



Case Report



The Replacement of Missing Mandibular Incisor with Single-Crown Mini-Implant Restoration



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Abstract

In cases of missing mandibular incisors, mini dental implants can be used to overcome limitations of bone volume that doesn't allow the placement of standard-sized implants. This article describes a 48 years old female patient who presented in the department of prosthodontics with a defective dental supported restoration of an unhealthy mandibular incisor which imposed its extraction. After clinical and radiographic study, the minimal bone volume could only accommodate the placement of a mini-dental implant to support a metal ceramic mandibular incisor.

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Introduction

Dental implants are considered as a treatment of choice for replacement of all forms of tooth loss. Apart from providing function and esthetics similar to natural dentition, they also provide the most conservative treatment option^[1]. Their use to replace natural teeth has become commonplace in contemporary restorative and surgical dental practices throughout the world. Substantiation of their efficacy has been well documented in the dental literature^[2]. In fact, the use of conventional implants is suggested to allow favorable contact surface between the bone and the implant itself. Occasionally, lack of space does not allow to place implants of such dimensions^[3]. Standard-sized implant requires adequate bone width, and interdental space: they appear problematic in small space between the teeth where the implant was supposed to be placed, in areas in which bone resorption had occurred, and in cases where edentulous arches were with minimal bone in a facio-lingual or mesio-distal direction^[4] that could lead to augmentation and additional surgical procedures which can be used to overcome these problems. But, this can increase the duration of the treatment, morbidity, and mainly the cost of the treatment. It can also cause post-operative pain, and discomfort for the patient^[5]. The mini-dental implants (MDIs) can be used in many such cases to overcome these kind of limitations. They are endosseous implants made of titanium alloy, and have diameter ranging from 1.8 to 3 mm with length ranging from 10 to 18 mm. They were introduced commercially to the dental profession in the 1990s^[6,7]. MDIs were initially designed for the temporary stabilization of a prosthesis during the healing period of conventional implants. However, research has suggested that the pull-out strength of endosseous implants may be based on the length rather than the diameter of the implant, and histologic analysis has shown that mini-implants undergo osseointegration comparable to that of larger-diameter implants^[1,3]. Recently, they have become popular in use for orthodontic anchorage, periodontal therapy, fixed prosthetics, and complete denture stabilization^[7,8]. The best candidates have good general and oral health and gum tissues that are free of periodontal disease since the mini-implants are intimately connected with the gum tissues and underlying bone in the mouth, according to the American Dental Association (ADA). Suggested indications for use for MDI include patients with inadequate bone width; older or medically compromised patients who would benefit from the preservation



of blood flow to the implant area as a result of the flapless insertion technique^[6]. MDIs are also indicated as the sole support of single-tooth replacements in the bone areas less than 6 mm in the facio-lingual orientation and 10 mm in a crestal-apical orientation^[4]. In situations where there is a missing tooth with small cervical diameter, in cases of reduced inter-radicular bone (convergence, or close proximity of adjacent tooth roots), and restricted inter-occlusal space, MDIs may be appropriate. They have also been shown to be viable alternative to bone augmentation when poor alveolar ridge width is encountered^[2,9-11]. This often occurs in situations of congenitally missing teeth, thin posterior ridges that would require bone augmentation and in the mandibular incisors areas^[2,3]. The average width of a mandibular central incisor is 5.3 mm at the height of contour and 3.5 mm cervically. This extremely small spacing creates several restorative challenges and limitations. Regardless of the type of abutment selected, it can be difficult to create a healthy emergence profile that mimics the adjacent natural teeth^[10].

This article describes the replacement of missing mandibular incisor with MDI supporting metal ceramic single-crown, and highlights the advantages, and the success of this therapeutic modality.

Case Presentation

A 48-years-old woman with insignificant medical history, presented at the department of fixed prostheses in dental clinic of Monastir. The patient reported excessive mobility and pain in the right mandibular central incisor, which was restored by fixed metal ceramic crown. Periodontal examination revealed a defective restoration with biological failure related to the lack of oral hygiene, and accumulation of plaque and calculus in the anterior teeth, especially around the right mandibular central incisor (Figure1). This latter showed to be extruded, and presented grade3 mobility (Figure2). Periapical radiograph revealed excessive bone loss around its root, which required the extraction of the teeth and its replacement (Figure3). Clinical and radiographic evaluations revealed 5 mm of mesio-distal bone in the central incisor location, and slightly less than 5 mm of mesio-distal diameter between the right lateral and the left central. After the extraction of the central incisor, a removable denture was placed not only to guide tissue healing, but also to maintain the space between incisors. Once the edentulous crest was healed, cone beam computerized tomography was made to assess bone parameters, and to plan implant placement sites. For that, the removable prosthesis was utilized as a radiographic stent. The result was in favor of MDI supported single restoration. The next step was to determine the suitable MDI size: a diameter of 2.5 mm, with 13 mm of length were selected (MSP30133R, MS System, OSSTEM). Then, the surgical stent was placed to mark the implant placement position through the stent opening. Local-regional anesthesia in the region of mental foramen was administrated. The pilot hole was made using a 1.2 mm pilot drill to 60% of the length of the MDI. A pilot drill guide was utilized to position the pilot hole in the center of the surgical stent, and to maintain a correct trajectory of the drill. Then, a parallel pin was used to check the parallelism of the implant position. The sequence of 1.8 and 2.3 mm drills was made. The implant was removed from its package using contra angle adapter. It was inserted into the pilot hole, and slowly rotated clockwise with drill instrumentations (Figure4). A periapical radiograph was made

to confirm the desirable position of the MDI in the mesio-distal center of the edentulous space without compromising adjacent teeth. A temporary cap was used to make temporary prosthesis allowing immediate esthetic rehabilitation, and was inserted with clipping (without cementation) which is in favor of tissue healing without compromising periodontal health. The interim crown was kept out of occlusion with minimal interproximal contact. Postoperative instructions were given and appointment was scheduled after 7 days to control the mucosa healing. The patient reported minimal discomfort post operatively. After one month, a definitive impression was made using impression coping (Figure5,6). This allowed a precise impression work. After the lab analog was placed into the coping, and the cast model was made, the plastic coping was used by the laboratory technician to perform the framework of the future porcelain-fused-to-metal crown. Intraoral checking of the framework revealed a perfect marginal adaptation due to the use of the impression coping. After veneering with feldspathic ceramic, and intraoral checking, single crown was glazed, then cemented to the MDI (Figure7-9). Periodic follow-up visits were scheduled to monitor to MDI, and health of the gum.



Figure 1: Front view showing the biological and esthetic defect of the fixed restoration



Figure 2: Front view showing the extruded mandibular central incisor

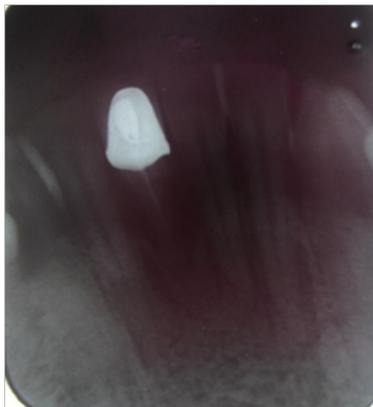


Figure 3: Periapical radiograph showing the bone defect around the central incisor's root



Figure 7: Front view of the definitive metal ceramic restoration

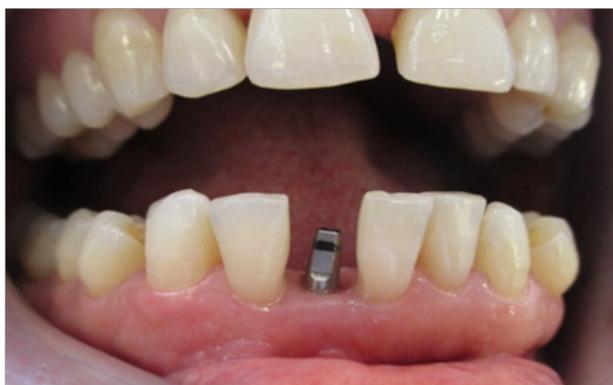


Figure 4: Photograph showing the healing of the mucosa one week after the one piece MDI placement.



Figure 8: Lateral view showing the alignment of the single-crown mini-implant restoration with adjacent teeth.



Figure 5: Plastic impression coping placed into the MDI



Figure 9: Lateral view of the patient's smile



Figure 6: Master impression after analog placement.

Discussion

If an implant site is inadequate, augmentation techniques can facilitate standard-sized implants placement in deficient ridges. Nevertheless, they have drawbacks such as prolonged treatment times, morbidity, and expense. MDI may be an appropriate alternative to conventional implants in the appropriate cases. Proposed advantages of their use include a less surgical time, and flapless procedure compared to normal implant, reduced bleeding, decreased post-operative discomfort, placement into narrow ridge, and immediate loading^[2,9]. MDIs produce less osseous displacement, and may present less of a barrier for osseous healing and angiogenesis for osseointegration due to their

small size^[6]. Histological evaluation showed that bone was in close adaptation to the MDI implant surfaces and vascular elements were apparent in the bone. The bone around the MDIs appeared to be healing, mature and well integrated into immediate function in the four to five month post-insertion period. Although the MDIs have a reduced surface area compared with standard-sized implants, histology has shown that the MDIs undergo osseointegration. Their ability to avoid flap surgery aids in healing as the periosteum is left undisturbed, and gingival healing is seen in 2 to 5 days. The healing period may be shorter than that for conventional implants^[2,9].

MDIs are one piece without abutment micro gap and have much less physical displacement, which may be responsible for their long-term survival rate. This can simplify the restorative phase resulting in a reduced cost^[2,6]. Raghani, et al.^[9] reported that radiographically, all the MDIs showed absence of interfacial radiolucency. Gingival inflammation and plaque formation was found to be less, and bleeding on probing was present at one implant site, which indicated that patients with single-tooth implant replacement exhibited good oral hygiene. On the other hand, Vigolo, et al.^[12] showed that cementation of implant restorations avoids anesthetic screw access openings, and problems related to the development of unstable and occlusal contacts.

When replacing mandibular incisor, a limitation comes from the space requirements for the material used. With such limited space available, adequate thickness for esthetic ceramic systems may not be possible. A cement-retained implant crown would require an additional 0.3 mm for the crown coping material, leaving only 0.6 mm for porcelain. The inadvertent result of inadequate room for these restorative materials is either a restoration that is over-contoured, and therefore unhealthy for the surrounding tissues, or one that is opaque and unaesthetic. Implant systems are available with differing dimensions; therefore, it is the restorative dentist's responsibility to dictate implant sizes prior to placement and understand the implant system being used^[10]. Such tissue complications around MDIs were reported as moderate inflammation, edema, redness, and bleeding on probing. However, they were easily resolved with good oral hygiene instructions, and do not compromise osseointegration^[9].

Researchers reported that failed MDIs presented as being mobile or fractured may have been due to placement in inadequate bone sites or use of implants of inadequate length^[7]. The clinicians must have knowledge of the osseous contour of the underlying bone because the implants require osseous support for proper osseous integration and long-term function. Without proper support, osseous dehiscences or fenestrations may result in an early or late failure under load. Computerized tomographic scans or ridge-mapping techniques can provide the clinician with contour information to ensure proper implant placement^[2]. Vigolo, et al.^[3] reported that the results achieved by the MDI rehabilitation were similar to those reported for standard single-tooth implant restoration. They concluded 94.2% survival rate of 52 MDIs for single tooth replacement in a retrospective 5-year study.

Besides, Balaji, et al.^[5] focused on 2.4 diameter implant for single tooth restorations summarized a 90.9% success rate with satisfying results of the implants-mucosa interface.

In addition, Degidi, et al.^[13] reported that anatomic locations, bone quality, esthetic considerations, and protective

occlusal schemes are keys to ensure successful treatment outcomes. For that, suggested initial guidelines for MDI use must be respected by practitioners to ensure esthetic, functional, and mainly biological success: type I and II bone sites are most appropriate for MDIs, minimum of 1mm thickness of facial and lingual cortical bone, minimum space of 0.5 mm between MDI and the adjacent tooth, approximately 100 µm occlusal relief, and implant protective type of occlusal scheme for fixed prosthetics^[2]. Because of the flapless surgical technique most often utilized with mini implants, a surgical stent designed from pre-operative dental models, x-rays, and/or cone beam CT scans provides for proper angulation in the bone to ensure closely parallel MDIs. So, that no preparation of the abutment will be required while having passive fit^[2,7].

Conclusion

MDIs can be used successfully in a variety of clinical situations. Their advantages include less surgical time and post-operative pain, ability of direct loading after surgery with no harm to bone, and cost effectiveness. The single-tooth mini-implant restoration can be a valid alternative in many clinical situations in which space problems do not permit the use of standard-sized implants, and mainly for the replacement of a single missing mandibular incisor. MDIs show high survival rates, but special cautions for bone quality, and good oral hygiene should be maintained.

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