** functional loading between 2 weeks and 3 months of implant placement.
- **Nonfunctional immediate restoration:** implant prostheses placed within 2 weeks of implant placement with no direct functional occlusal loading.
- **Nonfunctional early restoration:** implant prostheses delivered between 2 weeks and 3 months from implant placement.
- **Delayed occlusal loading:** the restoration of an implant more than 3 months after placement.

Esposito et al.[2] in 2013 defined 3 protocols for implant load timing:

- Immediate loading implants (ILI): within 1 week from implant placement.
- Early loading implants (ELI): between 1 week and 2 months.
- Conventional loading implants (CLI): after 2 months from implant placement.

Two subclassifications point out the different loading modality:

- **Occlusal loading or Non-Occlusal loading.**
- **Direct loading or Progressive loading.**

German Gallucci et al[3] in 2018 gave a classification combining placement and loading protocols in oral implantology as follows:

- Type 1A: Immediate Placement + Immediate Restoration/Loading.
- Type 1B: Immediate Placement + Early Loading.
- Type 1C: Immediate Placement + Conventional Loading.
- Type 2A: Early Placement with Soft Tissue Healing + Immediate Restoration/Loading.
- Type 2B: Early placement with Soft Tissue Healing + Early Loading.
- Type 2C: Early Placement with Soft Tissue Healing + Conventional Loading.
- Type 3A: Early Placement with Partial Bone Healing + Immediate Restoration/Loading.
- Type 3B: Early placement with Partial Bone Healing + Early Loading.
- Type 3C: Early Placement with Partial Bone Healing + Conventional Loading.
- Type 4A: Late Placement + Immediate Restoration/Loading.
- Type 4B: Late Placement + Early Loading.
- Type 4C: Late Placement + Conventional Loading.

In the late 1960s, Branemark introduced the concept of osseointegration whereby predictable long-term implant function could be achieved following a strict protocol. This involved placement of titanium implants involving a healing phase of between 3 to 6 months depending on the bone quality, followed by a delayed phase of prosthetic loading on cross-arch fixed prostheses in the edentulous jaws.

Immediate loading, otherwise known as Immediate Function, involves Placement of a restoration within 48 hours of implant placement. The technique was developed to meet the patients growing demand for quicker treatment and faster time-to-teeth. Ledermann was the first to document successful healing of immediately loaded implants, which were placed in the anterior part of the mandible. The provisional should be taken out of occlusion or the patient should be instructed to follow a soft diet to avoid loading a restoration.

Misch developed a progressive implant loading protocol which was recommended for implants that have been placed in soft bone or grafted sites. After the osseointegration period, the implant is exposed and progressively loaded to avoid overloading while simultaneously increasing bone density. Implant if loaded within physiological limits it can enhance bone formation and increase bone density.

INDICATIONS

- Adequate bone quality (D1, D2, D3 bone).
- Sufficient bone height (i.e. approximately 12mm).
- Sufficient bone width (i.e. approximately 6 mm).
- Adequate oral hygiene.
- Good dexterity for oral hygiene maintenance.

CONTRAINDICATIONS

- Poor systemic health
- Smoking
- History of radiation therapy
- Adjacent to teeth with periapical radiolucencies
- Severe parafunctional habits.
- Bone of poor quality
- Bone height less than 12 mm
- Bone width less than 6 mm
- Inability to achieve an adequate AP spread

ADVANTAGES

- Eliminates the use of a removable provisional prosthesis.
- Provides emotional benefit for a patient scheduled to be rendered edentulous.
- Improves bone healing.
- Facilitates soft tissue shaping.
- Premature implant exposure is avoided which is often associated with wearing of a removable denture during the healing period.

DISADVANTAGES

- Risk of crestal bone loss or implant failure from micro movement of the implant which is avoided in two stage procedure.
- Trauma and crestal bone loss may occur due to parafunction from tongue or foreign bodies (Pen biting).
- Great crestal stress contours may occur from too soft bone, small implant diameters or implant designs with less surface area, and may lead to bone loss or implant failure.
- Adjuvant bone loss may occur if immediate loading leads to failure of the implants.

FACTORS INFLUENCING IMMEDIATE LOADING IN IMPLANTS

There are various factors that need to be taken into account before deciding to load an implant immediately. These factors being **primary stability, bone quality and quantity, surgical techniques, implant design.**

1. Primary Stability:

One of the most critical factors that must be obtained at the time of the implant's insertion, before any load is applied is primary stability. Two methods are usually employed to measure the primary stability of an implant, namely, the Periotestand resonance frequency analysis (RFA) measurement using Osstell device (Fig 1). Comparatively less sensitive information concerning the implant stability is provided by the periotest values.

Fig 1: Periotest and Osstell device

The resonance frequency analysis device measures the resonance frequency of a transductor attached to the implant body, which is stimulated by different frequencies. A graphic display panel showing the implant stability quotient (ISQ) values is seen, which indicates the firmness at the implant–tissue interface. ISQ values greater than 70 have high implant stability, whereas ISQ values below 60 indicates a poor primary stability (Fig2).

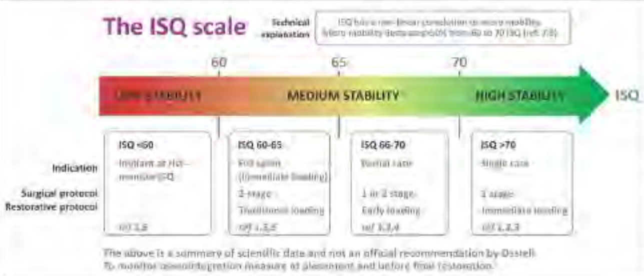

Fig 2: Implant stability quotient(ISQ) scale

During clinical evaluation, the torque during implant placement is a good predictor of implant stability. Studies have reported that implants placed with an insertion torque greater than 30-35 Ncm resulted in higher success rates for immediate loading.[4]

Additionally, to make sure adequate bone health and stability, copious irrigation both internally and externally is needed to ensure that temperatures do not exceed 47° C for prevention of necrosis of the encompassing bone.

Several studies[5,6] have reported high success rates with IL of dental implants, which are attributed to high primary stability. In some clinical studies[7,8] an immobilization using splinting (cross-arch restorations or partial splinting) was necessary to increase the stability of the implants after surgery

Effect of micro movements on primary stability:

One of the main risk for the success of osseointegration is micro movement from the implant.If the micro movements range results to be over 150 µm, this might jeopardize the osseointegration process. This excessive micro motion results to be directly implicated in the formation of fibrous tissues and inducing bone resorption at the bone-to-implant interface. Javed F and Romanos GE[9] reported that a well-controlled micro motion positively influenced bone formation; therefore, the peri-implant bone density implant integration is improved in immediate functional loading of implants placed in healed ridges or also fresh extraction sockets.

2. Bone quality and quantity:

It's important to evaluate the bone density at the implant site so as to achieve the necessary torque value to perform immediate loading. Cone Beam Computerized tomography (CBCT) has been regarded as the best radiographic method to evaluate the residual bone.

In 1990, Misch[10] proposed a classification based on macroscopic cortical and trabecular bone characteristics (Fig 3):

- Class I: dense cortical bone
- Class II: porous cortical bone
- Class III: coarse trabecular bone
- Class IV: fine trabecular bone

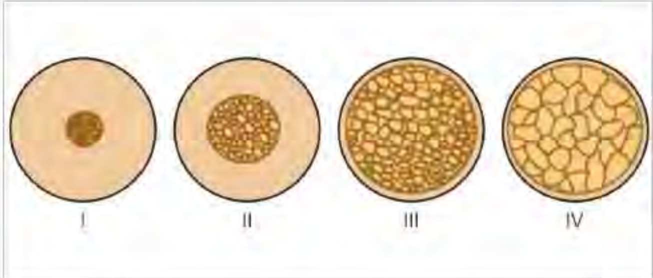

Fig 3: Classification of bone based on quality and quantity

Torque is directly proportional to the bone density. The density in D-1 type bone will be the highest while in D-4 type bone, it will be the lowest. Higher failure rates have been reported in type IV bone for immediate loading of implants.[11]

According to Misch[12], most of the immediately loaded implants are placed in anatomical sites with dense and good quality bone. The mandible (particularly in the interforaminal region) has a better bone quality compared to the maxilla and this is probably the reason why reports are available regarding IL in the anterior part of the mandible with high survival rates.[13]

Clinical studies[14,15] have reported dental implants in the mandible to have higher survival rates compared to those in the maxilla, especially for the posterior maxilla. In another study, immediately loaded implants in the anterior maxilla showed successful osseointegration (96%) with stable peri-implant conditions till at least the sixth year of follow-up.[45] Cross-arch restorations on immediately loaded implants placed in the maxilla presented high success rates (96.66% after 6 years of loading), when the implants have a design allowing high implant primary stability.[16]

The quality and quantity of bone is driven by Wolff's law which states that "every change in the form and function of bone or their function alone, is followed by certain definite changes in their internal architecture and equally definite secondary alteration in their external conformation on accordance with mathematical laws".

A constant state of bone remodeling always happens in the human body, which helps to maintain bone strength. Bone remodeling is a lifelong process wherein bone tissue is removed from the skeleton, and replaced with new bone tissue (Fig 4).

The bone will remodel itself over time to become stronger to resist that sort of loading if loading on a particular bone increases. Adaptive changes occur in the internal architecture of the trabeculae, followed by secondary changes to the external cortical portion of the bone, perhaps becoming thicker as a result. Vice versa the bone will become less dense and weaker due to the lack of the stimulus required for continued remodeling if the loading on a bone decreases.

Thus according to Wolff's law it can be said that immediate loading of implants leads to increased bone formation which can be highly advantageous.

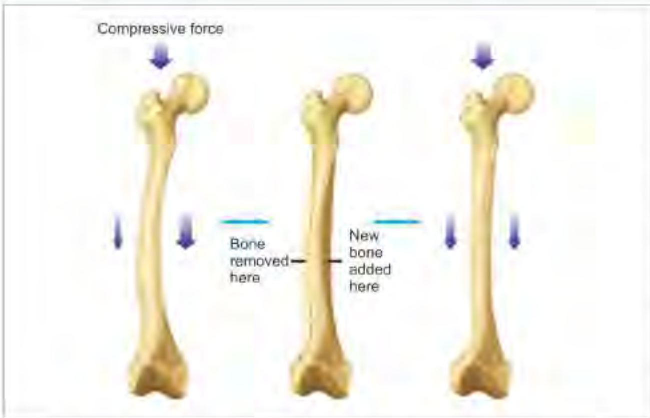

Fig 4: Remodeling of bone seen in areas where force is applied

3. Surgical techniques:

Various authors[17,18] introduced different techniques to locally optimize bone density and subsequently improve primary stability:

- 1–2 mm subcrestal implant placement.
- Bicorticalization into the nasal or sinus floor whenever possible.
- implant site under preparation.
- bone condensing technique.

The commonly used techniques are under preparation and the bone condensing technique, which is performed nearly always when in presence of Class III or Class IV bone. In the first technique a final drill diameter which is smaller than the diameter of the implant is used. The second technique is pushing aside cancellous bone with bone condensers (osteotomes), thus increasing the density of the implant surrounding bone.[19] Through the use of these procedures, it has been reported high survival rates with immediate loading implants.

4. Implant design:

The implant body design has been modified over the years to enhance primary stability, particularly for immediate loading, as the implant requires maximum stability at the time of the placement, and the bone has not had time to grow into recesses or undercuts in the implant body, or to attach to a surface condition before the application of occlusal load.

Such modifications were increased implant diameter and length, modification of number of threads, different types of thread designs and taper of the body of the implant (Fig 5). The common goal of all these modifications is to increase the implant surface area in contact with the surrounding bone and engage marginal and lateral cortical bone to a greater extent.

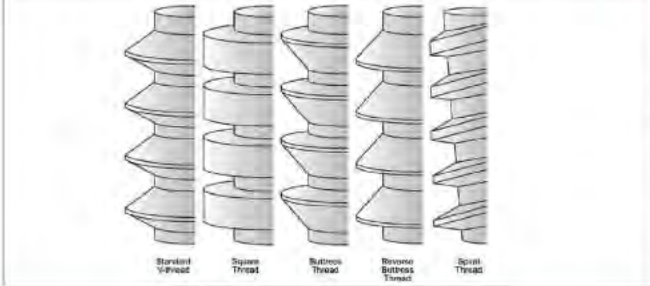

Fig 5: Implant thread designs

Gerard Torroella-Saura et al[20] reported that tapered implants with a wide pitch thread pattern and square thread geometry achieved greater primary stability values than cylindrical implants, with a narrow pitch thread pattern and V-shaped thread geometry measured with insertion torque value.

The square thread shape is often a more important feature than the amount of threads to get an acceptable implant stability value. Moreover, the combination of tapered implants and a square thread shape can be a good surgical strategy to achieve acceptable implant primary stability in situations of poor bone quality, or when implant primary stability has to be precisely achieved when immediate or early loading protocols are planned.

The screw or "threaded" design minimizes the implants' micromotion during function thereby maintaining the primary stability.[21] Furthermore, a threaded design also increases the surface area of the implant thereby offering a higher percentage of bone-to-implant contacts, in comparison to implants with a cylindrical design. Therefore, threaded type implants are generally recommended and particularly for IL.[22,23]

Vandamme et al[24] showed that threaded implants offer significant bone-to-implant contact during (compared to cylinder-shaped implants), which may also enhance the secondary stability.

When considering implant length, all authors prefer using longer implants whenever possible, with a minimum of 8 mm length, being 13 and 15 mm implants the most frequently used.[25]

The surface characteristics and diameter of the implant have also play an important role in achieving adequate primary stability. Rough implant surfaces make the area of implant-bone contact even more extended.

Clinical studies have shown that, in cases with a limited bone volume, implants with less than 3 mm diameters can reach sufficient primary stability.[26] Wider implants are often used in posterior regions with poor quality bone. Single teeth implants demonstrate a greater risk of failure, in comparison immediately loaded full arch restorations.

To obtain full-arch rehabilitation with ILI, most studies consider 6 implants to be the lowest adequate number to achieve a predictable outcome.[27] Paulo Malo et al.[28] described a technique to achieve successful results with only 4 implants.

IMMEDIATE IMPLANT PLACEMENT WITH IMMEDIATE LOADING

Immediate implant placement has proved to be more advantageous as opposed to delayed implant placement. Some of the benefits include placement of the implant in fresh extraction sites in the same position as the extracted tooth so that there is no need for angled abutments, improved osseointegration, recession of mucosal and gingival tissues is minimized as a result of preservation of bony receptors which is brought about by inhibiting atrophy of the alveolar ridge, the extraction socket is kept free of contaminants, esthetics can be enhanced through immediate restorations and drawbacks like prolonged healing periods and regeneration of osseous structures are completely ruled out with immediate implants.

Despite the popularity and increased success rate of immediately placed and immediate loading implants, the techniques cannot be employed for all the immediate implant patients. Immediate implant loading procedure is known to be more time consuming especially during implant placement for the prosthodontist as well as the patient. Hence, the dentist should be prudent in choosing immediate implant placement and immediate loading as a treatment modality for the patient.

The ideal requisites for immediately loaded implants are primary stability of immediately placed implants, reasonable bone quality (D2 or D3 bone), screw-shaped implants, rough implant surface, and minimum implant length of 10mm, appropriate primary stability and nullifying lateral forces

Quirynen et al.[29] inferred that the integration of immediate implant insertion and immediate loading as a treatment modality has resulted in increased rates of implant failure.

PISA CONSENSUS

The ICOI Pisa Implant Quality of Health is classified based on clinical evaluation. Based on this scale an implant can be evaluated using the listed criteria, place it within the appropriate category of health or disease, and then accordingly treat the implant. The primary categories established by the Consensus were success, survival, and failure. There are 4 implant groups to describe the clinical conditions of success, survival, or failure (Fig 6).[30]

Group I represents success and is indicative of optimum health conditions. There is no pain on palpation, percussion, or function. In loads less than 500 g no clinical implant mobility is noted. Crestal bone loss less than 2.0 mm is observed compared with the implant insertion surgery. The implant has no history of exudate. The prognosis of Group I implants is extremely good.

Group II implants are categorized as "survival" and have satisfactory health. These implants are stable, but show a history of, or potential for clinical problems. There is no pain on palpation, percussion, or function. In loads less than 500 g no clinical implant mobility is noted. Crystal bone loss ranges from 2.0 and 4.0 mm from the implant insertion. Depending on the stable condition of the crystal bone the prognosis is good to very good.

Group III implants are within the "survival" category, but exhibit mild to moderate peri-implantitis and compromised health status. There is no pain on function. No evident vertical or initial horizontal mobility. Radiographic crystal bone loss greater than 4 mm since implant placement with the bone loss being less than 50% from around the implant. Increase in probing depths from baseline up to one-half the length of the implant, usually accompanied with bleeding on probing. More than 2 weeks of exudates (if present). Depending on the ability to reduce and control stress, the prognosis varies from good to guarded.

Group IV of the Pisa Implant Health Scale is clinical or absolute failure. The implant should be removed under any of these conditions: (1) pain on palpation, percussion or function, (2) horizontal and/or vertical mobility, (3) uncontrolled progressive bone loss, (4) uncontrolled exudate, or (5) more than 50% bone loss around the implant. Implants which are surgically placed but unable to be restored (sleepers) are also included in Group IV failure.

Implant Quality Scale Group	Clinical Conditions
I. Success (optimum health)	a) No pain or tenderness upon function b) 0 mobility c) <2mm radiographic bone loss from initial surgery d) No exudates history
II. Satisfactory survival	a) No pain on function b) 0 mobility c) 2-4mm radiographic bone loss d) No exudates history
III. Compromised survival	a) May have sensitivity on function b) No mobility c) Radiographic bone loss >4mm (less than 1/2 of implant body) d) No exudates history
IV. Failure (clinical or absolute failure)	Any of following a) Pain on function b) Mobility c) Radiographic bone loss >1/2 length of implant d) Uncontrolled exudate e) No longer in mouth

*International Congress of Oral Implantologists, Pisa, Italy, Consensus Conference, 2007

Fig 6: PISA CONSENSUS showing implant quality scale

IMMEDIATE IMPLANTS VS CONVENTIONALLY LOADED IMPLANTS

Placement of a restoration within 48 hours of implant placement is termed as **immediate loading**, otherwise known as **immediate Function**. Prosthetic restoration and functional loading of an osseo integrated implant after a healing period of three to six months is termed as **conventional loading**. In modern day dentistry with the patients' high demand, immediate implant placement and loading seems to be a more viable treatment option.

High survival rates are seen in immediately loaded implants as well as conventionally loaded implants. The first part of a study about late inter-antral implantation in the nonaugmented edentulous maxilla reported survival rates of 98.3% in the immediate loaded implants group and 96.7% in the conventional group at a mean observation period of 4.7 years.[31] The results in the second part of the study, in cases of immediate inter-antral implantation, also showed similar findings. They were 97.6 and 96.6% for a mean observation period of 3.9 years.[32]

A survival rate of 98.2% in immediate loading versus 99.6% in conventional loading was observed in a systemic review evaluating[29] randomized-control studies.[33]

However, when considering the rate of failure between immediate loading and conventional loading in edentulous patients, there were publications that showed a higher risk of failure in treatment with an immediate loading protocol. Another article of meta-analysis showed that immediate loading indicated a slightly higher implant failure rate than conventional loading.[34]

IMMEDIATE FUNCTIONAL LOADING OF SINGLE IMPLANTS

In suitable cases, immediate placement and immediate loading offer an lot of benefits for the patient, including shorter treatment time and significantly reduced time (if any) spent with a gap in the dentition, on the day of surgery, aesthetic restorations are provided.

An overall survival rate for 1-year is 97.7%. A few complications (twopatients had experienced loosened abutments, one patient had swelling after surgery, and another patient had a ceramic crown fracture) were encountered. After 1 year of functional loading, the patients had lost an average of 0.32 mm (± 0.22) of peri-implant marginal bone; the mean probing pocket depth (PPD) was 2.16 mm (± 0.68). Immediate functional loading concept of single dental implants can be a successful treatment procedure, with satisfactory clinical outcomes.[35]

A total of 57 implants (38 in maxilla and 19 in mandible) were placed in 46 patients (23 men, 23 women, aged between 18–73 years). Of these, in post-extraction sockets 10 implants were placed. One implant was failed, in a healed site, giving a patient-based overall survival rate of 97.6% for 2 years. The incidence of biologic complications was 1.8%; prosthetic complications amounted to 7.5%. The immediate functional loading of single implants seems to represent a safe and successful procedure.[36]

Single immediate implants showed high implant survival rate and limited marginal bone loss in the long term. However, some deficiency is deteriorated after 1 year, they are mid-facial recession, mid-facial contour and alveolar process deficiency.[37]

Implant survival rate was 96.9% after a mean follow-up period of 4 years following implant placement. Thereby it can be concluded that immediate placement of implants followed by immediate provisionalisation resulted in a high survival rate, minimum peri-implant bone loss, very good aesthetics and satisfied patients after a mean follow-up period of 4 years.[38]

IMMEDIATE LOADING FOR COMPLETELY EDENTULOUS ARCHES

Implant placement in completely edentulous arches poses a great challenge due to various factors such as the lip line, gingival biotype, soft tissue anatomy, quality and quantity of bone, AP spread. Treatment options vary for completely edentulous arches from a simple implant supported over denture to all on 4 implants, all on 6 implants.

Successful outcomes suggested that immediate fabrication of final prosthesis on two tilted and two straight implants in edentulous jaws was safe. Marginal bone loss was less when compared with delayed loading protocol.[39]

The overall survival rate using the All-on Four immediate function treatment concept using an implant with a tapered body and a variable thread design can be a viable treatment concept for patients with edentulous arches and/or immediate placement.[40]

CONCLUSION

Immediate loading implants provides a popular notion of "teeth in a day", that is if the patient loses his tooth or teeth he can get a restoration on the same day of the placement of the implant instead of the conventional protocol of waiting for 3-6 months for osseointegration to complete.

Shimmel M. et al[41] in a recent review concluded that although all three loading protocols provide high survival rates, early loading implants and conventionally loaded implants protocol are still better documented than immediate loading implants and seem to result in fewer implant failures during the first year.

Immediate Loading Implants demonstrate a greater risk for implant failure when compared to Conventionally Loaded Implants, although the survival rates were high for both the procedures. Single teeth implants have aa greater risk of failure, when compared to immediately loaded full arch restorations.[42]

Thus we can conclude that various factors have to be taken into account such as primary stability, bone quality and quantity, surgical techniques, implant design before deciding upon the type of loading protocol.

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RADIOGRAPHIC ASSESSMENT OF MARGINAL BONE LOSS WITH IMMEDIATE AND EARLY LOADING OF CYLINDRICAL AND TAPERED IMPLANTS IN POSTERIOR MANDIBLE: A CLINICAL STUDY.

ABSTRACT

Aim: The purpose of this study was to radiographically assess the marginal bone loss around implants with two different designs placed in mandibular posterior region and subjected to immediate loading or early loading at various time intervals of up to 9 months.

Materials and Methods: A total of 40 implants were placed which were randomly divided into 2 groups of 20 implants each: immediate loading (IL) and early loading (EL). In each group, 10 implants with cylindrical design (Swell, ADIN Dental Implant Systems Ltd, Afula, Israel) and 10 with tapered design (Touareg-S, ADIN Dental Implant Systems Ltd, Afula, Israel) were placed. Standardized radiographs were made at the time of implant loading (baseline) and at 3, 6 and 9 months intervals for IL group; at the time of surgery (baseline), time of loading (1 month) and at 3, 6 and 9 months intervals for EL group. Bone loss measurements were obtained from the radiographs using photo editing and measuring software, and subjected to statistical analysis.

Results: Touareg-S demonstrated lower mean bone loss with early loading whereas Swell demonstrated a lower mean bone loss with immediate loading. One way Analysis of Variance (ANOVA) and Post hoc Tukey's analysis however revealed no significant differences between any of the study groups ($p > 0.05$).

Conclusion: Mean marginal bone loss was observed to be greater, but not statistically significant for Swell than for Touareg-S at all time with both immediate & early loading. The overall implant success rate was 92.5% for all study groups.

Keywords: Radiographic bone loss (RBL), crestal bone loss, immediate loading, early loading

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INTRODUCTION

Implant dentistry has been enjoying unprecedented success as a treatment modality for oral rehabilitation. Since the introduction of the concept of osseointegration in 1970s, dramatic changes have taken place in the field of implant dentistry. An osseointegrated implant is firmly anchored to bone and ensures prosthesis capable to withstand functional loading.[1] Criteria for successful osseointegration are often defined by the amount of marginal bone loss surrounding an implant. Albrektsson et al described the criterion which specifies that the average vertical bone loss should be no more than 0.5-1.6 mm for the first year of function and less than 0.2 mm thereafter.[2] These criteria were based on their studies in which implants were placed in native bone and allowed to heal for 3 to 6 months before restoration; however, these standards of success remain in place.

In the last few decades, there have been tremendous advances in biomaterials and clinical research. As a result clinicians have redefined some of the original prerequisites for osseointegration and perform more advanced procedures to satisfy patient's increasing expectations of reduced treatment time, improved esthetics and increased comfort.[3] With more refined surgical protocols, an optimized implant design, and other surface characteristics, new treatment concepts such as immediate and early implant loading have been proposed to shorten the overall treatment time and to allow the patient to have a final prosthesis in the shortest time possible following implant placement.[4] Immediate loading of oral implants involves placing a restoration on the implant within one week of implant placement in light occlusion during maximum intercuspation and free of contact in all eccentric excursive contacts. In early loading, a superstructure is attached within one week to two months after implant insertion.[5]

One of the main problems after immediate loading is the risk of a provisional prosthesis overloading the newly installed implants. Premature loading of an implant was believed to result in fibrous encapsulation and clinical failure. However, histological evidence from experimental studies and of clinically retrieved implants seems to suggest that implants integrate well under early loading conditions.[6] Rocci et al[7] demonstrated successful integration of oxidized titanium implants placed in soft bone when subjected to immediate loading. Most authors suggest that primary stability, type of surface as well as implant design are important clinical factors influencing immediate loading.[8-11]

Unquestionably, the initial implant stability is dependent on the implant geometry. Tapered implants have shown a higher insertion torque when compared with cylindrical implants.[12,13] When implants with a progressive thread design were compared with other implant designs, histomorphometric studies at the implant-osseous tissue interface demonstrated higher bone to implant contact percentages immediately after insertion. Torroella et al [14] evaluated the effect of two different designs, tapered v/s cylindrical and reported that tapered implants achieved greater primary stability and less marginal bone loss than the cylindrical implants. Stable bone implant contact without micro movements is also important for future osseointegration. Micro movements lower than 100 μm stimulate osteoblastic activity whereas micro movements greater than 150 μm may result in fibrous healing around the implant leading to failure.[15] Lower frequency micro movements have been suggested to provide a stimulative effect on bone healing.[16]

A comprehensive literature search reveals that only limited data was available comparing the success and survival rate of cylindrical and tapered threaded designs simultaneously in immediate and early loading techniques. Moreover, most of the studies only documented splinted implants and very few studies reported on single implants in posterior mandibular region. Therefore, the present study was carried out to radiographically assess the marginal bone loss around implants with two different designs placed in mandibular posterior region and subjected to immediate loading or early loading at various time intervals.

MATERIALS AND METHODS

The sample of study was drawn from patients attending the Prosthodontic clinic in the Department of Prosthodontics and Implantology, Himachal Institute of Dental Sciences, Paonta Sahib. Approval of the institutional ethical committee was obtained as per Helsinki declaration (1975) for the study along with informed consent of all patients participating in the study. The study enrolled patients more than 18 years old, with at least one missing tooth in the posterior mandibular region, adequate bone quantity to accommodate an implant at least 3.75 mm diameter and 10 mm length and with full complement of natural teeth or fixed prosthesis in the opposing dentition. Patients with poor oral hygiene, any systemic pathology, active infection at the implant site, radiation therapy in the craniofacial region within past 12 months, history of smoking, bruxism, unfavorable quantity and/or quality of bone, unfavorable or lack of opposing dentition or fixed prosthesis and those unwilling to return for follow up were not considered for the study. Patients were randomized into immediate and early loading groups. A total of 40 implants were placed which were randomly divided into 2 groups of 20 implants each: immediate loading (IL) and early loading (EL). In each group, 10 implants with cylindrical design (Swell, ADIN Dental Implant Systems Ltd, Afula, Israel) and 10 with tapered design (Touareg-S, ADIN Dental Implant Systems Ltd, Afula, Israel) were placed (Figure 1).

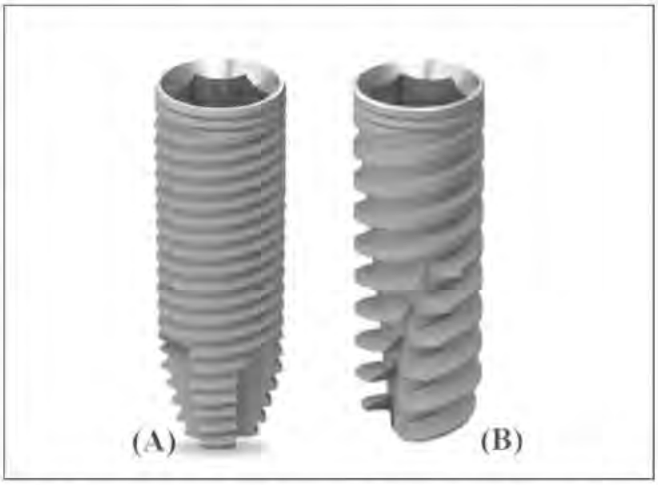


Fig 1: Implant designs used in the study: Swell (A) and Touareg-S (B)

Patients were assessed by clinical examination, medical and dental history, radiographs and diagnostic models were obtained (Figure 2a). Presurgical radiographic examination included standardized panoramic and intraoral periapical (IOPA) radiographs to assess the bone quality and quantity. Bone width was measured with the help of ridge mapping or bone caliper (Figure 2b). Diagnostic impressions were used to form wax patterns for the provisional restorations following duplication using a putty index (Figure 2c). In addition, individual impression trays were fabricated before surgery. Oral prophylaxis was done one week preoperatively (Figure 2d).

Fig 2: Preoperative clinical evaluation (a) and ridge mapping (b), wax pattern fabrication for provisional (c) and custom impression tray fabrication (d)

All patients were instructed to rinse with a 0.2% chlorhexidine mouthwash for 2 min before the surgery. Surgery was carried out under local anesthesia containing 2% epinephrine. The surgical phase was carried out by the same operator for every patient. Full thickness flaps were raised using a mid crestal incision with a minimal extension to minimize patient discomfort. The optimal implant site was marked by perforating the bony cortex using a 2.2 mm round bur at 1000-1500 rpm. A twist drill was used at a drill speed of 900-1200 rpm with profuse sterile irrigation to create a site of the appropriate depth for the chosen implant length, and a paralleling pin was used to verify the appropriate alignment with adjacent teeth, opposing occlusion, or other implants. After confirmation of final depth and angulation, the site was gradually expanded with implant drills of sequential size to the desired diameter using copious irrigation. Implants were placed manually with a ratchet until they were level with the alveolar bone crest (Figure 3a). All implants included in the study had insertion torque value ⩾ 40 Ncm. In the case that an implant was inserted with a lower torque, cover screw was placed, flaps were sutured back and it was conventionally loaded after 3 months of healing and was excluded from the study.

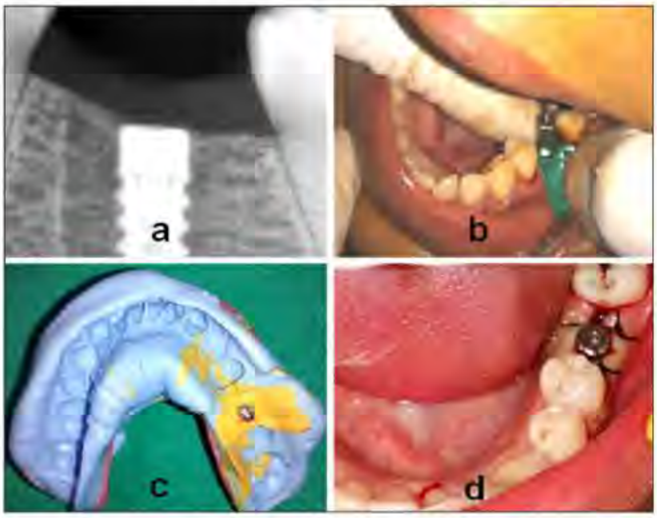


Fig 3: Implant placement at crestal level (a), surgical site protection for IL group (b), direct transfer impression (c) and healing abutment in place (d)

For the IL group, the procedure for fabricating the provisional restorations started immediately after surgery. Contamination of the surgical site with the impression material was avoided by using a small, sterile piece of rubber dam (Figure 3b). A direct transfer impression procedure was used to make implant impressions (Figure 3c) using a polyvinyl siloxane impression material (Aquasil monophase, Dentsply International, USA). Suitable healing caps were placed until cementation of provisional crowns (Figure 3d). For EL group, healing abutments were placed after implant placement and flaps were repositioned using interrupted sutures. Impressions for this group were made within 3 weeks after implant placement.

Antibiotics and non steroidal analgesics were continued for 4 days postoperatively. Patients were asked to remain on a soft diet for one week as well as to use 0.12% chlorhexidine mouth rinses during the same period. Sutures were removed on the tenth postoperative day.

Provisional acrylic restorations for IL group were cemented within 7 days while for the EL group, provisional restorations were placed within 1 month postoperatively (Figure 4a & 4b). The occlusion was checked to provide light contact in centric position and eliminate interferences during eccentric movements. After 3 months of loading with the provisional, the prostheses were removed, impressions were made using PVS impression material, definitive prostheses were fabricated and cemented (Figure 4c & 4d).

Fig 4: Provisional implant restoration, occlusal (a) and buccal aspect (b), final implant prosthesis, occlusal (c) and buccal aspect (d)

Crestal bone level changes for both groups were measured from the implant abutment junction to the most coronal point of bone to implant contact using standardized IOPA radiographs (Figure 5a). The radiographic angle was standardized using Rinn XCP (Dentsply International, USA) paralleling device. For the IL group, standardized radiographs were made at the time of implant loading (baseline) and at 3, 6 and 9 months intervals. For the EL group, standardized radiographs were made at the time of surgery (baseline), at the time of loading (1 month) and at 3, 6 and 9 months intervals. All radiographs were converted to JPEG format and two reference points on each radiograph were marked using a photo editing software (Paint, Microsoft Corp, USA) at 10x magnification. On the mesial and distal side of each implant, the most coronal radiographically visible bone to implant contact was located and was marked with green dot and implant abutment junction was marked with red dot on each radiograph (Figure 5b). Measurements of the mesial and distal bone crest level adjacent to each implant were made to the nearest 0.01 mm with the help of measuring software (Screen Pixel Measurer v1.9) (Figure 5c & 5d). The software was calibrated for every single image using the known distance of two consecutive implant threads. Mesial and distal measurements for each implant were averaged to determine the mean bone loss. The data obtained was analysed using one way Analysis of Variance (ANOVA) to determine statistically significant difference between the two loading protocols. Post hoc Tukey's test was applied to determine intergroup significant differences.

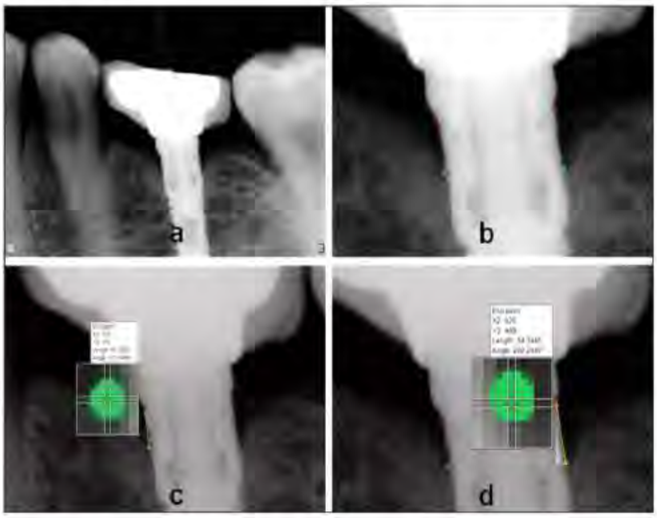


Fig 5: Standardized IOPA radiograph (a), implant-abutment junction (red) and crestal bone level (green) markings (b); measuring crestal bone loss on mesial side (c) and distal side (d)

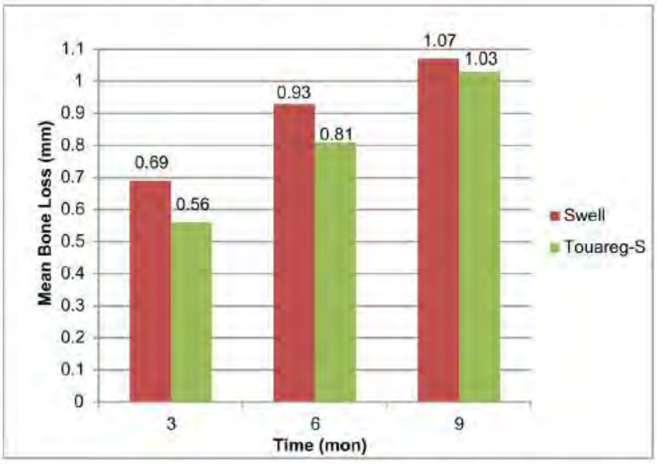
RESULTS

The descriptive statistics for all study groups are presented in Table 1

Time	Group	N	Mean	Std. Deviation	Std. Error	Confidence level (95%)
0 month	IL ADIN SWELL	10	0.00	0.00	0.00	0.00
	ADIN TOUAREG-S	10	0.00	0.00	0.00	0.00
	EL ADIN SWELL	10	0.00	0.00	0.00	0.00
	EL ADIN TOUAREG-S	10	0.00	0.00	0.00	0.00
1 month	IL ADIN SWELL	-	-	-	-	-
	IL ADIN TOUAREG-S	-	-	-	-	-
	EL ADIN SWELL	8	0.57	0.17	0.06	0.15
	EL ADIN TOUAREG-S	10	0.52	0.17	0.05	0.13
3 month	IL ADIN SWELL	10	0.69	0.14	0.04	0.10
	IL ADIN TOUAREG-S	9	0.56	0.19	0.06	0.15
	EL ADIN SWELL	8	0.83	0.26	0.09	0.22
	EL ADIN TOUAREG-S	10	0.64	0.23	0.07	0.17
6 month	IL ADIN SWELL	10	0.93	0.22	0.07	0.16
	IL ADIN TOUAREG-S	9	0.81	0.40	0.13	0.31
	EL ADIN SWELL	8	0.95	0.30	0.10	0.25
	EL ADIN TOUAREG-S	10	0.76	0.21	0.06	0.15
9 month	IL ADIN SWELL	10	1.07	0.17	0.05	0.13
	IL ADIN TOUAREG-S	9	1.03	0.31	0.10	0.25
	EL ADIN SWELL	8	1.09	0.33	0.11	0.28
	EL ADIN TOUAREG_S	10	0.86	0.19	0.06	0.14

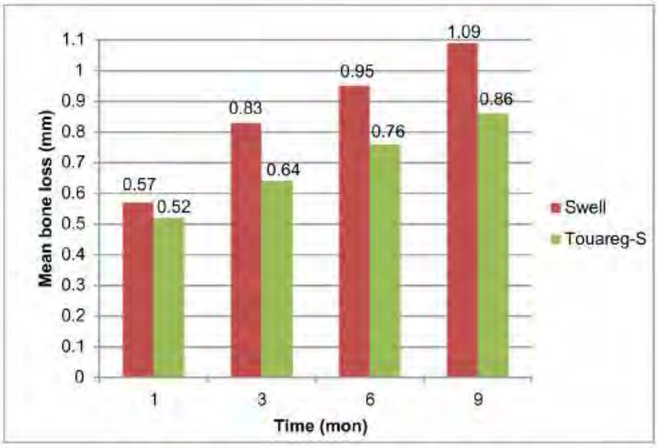
Table 1: Descriptive statistics for the study groups

For the IL group, the mean marginal bone loss for Swell at 3, 6 and 9 months was 0.69 mm, 0.93 mm and 1.07 mm respectively. For Touareg-S, the corresponding bone loss values (IL group) were 0.56 mm, 0.81 mm and 1.03 mm at 3, 6 and 9 months respectively (Graph 1).



Graph 1: Mean marginal bone loss for IL group

For the EL group, the mean marginal bone loss at 1, 3, 6 and 9 months was 0.57 mm, 0.83 mm, 0.95 mm and 1.09 mm for Swell; and 0.52 mm, 0.64 mm, 0.76 mm and 0.86 mm for Touareg-S, respectively (Graph 2).



Graph 2: Mean marginal bone loss for EL group

Thus, the mean marginal bone loss at all times was greater for Swell than Touareg-S with both loading protocols. Touareg-S demonstrated slightly lower mean bone loss with early loading while Swell demonstrated a lower mean bone loss with immediate loading over a 9 month time. One way ANOVA and Post hoc Tukey's analysis (Table 2) however revealed no significant statistical differences between any of the study groups ($p > 0.05$).

Dependent Variable (Bone loss)	(I) Groups	(J) Groups	Mean Difference (I-J)	Std. Error	Sig.
3 month	IL ADIN SWELL	IL ADIN TOUAREG-S	.12867	.09668	.550
		EL ADIN SWELL	-.13925	.09980	.511
		EL ADIN TOUAREG-S	.04300	.09410	.968
	IL ADIN TOUAREG-S	IL ADIN SWELL	-.12867	.09668	.550
		EL ADIN SWELL	-.26792	.10224	.060
		EL ADIN TOUAREG-S	-.08567	09668	.812
	EL ADIN SWELL	IL ADIN SWELL	.13925	.09980	.511
		IL ADIN TOUAREG-S	.26792	10224	.060
		EL ADIN TOUAREG-S	.18225	.09980	.280
	EL ADIN TOUAREG-S	IL ADIN SWELL	-.04300	09410	.968
		IL ADIN TOUAREG-S	.08567	.09668	.812
		E L ADIN SWELL	-.18225	.09980	.280
6 month	IL ADIN SWELL	IL ADIN TOUAREG-S	.11533	13408	.825
		EL ADIN SWELL	-.01925	13842	.999
		EL ADIN TOUAREG-S	.17200	13051	.558
	IL ADIN TOUAREG-S	IL ADIN SWELL	-.11533	13408	.825
		EL ADIN SWELL	-.13458	14180	.779
		EL ADIN TOUAREG-S	.05667	13408	.974
	EL ADIN SWELL	IL ADIN SWELL	.01925	13842	.999
		IL ADIN TOUAREG-S	.13458	14180	.779
		EL ADIN TOUAREG-S	.19125	13842	.519
	EL ADIN TOUAREG-S	IL ADIN SWELL	-.17200	13051	.558
		IL ADIN TOUAREG-S	-.05667	13408	.974
		EL ADIN SWELL	-.19125	13842	.519
9 month	IL ADIN SWELL	IL ADIN TOUAREG-S	.03844	11882	.988
		EL ADIN SWELL	-.02350	.12267	.997
		EL ADIN TOUAREG-S	.20800	11565	.292
	IL ADIN TOUAREG-S	IL ADIN SWELL	-.03844	11882	.988
		EL ADIN SWELL	-.06194	12566	.960
		EL ADIN TOUAREG-S	.16956	11882	.492
	EL ADIN SWELL	IL ADIN SWELL	.02350	12267	.997
		IL ADIN TOUAREG-S	.06194	12566	.960
		EL ADIN TOUAREG-S	.23150	12267	.253
	EL ADIN TOUAREG-S	IL ADIN SWELL	-.20800	11565	.292
		IL ADIN TOUAREG-S	-.16956	11882	.492
		EL ADIN SWELL	-.23150	12267	.253

Table 2: Post hoc Tukey's analysis

Implant survival rate was 90% for Swell (100% for IL group, 80% for EL group) and 95% for Touareg-S (90% for IL group, 100% for EL group); the overall success rate being 92.5% for both implants with both loading protocols (Table 3).

			Survival		Total
			Failed	Survived	
Group	IL ADIN SWELL	Count	0	10	10
		% within Group	0.0%	100.0%	100.0%
	IL ADIN TOUAREG-S	Count	1	9	10
		% within Group	10.0%	90.0%	100.0%
	EL ADIN SWELL	Count	2	8	10
		% within Group	20.0%	80.0%	100.0%
	EL ADIN TOUAREG-S	Count	0	10	10
		% within Group	0.0%	100.0%	100.0%
Total		Count	3	37	40
		% within Groups	7.5%	92.5%	100.0%

Table 3: Implant survival rate for IL and EL groups

DISCUSSION

The traditional approach of conventional implant loading requires longer treatment periods as well as an additional surgical appointment to uncover the implants. The submerged, undisturbed healing of the original "ad modum Brånemark" concept has been challenged over the years with introduction of the non submerged one stage technique.[17] Modifications in implant shape and surface characteristics has encouraged research with results suggesting that it is possible to restore implants predictably and safely in a considerably shorter time than previously recommended conventional loading protocols.[18-25] The present study aimed to evaluate whether immediate and early loading could provide satisfactory results with two different implant designs, tapered and cylindrical, since shorter treatment periods are highly appreciated and requested by many patients.

Of the 40 implants placed in the study, three failed providing an overall survival rate of 92.5%. All the 3 implants failed primarily because of infection in 2 to 3 weeks. Two patients did not follow the oral hygiene instructions given to them strictly. All the failed implants displayed postoperative pain, oedema and signs of infection with pus. The failed implants included two of Swell and one Touareg-S implant providing a survival rate of 90% and 95% respectively. Both failures for Swell occurred in the EL group (survival rate 80%) while the Toureg-S failure was reported in the IL group (survival rate 90%). However, the difference in survival rate was not found to be statistically significant. The survival rate was 100% for both Swell in IL group and for Touareg-S in the EL group. Similar survival rates for both immediate and early loading protocols have been reported by Ganeles et al[26], Kokovic et al[27], Degidi et al.[28] However, Zembic et al[29] and Shotwel et al [30] have reported a lower implant survival rate with immediate loading.

Swell demonstrated marginally higher bone loss in EL group than in IL group at 3 months and thereafter. Greater bone loss with early loading protocol may be attributed to a weak bone implant interface that is least mineralized and at high risk of overload postoperatively at three to five weeks, a time that usually coincides with early loading placement. The load bearing and highly mineralized lamellar bone at the implant site is initially replaced by the low strength and less mineralized woven bone during the repair process. Woven bone forms at a rate of up to 60 μm per day, whereas lamellar bone forms at a rate of only 10 μm per day. Thus most of the load in early loading is borne by the fibrous and weak woven bone that may result in greater bone loss. Buchs et al reported that early loading failures occurred primarily between 3 to 5 weeks postoperatively from mobility without infection.[31]

Bone loss in immediate implant loading may be attributed to factors like surgical trauma, remodeling of bone, implant micromotion, entrapment of impression material at the surgical site and occlusal overload. Causes of surgical trauma include thermal injury and mechanical trauma that may cause microfracture of bone during implant placement leading to osteonecrosis and possible fibrous and granulation tissue encapsulation around the implant. Ericksson and Albrektsson reported bone cell death at temperatures as low as 40°C.[32,33] Heat generated depends on the design and revolution of the drill, amount of bone prepared, drill sharpness, depth of the osteotomy, variation in cortical thickness, and the temperature and solution chemistry of the irrigant.[34,35]

Implant micromovement has been suggested as an important factor resulting in bone loss when implants are subjected to immediate loading by causing the wound to undergo fibrous repair. Brunski and Cameron suggested that as long as the micromovement does not exceed 100 μm, immediate loading of the implants can still allow for osseointegration.[36,37] Micromovement greater than 50-150 µm range has been considered deleterious and could be a cause of bone loss seen in relation to implants loaded with immediate loading protocol in this study. Szmukler-Moncler et al[38] also reviewed the histologic literature to determine how much micromotion a healing implant could tolerate and reported that an implant could osseointegrate despite a range of motion of 50 µm to 150 µm.

At the end of 9 months follow up, the mean marginal bone loss with both the loading protocols was slightly higher for Swell as compared to Touareg-S although the difference was not statistically significant. Touareg-S is a tapered, threaded, self tapping implant where as Swell is a parallel bodied implant. An important feature of Touareg-S that could have contributed to lesser bone loss in immediate loading may be the self drilling and self cutting design of the implant. This design feature condenses bone and promotes initial stability. Toyoshima et al [39], Yung-Soo et al[40] and Kokovic et al[27] in their respective studies have agreed that self- tapping implants show better primary stability and hence less initial bone loss. Greater bone loss for Swell could be related to its parallel body, long crest module of 3 mm and non tapping implant design.

For both the implant types, with any of the two loading protocols (immediate or early), no statistically significant difference was observed between mean marginal bone loss at any time interval up to the end of 9 months. The results of this study were in agreement with those conducted by Capelli et al[41], Kokovic et al[27] and Grandi et al[42] who also reported no significant difference in bone loss while loading implants with two different protocols. On the contrary, the results of this study were not in accordance with those of Ganeles et al[43] who reported higher values of bone loss with immediately loaded implants as compared with early loaded implants.

With an overall implant survival rate of 92.5%, the results of this study suggest that both immediate and early loading protocols may provide for a high rate of clinical success. Also, the type of implant system used, whether self tapping or non self tapping, parallel bodied or tapered, fine or coarse pitch, did not appear to influence significantly the amount of bone loss occurring around the implant whether it was immediately loaded or subjected to early loading.

CONCLUSION

The present study evaluated the mean marginal bone loss for two different implants with immediate and early loading protocols over a 9 month time period. The overall implant survival rate reported was 95% for immediate loading and 90% for early loading. For the two implant types, the survival rate for Touareg-S and Swell was 95% and 90% respectively. With immediate loading, the observed success rate was 100% for Swell and 90% for Touareg-S. With early loading, the success rate was 90% for Touareg-S and 80% for Swell.

The mean marginal bone loss values at 9 months were reported to be slightly greater for immediate loading as compared to early loading with Touareg-S but Swell demonstrated slightly greater bone loss at 9 months with early loading than immediately loaded. The differences, however, were not statistically significant. Mean marginal bone loss was observed to be greater for Swell than for Touareg-S at all time with both immediate & early loading protocols.

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REHABILITATION OF POST COVID MAXILLARY MUCORMYCOSIS DEFECT WITH ZYGOMATIC IMPLANTS - A CASE REPORT

ABSTRACT

Maxillectomy performed in patients with rhinomaxillary mucormycosis is often very extensive or bilateral, sparing very less hard and soft tissue in the oral cavity. These defects need both surgical and prosthetic rehabilitation. Depending on the extent of necrosis, surgical debridement usually entails various levels of maxillectomy. Patients who have had a low-level infrastructure maxillectomy and have healthy zygomatic bone can be restored with zygomatic implants supported prosthesis. This article presents a case report of rehabilitation of extensive hard and soft tissue defects caused by rhino-maxillary mucormycosis post COVID-19 infection. The patient underwent subtotal maxillectomy and was rehabilitated with an implant-supported removable maxillofacial prosthesis with zygomatic and pterygoid implants by following a delayed loading protocol.

Keywords: Zygomatic implants, Maxillectomy, Mucormycosis

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INTRODUCTION

Covid 19 infection has been associated with many long-term complications. Rhinomaxillary Mucormycosis has been commonly seen post covid 19 infection. Rhinomaxillary Mucormycosis represents as buccal vestibular sinuses, diffuse pain, sudden teeth mobility without periodontitis, palatal necrosis, gingival and mucosal soft tissue loss with underlying maxillary and zygomatic bone necrosis. Contrast-enhanced MRI of maxilla and biopsy is a confirmatory diagnostic test. Amphotericin B is the drug of choice for medical management. Unfortunately, in rhinomaxillary mucormycosis, only medical management is highly ineffective and thorough surgical debridement of necrosed bone and soft tissue is essential. In rhinomaxillary mucormycosis surgical debridement usually consist of different levels of maxillectomy depending on the extent of necrosis. Patients with low level of infrastructure maxillectomy, in whom zygomatic bone is healthy, can be rehabilitated with the help of zygomatic implants supported prosthesis. This is a case report of a patient whose post mucormycosis maxillectomy defect was rehabilitated with zygomatic implants supported and retained denture.

CASE REPORT

A 52-year-old female patient reported with a complaint of generalized pain in the upper jaw since 2 months. The patient had first developed the toothache when she was hospitalized for the COVID-19 infection 2 months ago. The patient complained that her toothache was overlooked during hospitalization and was treated for maxillary sinusitis as a part of the COVID-19 infection. The patient was discharged from hospital in 10 days, and she recovered from pulmonary symptoms but her dental pain was not resolved. After a few days, the patient developed multiple pus draining sinuses on the maxillary buccal gingiva and it was associated with mobility in teeth. Her pain was reduced but the mobility of teeth persisted and even increased in a few teeth. At the time of examination, she had multiple draining sinuses and swelling of the buccal gingiva. Generalized grade II mobility in teeth was present (Figure 1). Midpalatal necrosis was also observed (Figure 2). A biopsy was taken from the right premolar area, including maxillary bone and maxillary sinus lining, the sample was tested and revealed to be a case of rhinomaxillary

Fig 1: Generalized Gingival Abscess & Mobility in Maxillary Teeth

Fig 2: Palatal necrosis

mucormycosis. In contrast-enhanced MRI, areas of non-vascularity could be clearly demarcated (Figure 3).

Fig 3: Contrast-Enhanced MRI

A full-thickness flap was raised in the entire maxillary arch both buccally and palatally. Non-vital bone was seen throughout the maxillary arch (Figure 4 & 5). A bilateral infrastructure maxillectomy was done along with bilateral pterygoid plates under GA (Figure 6 & 7). Palatal mucosa was preserved and was sutured primarily to the buccal mucosa. Postoperative recovery was uneventful. The patient was relieved from pain. The patient had post-operative palatal mucosal necrosis in selected areas which resulted in multiple oro-antral and oro-nasal communications (Figure 8).

Fig 4: Non-Vital Bone Seen After Raising Flap

Fig 5: Palatal Necrosis

Fig 6: Infrastructure Maxillectomy

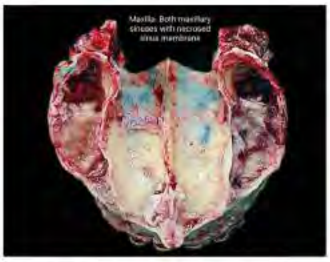

Fig 7: Maxillary Sinuses with Necrosed Sinus Membrane

Fig 8: Postoperative Maxilla with Multiple Oroantral & Oronasal Communications

After healing an attempt was made to rehabilitate the patient with a removable maxillary prosthesis. Unfortunately, due to lack of retention and support, the removable prosthesis was not successful and the patient could not be rehabilitated. Though the active disease had subsided, the patient was left with a poor quality of life due to inability to chew, oroantral and oronasal communications, and very poor facial aesthetics.

Three months later a CBCT was taken and it showed no residual disease and a good volume of zygomatic bone bilaterally. The patient was offered zygomatic implants and simultaneous soft-tissue defect closure with radial forearm free flap. The patient expressed her unwillingness for another major surgery so it was decided to place zygomatic implants only. Quad Zygomatic implant placement was done under LA (Figure 9). After 3 months of healing, a bar was fabricated over zygomatic implants, and over denture was provided over that bar with ball and socket attachment for retention (Figure 10-13). Postoperative OPG was taken to verify the fitting of prosthesis (Figure 14).

Fig 9: Quad Zygomatic Implants

Fig 10: Screw Retained Bar on Zygomatic Implants

Fig 11: Denture with Ball And Socket Attachments

Fig 12: Maxillary Prosthesis

Fig 13: Patient with Final Prosthesis

Fig 14: Postoperative OPG

DISCUSSION

Reconstruction of maxillary defects can be challenging. Most important is to choose the most suitable reconstruction method among all the treatment modalities available. Maxillary defect can be rehabilitated either surgically or prosthetically or with both.

Radial forearm free flap is the method of choice to close the soft tissue defect of maxilla. Other options to close soft tissue defect are anterolateral thigh flap or temporalis flap. For dentoalveolar reconstruction these flaps can be combined with or followed by either zygomatic and pterygoid implant supported prosthesis or a removable prosthesis can be given.

Those cases which have lost zygomatic bone also due to mucormycosis, possibility of zygomatic implant retained prosthesis is not an option. Fibula free flap can be used in these cases for osseous reconstruction, which can be later followed by dental implant placement in fibula flap.

Considering the complexity of surgery, associated morbidity and uncertainty of free fibula flap, the zygomatic implant retained fixed prosthesis should be preferred when zygomatic bone is intact.

Depending on the volume of zygomatic bone, one or two zygomatic implants can be placed on one side. If it's a unilateral defect, it's preferred to combine zygomatic implant with one anterior axial implant and one posterior pterygoid implant. If pterygoid bone has also been removed, then it's advisable to put two zygomatic implants, with the distal zygomatic implants emerging in molar region. For unilateral defects, anterior axial implant is very important, since due to anatomic constrains, usually it's not possible or it's difficult to place anterior zygomatic implant mesial to canine region. Anterior axial implant splinted with zygomatic implants minimizes the flexon of zygomatic implants and decreases anterior cantilever.

For bilateral defects, quad zygomatic implants are preferred, along with pterygoid implants if pterygoid plates are spared during debridement. Zygomatic implant placement is usually done minimum three months after the maxillectomy, to rule out any delayed or residual necrosis of bone. Zygomatic implants can be placed under general anaesthesia or local anaesthesia with sedation.

On zygomatic implants and pterygoid implants, either a fixed screw retained or a removable prosthesis can be given. Fixed prosthesis is preferred only when there is no oro nasal or oro antral communication because in case of communication, fixed prosthesis makes hygiene maintenance difficult.

Since in post mucormycosis defects, patient's losses alveolar bone also, so prosthesis needs to replace both teeth and the lost bone. In that case there may be excessive vertical as well as horizontal cantilever present, and an implant supported removable prosthesis may be preferred over a fixed prosthesis. With a removable implant-supported prosthesis it's easier to restore the facial fulness. Considering the excessive cantilever, and unfavourable biomechanical situation, it's not advisable to load these cases immediately. Delayed loading is always preferred.

If there is a large soft-tissue defect, it can be repaired simultaneously with a ZIP (Zygomatic Implant Perforated) flap. In this a radial forearm free flap is used to close soft-tissue defect, with simultaneous placement of zygomatic implants, perforating through radial forearm flap.

CONCLUSION

Zygomatic implants supported prosthesis can be a preferred rehabilitation method in post mucormycosis maxillary defects. It avoids the need for extensive grafting surgeries and provides both functional as well as esthetic rehabilitation with minimum morbidity.

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SURGICAL GUIDES: A NARRATIVE REVIEW

ABSTRACT

Guided surgery allows clinicians to develop a restoratively driven surgical plan, with the ultimate goal of patient-centred, positive outcomes. The use of surgical guides can be a confidence-building and predictable method for implant placement. It can assist the practitioner in avoiding damage to anatomic structures, as well as limiting fenestration and dehiscence of the alveolar ridge at potential implant sites. Surgical guide plays a crucial role to facilitate optimal positioning and angulations of implants. This article aims to sketch an outline on the latest classification, application, fabrication process and implication of surgical guides in implant dentistry.

Keywords: Implant guidance, implant placement, surgical guide, surgical template, implant dentistry

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INTRODUCTION

In recent years, there has been an increase in demand for fixed implant-supported prostheses[1]. Correct positioning of dental implants is crucial to fulfil both functional and aesthetic success[2]. In addition, a well-planned surgery minimizes risks such as sinus perforation, dehiscence, fenestrations, and mandibular nerve damage and prevents contact between a dental implant and the root of an adjacent tooth[3,4]. Moreover, it is possible to check parameters such as the distance between two or more implants, the distance between a tooth and an implant, and implant depth[5,6]. Prosthetic aspects such as the implant emergence profile can also be evaluated by using the abutment projections and some software packages [7].

Surgical guides are advocated during dental implant surgery to assist in the accurate placement of implants[8]. Esthetic consequences of incorrect implant placement include excessive or inadequate interocclusal space, insufficient emergence profile, a visible implant collar, and reduced or missing papillae[9,10]. Surgical guides (stents) are templates that transfer information regarding tooth position(s) to the dentist prior to implant placement[11]. Surgical guides are manufactured in the dental laboratory, manually or using CAD/CAM technology mostly from acrylic resins, on instructions from the restorative dentist to assist with placement of the dental implant in its ideal restorative position. Holes are placed into the surgical guide to guide implant placement[12]. Surgical guides have evolved to be the mean that can aid in this treatment planning and the implementation of that plan[13].

Glossary of prosthodontic terms-8 defines surgical template as a guide used to assist in proper surgical placement and angulation of dental implants[14].

High accuracy in implant placement is of great clinical importance. In a study, Wang et al. concluded that the use of the surgical guide makes a significant difference between the planned and actual positions of the implant, especially at the root apex, implant shoulder, and angulation relative to the manual implantation method[15]. Some researchers said that implant placement using a surgical guide is more accurate than other methods[16]. Preoperative planning using surgical guides can ensure the safety of implant placement and reduce the incidence of complications, which is advantageous for young and less experienced surgeons.

In their study, Yogui examined the survival rate of implant placement in both surgical guides and free-hand methods. The results of his 5-year study on implant survival in patients showed that both techniques have had similar results in terms of survival, with rates ranging from 91 to 100%[17]. In another systematic study, the rate of implant failure in free hand implant surgery was reported to be almost three times that of surgical guides[18].

The results of numerous randomized controlled trials show that implant with guided surgery leads to greater accuracy, less pain and swelling, and shorter surgery time, but is more costly than free-hand implants.

USES OF SURGICAL GUIDES

- Guidance of osteotomy drills at correct position, angulation and depth

- Guidance of implant fixtures at correct position, angulation and depth
- Guidance of amount of bone reduction or bone harvesting if necessary (both soft tissue and hard tissue harvesting [19,20,21].

CLASSIFICATION OF SURGICAL GUIDES

There are different opinions about the classification of surgical guides. For example, Balshi and Garver[22] considered the condition of the patient's teeth as the main parameter and introduced three surgical guide stents for implant placement: (1) Completely edentulous (Figure 1)[23], (2) Partially edentulous design (Figure 2) Slightly edentulous tooth-supported design (Figure 3)[24].

Fig 1: Completely edentulous design

Fig 2: Partially edentulous design

Fig 3: Slightly edentulous tooth-supported design

Considering the remaining dentition and needed accuracy for the guide, they have proposed 4 options in regard to supporting area: tooth supported (Figure 4), tissue supported (Figure 5), tooth and tissue supported (Figure 6), and tissue supported with an accessory fixation for edentulous patients (Figure 7).

Fig 4: Tooth supported guides

Fig 5: Tissue supported guides

Fig 6: Tooth and tissue supported guides

Fig 7: Tissue supported guides with accessory fixation for edentulous patients

A conceptual method is also used to describe different types of surgical guides, which includes three different concepts[26]: (1) Non-limiting design (2) Partially limiting design (3) Completely limiting design. These three concepts are classified based on the amount of limitation that surgical guide templates offer[26].

The Non-limiting design is a simple, unrestricted surgical guide, so called free guide (Figure 8)[25], that tells the operator where to go in relation to the implant site and guide the surgeon on where the future prosthesis would be in relation to the implant, and the operator will decide on other parameters related to the exact angle and position of the implant.

Fig 8: Non Limiting Design

It also provides the surgeon with the best location of the implants without too much focus on the angulation of the surgical drill, therefore allowing too much flexibility; the operator will decide on other parameters related to the exact angle and final position of the implant.

Partially limiting design known as access guide (Figure 9)[25] is somewhat restrictive, which is a guide sleeve that will direct only the first drill used for the preparation of the implant site there, and other preparation steps are done by the surgeon[26].

Fig 9: Partially Limiting Design

Completely limiting design is a completely restrictive surgical guide or the precision guide (Figure 10)[25] wherein all the instruments used for drilling the implant area by that guide, containing the buccolingual and mesiodistal planes, as well as to drill, stops limiting the depth of the preparation and so the final positioning of the prosthetic part[24].

Fig 10: Completely limiting design

Since these guides are more restrictive, decision-making and following surgical procedure that is done during the operation would be less. Considering 3 design concepts and 4 supporting area mentioned before, there could be 12 types of surgical guides[25]. Requiring a free or access guide with tissue support and accessory fixation would be somehow rare; therefore, feasible options for a surgical guide would be as follows:

- Non-limiting, tooth supported
- Non-limiting, tooth and tissue supported
- Non-limiting, tissue supported
- Partially limiting, tooth supported
- Partially limiting, tooth, and tissue supported
- Partially limiting, tissue supported
- Completely limiting, tooth supported
- Completely limiting, tooth, and tissue supported
- Completely limiting, tissue supported
- Completely limiting, tissue supported with accessory fixation.

MATERIALS FOR SURGICAL GUIDE FABRICATION

Traditionally, the more rigid surgical guides are fabricated with an auto-polymerizing acrylic resin or with composite resin. If a guide sleeve is used, it would be embedded in the resin. The guide will extend over the teeth for support and repositioning and this carries the risk of improper seating in a rigid guide if only a small area is not perfect. It has, therefore, been suggested to disclose all rigid guides with a thin layer of VPS (Vinyl Polysiloxane) impression material to adjust those poor contact areas. A less rigid, more flexible guide will usually fit completely even if minor discrepancies were present; however, most acrylic and composite resin guides will not gain retention from below the height of the covered teeth and will not be very stable during surgery. The use of rigid VPS as the main guide material has been advocated as a rapid, simple and relatively inexpensive alternative[20].

It can be technically difficult to position a surgical guide in the edentulous jaw or in patients with limited dentition. It has been suggested, in such cases, to use bone anchor pins or transitional implants to gain further stability of the surgical guide[27]. Surgical guides can be fabricated manually, or by milling and 3D printing.

METHODS FOR SURGICAL GUIDE FABRICATION

Techniques commonly used for fabricating the radiographic and surgical implant guide are conventional free-hand, (CAD-CAM) technology and 3-D printing[28].

Customized Conventional Radiographic Surgical Template

The radiographic template (Figure 11) is the key to the success, since it allows the transfer of the predetermined prosthetic setup to the actual implant planning[29]. Conventional dental panoramic radiography and plain film radiography are usually performed with the patient wearing a radiographic template with integrated metal spheres or rods, sleeves, guide posts at the position of the wax up. Based on the magnification factor and the known dimensions of the metal, the depth and dimensions of the implants are planned[30,31,32].

Limitation: However, panoramic radiography which is still the standard and widely used, has diagnostic limitations, such as distortion, setting error, positional artefacts and there is no information regarding the dimension of bone in bucco-lingual direction[28]. It requires more chair time, leads to stress on the dentist and patient.

Fig 11: Non Limiting Design

Computer Generated Surgical Template (Milling, 3D Printing/ Rapid prototyping)

To overcome the limitations associated with conventional radiographic surgical template, computer generated surgical template have been evolved[32]. A computer generated surgical guide provides a link between our treatment plan and the actual surgery by transferring the simulated plan accurately to surgical site. This surgical guide is made using stereolithography process and is custom manufactured for each patient.

Stereolithography (Figure 12,13) a rapid prototyping technology, a newer outcome in dentistry allows the fabrication of surgical guides from 3D computer generated models for precise placement of the implants. The surgical templates fabricated by this technology are pre-programmed with Individual depth, angulations, mesio-distal and labio-lingual positioning of the implant[33].

Steps in fabrication of stereolithographic templates :-

a. Radiographic template and CT scan procedure
b. 3D computer simulation
c. Fabrication of templates

Fig 12: Stereolithographic models

Fig 13: Fabricated surgical guide made of stereocol resin

Surgical template thus fabricated contains all the necessary planning information. It is customized according to location, type and size of the planned implants.

Advantages:

- More precise placement of implants.
- Preservation of anatomic structures.
- High geometrical accuracy of 0.1 mm.
- Shorter treatment times, surgery times.
- Less invasive, flapless surgery and therefore less chance of swelling.
- Less post-operative strain on dentist and patient

GUIDED SURGERY KIT

Includes (Figure 14) Mucosal punch (14a), Drill handle(14b), Template fixation pins (14c), Retentive anchor driver(14d), Stop key for guided implants (14e), T-sleeve (14f), Guide tubes (14g).

Fig 14: Guided surgery kit - (a) Mucosal punch (b) Drill handle template (c) Fixation pins (d) Retentive anchor driver (e) Stop key for guided implants (f) T-sleeve (g) Guide tubes.

Selecting Retentive Anchor Pins For Various Guides[29,34]:

For Tooth supported guides: If edentulous site is bound by teeth bilaterally, then fixation anchor is positioned in the middle of the edentulous site. If distal edentulous site, fixation anchors are positioned as distally as possible in the arch, not necessarily adjacent to distal edentulous site.

For Mucosa supported guides: At least three in number. Two anchors positioned at distal ends, and one anchor positioned in the centre of edentulous arch. The distal areas or posterior areas usually contain important structures such as maxillary sinus, mandibular nerves. In such conditions, we have to take these structures into consideration and plan more distally as possible. While using a mucosa supported guides, the undercuts are relieved in the labial region where the fixation anchors are attached. Screwing in these areas can lift the guide away from the mucosal tissues. Latter can be prevented by holding the guide initially till at least positioning one screw in position.

For Bone supported guides: Two fixation anchors are enough to rigidly fix the guide to the bone. One on the right side and the other onto the left. In the undercut area, tilting off or lift off of the guide can occur on tightening the screw. Latter is prevented by holding the guide while the second anchor is tightened. It is not a rule that the whole of the guide should contact bony tissue.

STEPS TO USE A SURGICAL GUIDE

Umapathy et al (2015)[34] suggested the following:

Step 1: Diagnosis and treatment planning.

Step 2: Virtual implant and prosthesis planning with software.

Step 3: Selection of particular implant system and components.

Step 4: Planning for the surgical guide compatible with particular implant system.

Step 4a: If more than 3 teeth-tooth borne, if less than 3 teeth -mucosa or bone borne surgical guide.

Step 4b: Selection of anchors (depending on the site, implant number, angulation, anatomical limitation)

Step 5: Surgical guide fabrication (online ordering is possible with most softwares)

Step 6: Disinfection of received surgical guides followed by evaluation of guides.

Step 6a: For teeth supported, evaluate on cast and patients mouth.

Step 6b: For mucosa supported, evaluate on cast and patients mouth, for a mucosa-supported guide, it is recommended to make a surgical index to stabilize the guide during fixation.

Step 6c: For bone supported, evaluate on digital bone model.

Step 7: Verification of specific surgical drills and drill keys.

Step 8: Stabilization of guides in patient's mouth using anchor pins followed by verification of the guide stability.

Step 9: Drill sequence.

Step 10: Fixture installation (possible with safe guides).

ADVANTAGES OF SURGICAL GUIDES

- Reduced manual errors with free hand implant placement
- Allow minimal intervention, minimum postoperative surgical problems
- Accurate and precise implant placement
- Prevention of vital structures in the mouth.
- Predictability - Alertness throughout the whole procedure cannot be maintained. Even experienced hands are associated with decreased quality in comparison to guided implantation technique.
- Good cosmetic results
- Hygiene - Maintenance of proper oral health is ensured because of correct implant placement.
- Longevity and survival of prosthesis aided by quality placement of implants
- Reduction in implant surgery time
- Increased visibility of the surgical site and easy access for flap exposure[1,35,36].

DISADVANTAGES OF SURGICAL GUIDES

- Start-up cost associated with software purchasing.
- Guide dislocation can occur during surgery if the guide is not stabilized.
- Once if guides are fabricated, they do not allow any change or modification from predetermined position if required at the time of surgery.
- Any tissue changes (e.g. Swelling, loss of abutment teeth) between time of ordering and implant installation can alter fit of the prosthesis ultimately functioning of implant prosthesis.
- Guide dislocation also occurs when drilling is intended to penetrate hard bone, producing torsional forces on the sleeves, thus lifting off the guide[29,30].

CONCLUSION

Anatomical variances are a common occurrence among patients. While not all of variances pose difficulties for surgeons to undertake the operation, in different procedures, it may not be the case. With the arrival of the CAD and RPM technologies, taking these differences into account, surgical guides provide the surgeons with help they need in determining exactly where and how to cut. This not only helps with giving the patients the personalized treatment that is the best for them specifically, but also simplify the procedure for the surgeons[37].

While it is true that there are extra costs associated with the use of surgical guides, it has been suggested that the clinical benefits and the financial benefits that come along with reduced operating time causes balances or at least mitigate these extra costs[38,39].

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