FULL MOUTH REHABILITATION WITH NATURAL TOOTH AND IMPLANT CONNECTED COMBINATION PROSTHESIS: A CASE REPORT WITH REVIEW

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ABSTRACT

Connecting teeth to osseointegrated implants presents a biomechanical challenge. It is due to the implant being rigidly fixed to the bone and the tooth being attached to the bone with a periodontal ligament. This paper reports a case of patient treated with dental implant as alternative to replace the missing teeth and connected with natural tooth as abutments in a fixed restoration. The result shows that even after one year of the treatment, there is no disadvantageous effect of connecting teeth to implants as abutments in fixed dental prosthesis and there is no sign of a harmful effect to the opposing teeth either.

Keywords: Dental implants, natural tooth, rigid connection, connecting implant to natural tooth, osseointegration

INTRODUCTION:

'All truth is definable only at the time and instance of its application'

Every historical truth should be evaluated precisely with development in information and technology. This statement also applies to tooth-implant connection. It appears that connecting tooth to implant despite this historical truth that 'they cannot be directly connected' is a useful option in appropriate cases.[1] Based on declaration by 'Academy of osseointegration' in 2001, one of the most argued issues in the field of fixed partial dentures (FPDs) support is probably the combination of teeth and implants.[2]

REVIEW OF LITERATURE

The history of connecting implant to the natural teeth dates back to early 1980s, when there was no implant with anti-rotational feature. So connecting implant to teeth was done to prevent rotation of the restoration and its complications.

Core-vent (Zimmer), in 1984 introduced the first anti-rotation implant abutment that had an 'adjustable narrow neck'. So to overcome this weak link, tooth-implant connection was made necessary.

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In 1986, the first screw retained abutment without any anti-rotational feature was introduced, which necessitated tooth-implant connection.

Dr. John Beumer (1988) introduced the first screw retained abutment with anti-rotational feature, 'The UCLA Abutment'.[3] With this invention, creation of free standing implants without the tooth-implant connection became feasible for the first time.

Akagawa et al. (1998) performed a comparative analysis of tooth-implant supported prosthesis (TISP) and implant-only supported prosthesis (ISP), in monkeys for 2 years and concluded that teeth connected to implants with rigid connectors performed well as bridge supported by natural teeth. Gunne et al.(1999)[4] and Lindhe et al.(2001)[5] also reported that bone resorption around implants incorporated in a TISP was similar to the bone loss adjacent to the implant in an ISP when assessed within the same individual. Hosny et al.(2000)[6] compared the free-standing and tooth-connected implants for a period of 14 years and found that the amount of marginal bone loss in either situation did not differ significantly. Thus stable bone levels around the implants suggest that excessive loads to implants did not occur when they were connected to teeth.

CASE REPORT:

A-46-year old female patient came to the department with chief complaint of difficulty in chewing. Clinical examination showed that in the maxillary arch teeth 11,13,14,21,22 and 23 are present and in the mandibular arch 46,43,31,32,33,34 and 37 are present. (Fig. 1) Patient wanted a fixed replacement for her missing teeth.

Fig. 1: Pre-Operative View

Treatment Planning:

In the mandibular arch sufficient number of abutment teeth were present, so a conventional fixed dental prosthesis was planned. Teeth 22 and 13 have poor prognosis, so extraction of these teeth was planned. As fixed partial dentures are contraindicated in bilateral distal extension situations, due to absence of distal abutments, additional support taken by placement of implants was planned in the maxillary arch.

Procedure:

First, the mandibular teeth were prepared to receive a conventional fixed dental prosthesis. (Fig. 2)

Fig. 2: Conventional Fixed Prosthesis In Mandibular Arch.

In the mandibular arch, fixed dental prosthesis was cemented in the patient mouth. (fig. 3)

Fig. 3: Cemented Fixed Dental Prosthesis In Mandibular Arch.

When the patient was fully comfortable with her lower fixed dental prosthesis, the treatment for maxillary arch was initiated. The 13 was extracted because it was badly damaged and incapable of giving any support to the prosthesis. A full thickness muco-periosteal flap was raised in the maxillary arch in the region of 15 to17 and 25 to 27 regions. In the right and left quadrants, two implants on each side were placed in 2nd premolar (3.5 mm × 11.5 mm) and 2nd molar (5.0 mm × 11.5 mm) regions. (Fig. 4)

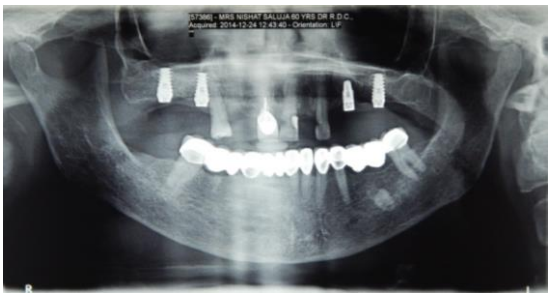

Fig. 4: Implant Placement In The Maxillary Arch

A total of four implants were placed in the maxillary arch. The flap was closed with sutures. The patient was covered with antibiotic, anti inflammation and analgesic drug during the healing process. Clinical symptoms as pain, implants mobility and sign of inflammatory process were not presented. Chlorhexidine mouth rinses was also prescribed for preventing wound infection and maintaining the normal oral hygiene After 1 week, the sutures were removed.

Six months after the implant placement, flaps were raised to locate the implants and abutments were attached to them and adjusted to obtain proper occlusal clearance and finish lines. After attaching abutments to the implants patient was recalled after one weeks so that the injured gums around

the implants can be healed. In the next appointment, teeth 11,14,21 and 23 were prepared and final impression of prepared teeth and implant abutments was made with putty reline technique. (Fig. 5)

Fig.5: Teeth and implant abutment preparation

In the right quadrant natural teeth 11,14 and implants in the region of 15,17 were used as abutments and a fixed tooth supported prosthesis was fabricated from 11 to 14 and an implant supported prosthesis from 15 to 17. In the left quadrant natural teeth 21,23 and implants in the region of 25,27 were used as abutments and a single fixed prosthesis was fabricated from 21 to 27. First metal try-in was done (fig. 6) and then final prosthesis was cemented (fig. 7).

Fig. 6: metal try-in

Fig.7: final cementation

The patient was recalled at every one month for routine check up and up till now it has been one year after the prosthesis cementation and there was nothing wrong with the treatment.

DISCUSSION:

The rational of using tooth-implant connection: [7]

The reasons of connecting the tooth to the implant are summarized in five categories:

• To gain support from the tooth or implant: As an example in the patients with bruxism, proprioception of the tooth may help to reduce applied stresses to the implants.

• The absence of other options: Because of systemic, local or financial limitations, bone augmentation and insertion of additional implants are not always possible.

• To preserve a key tooth or teeth with good prognosis.

• To provide stability against rotational forces.

• For esthetic reasons. Implants unlike natural teeth always present challenges with regard to esthetic. Furthermore, retaining the tooth preserves the adjacent papillae.

The causes of potential problems:[8]

The virtual problems refer mainly to the difference in the tooth and implant supporting mechanisms. PDL causes greater movement in the tooth. Lateral movement of the teeth is about 56 to 108 µm in comparison to 10 to 50 µm in the implant with the same force magnitude; apical movement of the tooth is 25 to 100 µm and that of the implant is 3 to 5 µm. When force is applied to the pontic connecting the tooth to the implant, this difference can cause greater stress on the implant.

The other cause of potential problems is difference in survival rates of the tooth and implant. The tooth, as opposed to the implant, might decay or need endodontic therapy. These problems may cause the whole system failure.

The advantages of connecting the tooth to the implant:[9]

• Broadened treatment possibilities.

• Reduced cost (reduction of implant numbers).

• Protective value of proprioception provided by tooth.

• Desire to splint a mobile key tooth to an implant.

• Additional support for total load on dentition.

• Reduction of the need for a cantilever.

• Preservation of the papilla adjacent the tooth for esthetic and phonetic reasons.

• More favorable bone reaction when the bridge is connected to both the implant and teeth.

Cavicchia reported that problems such as loosening and fracture of fixation screws and abutments, ceramic fracture and tooth migration seem to occur more frequently in free standing

implants compared to the tooth connected restorations. This result can be related to the decrease bite force in tooth-implant supported prosthesis because of tooth related proprioception.

Disadvantages: [10]

• Technical problems, such as implant or tooth fracture, tooth intrusion, cement bond breakdown,screw loosening and prosthetic materials fracture.

• Biological problems, such as peri-implantitis, endodontic problems, lose of tooth or implant, caries and tooth fracture.

Intrusion of the tooth is one of the most debated topics in the literature. Intrusion of the tooth in TISP has been reported particularly with nonrigid connectors.

Etiology of intrusion

The cause for intrusion is unknown and several theories have been proposed. The cause may be multifactorial depending on the clinical situation and includes disuse atrophy, mechanical bending and impaired rebound memory.

Intrusion theories:[11]

FPD flexure:

When a tooth connected to an implant, through keyway stress-breaker is loaded occlusally, the frictional resistance between the patrix and matrix attachments prevents the free movement of natural tooth. So with each application of apical loading force, the tooth is depressed slightly and is prevented from rebounding totally. This leads to intrusion.

Differential energy dissipation:

It is theorized that a natural tooth that supports an implant restoration receives an abnormally high level of mechanical stress, which activates the osteoclasts surrounding the root than the implant. This results in **intrusion.**

Impaired rebound memory/Ratchet effect:

A constant excessive force on a tooth causes its periodontal ligament to loosen its elastic memory and to remodel to a new less traumatic position. This new position of the tooth acquired is apical to its original position. The tooth will continue to move farther apically until no compressive force is placed on the periodontal ligament.

In conclusion, the potential for intrusion of an abutment tooth cannot be ignored; however, it should not be a deterrent from connecting teeth to implants. This dilemma can be avoided by proper patient selection (avoidance of those with bruxism), use of rigid connectors, avoidance of placing copings on teeth used as abutments, proper abutment preparation (parallel walls) to maximize retention and resistance form, and permanent cementation.

Intrusion phenomena associated with tooth implant supported prosthesis:

Intrusion is a major complication associated with tooth implant supported prosthesis whether rigid or non- rigid connectors are used and have been extensively debated in literature. The phenomenon of intrusion is troublesome for

the patient and on the other hand a challenge for the clinician.

5. **The available methods of connection are as follows:**

Celso Hita-Carrillo has classified the methods of connection into two main groups: Rigid and nonrigid connection.

• Some authors believe that rigid connection of the teeth to the implants is not rational due to the adverse effects on the implant in long-term.

• It will produce greater marginal bone loss, with a corresponding increase in probing depth around the supporting abutment (tooth or implant).

Types of connection:[12]

The type of connection used in tooth implant supported prosthesis is of three types:

1. Rigid connection: The tooth is rigidly connected to the implant with a fixed dental prosthesis.

2. Non rigid connection: The tooth is non-rigidly connected to the implant by means of precision attachments, non-precision attachments. It acts as a stress breaking element.

3. Resilient connection: It incorporates a flexible component that simulates the periodontal ligament. It acts as a stress absorbing element.

Rigid versus non rigid versus resilient connection:

Rigid connection has been considered as an acceptable procedure by many authors who reported survival of restoration with the rigid connectors on account of the decreased rate of mechanical failure.

Different types of non rigid connectors are described with most common being key and key way. The placement of the key way on the natural teeth seems to be beneficial as it would allow for physiological tooth movement under function. Biomechanical studies demonstrate that a shift of force distribution from the superstructure to the supporting teeth occurs when non- rigid connectors are used and tooth intrusion was considered as potential complication of non-rigid connection with frequent emergency appointments. Rigid connection achieves better outcomes with regard to avoiding dental intrusion. [13]

Guidelines: [12]

Guideline 1: Splint implants to natural teeth only when the teeth need support: Teeth do not stabilize implants:

when a decision is made to include weakened natural teeth with an implant-supported prosthesis, the method and

placement of attachment for the natural abutment to the implant supported abutments must be decided. Becker et al., suggested to splint implant to two teeth when non-rigid connectors are considered. The process of double abutting the natural teeth greatly reduces the chance for intrusion but may not totally eliminate the occurrence.

Guideline 2: Do not end the fixed prosthesis on the weakest splinted abutment:

A weak tooth does not offer additional support and further burdens healthier abutments. Natural abutments connected to rigidly fixated implant should not exhibit clinical mobility or poor retentive form**. A natural tooth with no clinical mobility could be connected rigidly to an osseointegrated implant because the implant, bone, and prosthesis compensate for the slight tooth movement.** However, the occlusion should be modified to allow the initial occlusal contacts on the natural tooth so that the implant does not bear the major portion of the initial load.

Guideline 3: Regardless of the connection teeth must be cemented using definitive cement:

Tooth pushes 28 microns but rebounds only to about 8 microns. The fixed prosthesis rebounds and pulls on the tooth. The cement eventually breaks, causing a space to develop. The prosthesis acts as a orthodontic appliance and pushes in the vertical direction. When a natural tooth acts as a pier abutment it must be considered as a pontic as it does not contribute to the support of the prosthetic load.

Guideline 4: For a natural pier abutment between two implants a stress breaker is not indicated:

When a natural tooth serves as a pier abutment between two or more implants, the tooth may act as a living pontic. No stress breaker is needed in this situation. If the natural tooth must be included with implants in the restoration, make it a "living pontic" by adding implants on each side and splint together. When the two or more implants may support the load of the prosthesis alone, the natural tooth becomes a living pontic. In other words, in absence of the tooth, the dental unit would be a pontic.

Guideline 5: Avoid telescopic attachments whenever possible:

Intrusion has also been observed in tooth implant supported prosthesis with rigid connectors primarily in patients treated with telescopic attachments. The reason may be due to disuse atrophy of the periodontal ligament. When intrusion

occurs debris and microorganism get impacted between the primary coping and telescopic superstructure. This will in turn lead to a vicious cycle, preventing the tooth from rebounding to its original position which potentially leads to progressive intrusion.

Guideline 6:

Another requisite to join an implant to a natural tooth is that no lateral force should be designed on the prosthesis. Lateral forces increase the amount of tooth movement and decrease the amount of implant movement (faciolingual versus mesiodistal).

Summary: In summary, a completely implant-supported restoration is desirable. Grafting the edentulous site or the use of additional implants is the treatment of choice. However, when insufficient implant support is available, the natural teeth may be considered as potential abutments. The most important natural tooth criterion for implant-tooth–supported restorations is tooth mobility. A clinical assessment of zero mobility often allows a rigid connection between the tooth and implant. However, if mobility is present, the practitioner should design the prosthesis to include more natural abutments and return the dental elements to zero mobility or consider an independent implant restoration. Splinting natural teeth is the usual method to reduce mobility.

In order to reduce the complications and improve TISP performance, some studies proposed useful guidelines to follow:

• The natural tooth should have superior stability through long rooted, multirooted, negligible mobility, adequate periodontal support or splinting to an extra tooth or teeth.

• The implant should have substantial size and be in type I or II quality bone.

• Nonrigid attachments should be avoided as they increase the incidence of tooth intrusion. In case of inevitable use of these connectors, connect the attachment to the implant restoration (between the pontic and the implant).

• Use highly retentive cement with superior retentive preparation design on the tooth abutment.

• If telescopic crown or coping are utilized, avoid using temporary cements, particularly avoid the nocement coping technique.

Despite the fact that the potential mobility between a tooth and an implant are different and the precise etiology of tooth intrusion is unknown, it is reasonable to rigidly connect a tooth to an implant.[14] In dental literature

it is reported that intrusion can be prevented with using rigid connectors.[15]

CONCLUSION:

Although the best option in partially edentulous patients appears to be complete implant-supported prosthesis, there are specific conditions in which the dentist should select between connecting the implant to the tooth in a fixed partial denture or using a removable denture, extraction of remaining teeth, or accept the related risks of other treatment options. Based on literature reviewed, using implant-tooth splinting can be reliable treatment option in properly selected patients; there is no scientific support for extraction of the teeth to avoid connecting them to the implant.

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