Implant Placement in the Aesthetic Zone: Using Digital Technologies to Maximize Efficiency and Minimize Chair Time in the Post COVID-19 Era - A Clinical Case Report

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Introduction:

The onset of the Coronavirus global pandemic has created several challenges for the dental practitioner. Despite these difficulties, demand for continued dental treatment remains strong for patients suffering from dental ailments and, in particular, dental emergencies. The objective of a dental practice working through these trying times is to provide relief to these patients in a safe environment. Particular concern is given to maximizing clinical efficiency whilst keeping chair time to a minimum to limit any unnecessary exposure to patients and staff alike.

Tooth fractures are typically considered emergencies that require immediate attention not just to provide relief, but because if left untreated, can result in additional damage and long-term irreversible changes to the existing anatomy that can result in their long-term treatment becoming more challenging, time-consuming and costly. The fracture of teeth in the esthetic zone can be a particularly harrowing experience for patients as it can affect their speech, physical appearance and general self-confidence in addition to physical discomfort and compromised masticatory function.

This case report documents the clinical presentation and subsequent treatment of a patient who suffered from simultaneous fracture of both his maxillary central incisors in an un-favourable manner that rendered them untreatable using conventional tooth-saving treatment measures. A treatment plan was devised to extract these fractured tooth remnants, limit dimensional change of the remaining dental structures and provide a long-term replacement of the extracted teeth using dental implants while still respecting the limitations that the on-going global pandemic has placed on our profession.

Materials and Methods: Numerous digital technologies were used to aid the planning and execution of this treatment to allow for fewer and shorter appointments. During the initial consultation with the patient, a cone-beam CT scan (Galileo's by Sirona GMBH, Germany) was taken to gain an insight towards the condition of the alveolar bone surrounding the remaining tooth remnants. An intraoral scan was also taken using a hand-held intra-oral scanner (Medit i500, South Korea) to capture the oral tooth and soft tissue morphology. These two data sets were imported into an independent implant planning software (Blue Sky Plan, USA) and merged together. This allows for an understanding of soft tissue thickness surrounding the planned implant sites as well as a better visualization of the location and shape of the proposed replacement teeth to determine the position of the dental implants. A surgical guide was then designed in the same implant planning software. It composed of channels of a pre-determined diameter based on the size of the implant drills directly above the planned implant positions. Around these channels, a scaffold was designed to sit on the adjacent teeth and hold the guide in a stable position. This was then exported as an STL file and 3D printed in-house using a dental 3D printer (Moonray S, Sprintray, USA). Finally, a removable acrylic partial denture was designed from the intraoral jaw scans to provide an interim restoration during the healing period.

The second visit involved the delicate extraction of the broken teeth while exercising caution to preserve the surrounding periodontal structures. Once removed, the root sockets were assessed to verify that there was no residual granulation tissue and that the bony walls were intact. The surgical guide was then inserted and its fit checked to ensure a stable position. An implant surgical kit (R2 Gate Surgical kit, Megagen, South Korea) designed specifically for use with surgical guides and a fully guided drilling protocol was used to create the implant osteotomies in the position that had been determined with the aid of the planning software. Digital radiographs were exposed chairside intermittently to verify the angulation and depth of drilling remained true to the desired positions. The implants (Any ridge 3.5x15mm, Megagen, South Korea) were then inserted through the surgical guide and their cover screws placed. Bone substitute (Beta-TCP, Megagen Bone Plus) was placed around the implant to fill the gaps between the implants and the surrounding bony walls and the cover screws were replaced with taller healing abutments to allow for a single stage surgical protocol. Stock titanium healing abutments were used as opposed to customized chairside healing abutments or provisional restorations to minimize the need for adjustments using aerosol generating procedures and to keep the appointment duration as short as possible. The previously fabricated partial denture was then inserted to restore the patient's esthetics and function without placing any additional stress to the newly placed dental implants. This ensures an adequate undisturbed healing occurs without complications and without the need to see the patient until the implants have healed.

Prior to the patient's third visit 6 weeks later, the initial intraoral scans were duplicated and edited to crop out the region of interest around the maxillary central incisor region. The healing abutments were unscrewed, and a digital impression of the implants was acquired without the need of any physical materials. This digital file was then sent to our dental technician for design and fabrication of the implant-supported provisional restorations. We were able to request modifications of the CAD proposal remotely and approve the final design before receiving the work back from the laboratory.

During the fourth visit, the provisional restorations were attached to the healed implants, restoring the patient to normal function. A plan will be made to finalize these in due course as the dental industry begins to allow for elective dental procedures.

Conclusions: The purpose of this report is to show how digital technologies can be adapted to our conventional diagnostic and clinical workflow to accurately diagnose and plan dental implant procedures, gain a better understanding of the patients anatomy, improve surgical efficiency and communicate with the dental laboratory personnel without the need for sending disinfected, but potentially still contaminated physical impressions and stone models of the patient back and forth.