Natural teeth and implant supported fixed partial denture: a case report

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THE CASE
A 30 years old man presented with the main complaint of loose lower denture with which he was unable to chew and speak properly. The loss of multiple teeth (fig.1) was from an alleged roadside accident and it was also associated with multiple fractures of the lower jaw. Upon clinical examination, it was found that the mandibular teeth distal to the left lateral incisor, except for the impacted wisdom tooth, and multiple teeth in the maxilla were missing. Periodontal probing and radiographs revealed that the remaining teeth were healthy. The lower anterior teeth were slightly proclined and spaced. It was decided to initially restore the left and right quadrant of the upper arch with a porcelain bridge each, involving the remaining upper teeth on the left and the right quadrant separately. After completing the restoration of the upper arch, it was then decided to restore the edentulous lower left quadrant by a rigid, conventional fixed partial denture, supported by two endo-osseous implants as the distal and intermediate abutments, and the teeth nos.31, 32, 41, 42 and 43 as the anterior abutments. The type of the two implants that were used was the two-stage DFI system of the Alpha Bio Implant Ltd., Germany. An Orthopantogram (OPG) of the mandible showed a bone thickness of 13mm above the mandibular canal in the posterior region.

Surgical procedure
First surgical phase: An incision was placed at the crest of the edentulous ridge and a mucoperiosteal flap was raised to expose the crest of the bone. An Osteometer was used to assess the bone volume for determining the implant diameter. A crestotom bur was used at slow speed to shape the implant site. The patient's old denture was used as a surgical template creating a pathway for the drill, each along the axis of the first premolar and the second molar present in the denture. The pathway for insertion of each implant was prepared at the sites determined by the template, with a slow speed drill, graded from 2 to 4mm. in diameter, and the two pathways were passed by a screw tap to remove the bone.
debris. The depth of the drill channels, as measured by the depth gauze, was 18mm and 11mm at the premolar and the molar sites respectively. A 4.5mm diameter implant prefixed with an insertion mount, the length of which was equal to the depth of the corresponding bony channel, was engaged to the tightener and gently screwed to the full depth of each channel, so that the fixture head was slightly countersunk (fig.2). A cover screw was inserted into each fixture hole and the flap was then closed and sutured.

**Second surgical phase:** A crestal incision was again given, 4 months later, to expose the implant fixture and to verify osseointegration. After removing the cover screw, a healing cap was screwed to each fixture followed by suturing of the soft tissue to form a collar around the healing cap.

The transfer coping was then separated from the implant analogue which remained embedded in the lower cast. The 2 implant analogues in the cast were attached with an implant abutment each. The bite was then registered and the 2 casts were mounted in the articulator. A 10-units porcelain bridge was then fabricated involving tooth nos. 31, 32, 41, 42, 43 and the two implants as abutments. The implant abutments were attached to the implant fixtures by screws. The bridge was then fixed to the natural teeth abutments and the implant abutments by polycarboxylate luting cement to restore the missing teeth (fig.3). Implant specific oral hygiene instructions were given after finally completing the restoration.

**Follow-up:** Follow-up was done at 1 month (fig.4), 3 months, 6 months and yearly, thereafter, till the 5th year (fig.5) for clinical and radiographic examinations. Signs of implant failure were checked and patient’s compliance with implant-specific oral hygiene programme was monitored during the follow-up period.
Discussion

The highly predictable clinical outcome of osseointegration has led to its applications in various prosthetic situations, leading to the development of as many as 5 dental prosthetic designs, namely FP-1, FP-2, FP-3, RP-4 and RP-5 [1, 2]. The connection of natural tooth and osseointegrated implant, as abutments, by a fixed partial denture (FPD) has raised questions because of the disparity in movements between the tooth and the implant [3]. Intrusion of natural abutment tooth, pronounced vertical bone loss around the implant abutment, peri-implant infection, breakage of implant components, and damage to the abutment teeth are reported to be associated with such tooth-implant supported FPD design [4-6]. Bone loss is explained by the displacement of the abutment tooth transferring unfavourable load to a non-resilient implant abutment at the other end [3]. Theories for intrusion of tooth include lack of normal stimulation of the periodontal ligament leading to its atrophy and subsequent intrusion of the tooth, and failure of rebounding of the tooth after its initial functional depression which is related to defective non-rigid connectors [5]. While complications support an avoidance of certain types of such dual-support prosthesis, there are reports of its successful use, with equal predictability being mentioned regarding both the completely implant supported and the tooth-implant supported FPD [4, 7, 8]. High concentration of stress, demonstrated by stress analysis, around the neck of the implant connected rigidly to teeth are not reflected clinically [9]. Though, a nonrigid connector is to compensate for the disparity in movements of the implant and the tooth abutment, the issue of using either a rigid FPD or a nonrigid connector remains unsolved with growing evidences favoring a short-span rigid connection with non-mobile teeth [3, 9]. Tooth intrusion, increased tooth-implant displacement ratios and increased prostheses stress are associated with nonrigid connectors [3, 6, 9-11]. Totally implant-supported prostheses is the treatment of choice [3]. Ideally, an implant is required for each missing tooth to be replaced, even resorting to bone grafting to provide adequate bone for insertion of the required number of implants [12]. However, a situation where teeth may be connected to implants would be the region of the mandible distal to the mental foramen where anatomic restriction prevents the insertion of adequate number of implants of appropriate size. In our case, the mandibular teeth distal to the left lateral incisor were missing, except for the impacted wisdom tooth. Normally, the region of the mandible anterior to the mental foramen provides the entire height of the mandible for insertion of implant of adequate length. In our case, because of trauma related bony defect in the canine region, we decided to insert the anterior implant in the 1<sup>st</sup> premolar region for a more durable osseointegration. A 2<sup>nd</sup> implant of 11mm length, as permitted by the available bone above the mandibular canal, was inserted in the 2<sup>nd</sup> molar region. Considering the financial restriction against additional implants, the unaesthetic anterior teeth of the patient and the situation where a completely implant-supported FPD would have created a cantilever canine pontic, it was decided to fabricate a dual-support FPD of 10 units, which included the remaining anterior teeth as the natural abutments, and the
two implants as the intermediate and the posterior abutments. Splinting of multiple teeth as a combined natural abutment unit to bring natural abutment mobility to 0, and also when the crown-root ratio is less than 1:1, is desired for abutment resistance to displacement in a dual-support FPD [3]. Anterior tooth has greater mobility and is subjected to great lateral forces during excursions and, hence, should not be joined to an implant unless it is a "living pontic" or part of a restoration using a splinted arch concept for stress distribution [12]. In our case, the 5 remaining anterior teeth were joined together as a single unit and were connected to the implants by a rigid FPD. Occlusal overload of implant is one of the main causes of implant failure in later stages, while improperly splinted abutments, cantilevered pontics and improperly positioned implant are among the factors related to implant overload [13]. Our treatment plan and prosthetic design took the above factors into consideration. After a follow-up period of 5 years, our case was not associated with any of the indicators of implant failure like persistent pain, peri-implant infection, neuropathies, implant mobility, continuous peri-implant radiolucency or annual bone loss of more than 0.2mm.

Conclusion
The case is reported because of the impressive clinical function of the dental restorative design used in this case, during the follow-up period of 5 years, when the prevailing attitude in the profession is against such a design. As in our case, when there is financial limitation for additional implants, no bone to support adequate number of implants and when bone grafting is to be avoided in such a situation, a natural tooth-implant supported FPD may be designed as a less expensive and simple option, if bounded by certain guidelines. When guided by certain prudent concepts, as shown by our case, such as involving adequate number of natural teeth as abutments till the mobility of the combined teeth is zero, inserting implant of substantial size, attaching short span pontic, superior crown cutting of the abutment teeth for stability, using superior luting agents, avoiding unbalanced tooth contacts in various mandibular positions and avoiding non-rigid connectors, the adverse affects reported with such a hybrid prosthesis may not be experienced.

References

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