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Review Article

ONE-PIECE IMPLANTS: A REVIEW

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ABSTRACT

The original Branemark dental implant was designed as a two-piece implant (TPI) to be used in a 2 stage surgical procedure. One piece implant (OPI) was introduced to incorporate the transmucosal abutment as an integral part of the implant. The unibody design of OPI mimics natural tooth with seamless transition of radicular unit to coronal unit. In recent years OPI is becoming more and more popular because it reduces the requirement of multiple surgical procedures and prosthetic components thereby reducing the inventory and cost. OPI is generally indicated where bone is insufficient in terms of width and height and also in cases of immediate implant placement in fresh extraction sockets. This review of literature outlines the indications, advantages, disadvantages, surgical protocols and prosthetic phase of OPI.

Keywords: One piece implant, Single piece implant, One stage implant, Immediate implant placement.

INTRODUCTION

The use of dental implants to replace the natural tooth system has become commonplace in the contemporary restorative and surgical dental practice[1,2] .The original Branemark concept consists of a two-piece dental implant designed to be used in a two-stage surgical procedure. The conventional two-piece implant (TPI) is inserted into the bone after raising a soft tissue flap which is subsequently repositioned to cover the implant during healing. After a healing period of 3 to 6months a new flap is raised and a transmucosal abutment is attached to the implant to allow the prosthesis to be connected. This TPI design has the implant abutment connection rendering the design with a weak link in the entire assembly. In TPI, microleakage and micromovement of the prosthetic abutment can occur, which may lead to local inflammation of soft tissue around the implant[3] .One piece implant design (OPI) was originally created to eliminate the structural weakness (microgap) built into the TPI design. This review of literature outlines the indications, advantages, disadvantages, surgical protocols and prosthetic phase of OPI

DESIGN OF ONE PIECE IMPLANTS

The design of implant plays a key role in the success of a final restoration. The evolution of science of implant dentistry yielded technological breakthroughs, including improved implant threading patterns and surface treatments that have demonstrably fostered greater primary stability and faster healing[4]. The OPI design is unique because it incorporates the prosthetic abutment and surgical implant into one unit[5,6]. Thus the unibody design of OPI eliminates the fixture abutment interface (microgap) and mimics natural tooth with seamless transition of the radicular unit to coronal unit.

INDICATIONS OF ONE PIECE IMPLANTS

OPI is indicated to replace single tooth, multiple teeth or provide abutment for complete or partial denture. The specific indications of OPI are

1. Narrow edentulous spaces.

OPI is generally indicated in sites with narrow labiolingual width and limited interdental space. When the labiolingual dimensions are decreased and amount of bone available is 4mm wide then, placement of standard width implant leads to exposure of implant threads. Thus, the use of small diameter implants lead to restoration without bone grafting[7].Stephen M Parel et al[8] and Reddy M S et al[9] stated that the use of OPI in tight spaces of mandibular anterior, maxillary laterals and first bicuspids has shown good clinical success comparable to that of TPI.

2. Immediate implant placement in fresh extraction socket.

When an immediate placement of implant is planned in fresh extraction socket since the procedure with TPI has no scope

for the flap closure and abutment has to be joined to the root implant in the same appointment, use of OPI in such situations makes more sense and the soft tissue maturation on the implant body gives better aesthetics. The OPI can be used in immediate placement and immediately restored with an advantage of having no microgap between the abutment and implant. When OPI is immediately placed in fresh extraction socket sites the socket guides the portion of implant and emergence of abutment matches the natural tooth[10,11].

ADVANTAGES OF ONE PIECE IMPLANTS

The OPI design has some genuine advantages over the TPI design.

1. The OPI has more mechanical strength because, the implant cross section is solid as compared to TPI[12].As there is elimination of abutment screw in OPI , there is no empty space in the implant which provides sufficient strength to OPI despite of its smaller diameter as compared to TPI[7,13].
2. OPI shows reduced marginal bone loss as it has no microgap between implant and the abutment. Thus the loss of alveolar bone around the implants is minimized as it cannot harbor bacteria. Hermann JS et al[14], Broggini N et al[15], and Archie A. Jones et al[16] concluded that the one piece implant system has no micro-gap and therefore does not display bacterial colonization at the FAI (fixture abutment inter-phase) and minimal early bone resorption when compared to the two piece system.
3. OPI reduces the requirement of multiple surgical procedures and prosthetic components thereby reducing inventory (abutments, impression copings, implant analogs etc..) & cost.
4. No loosening or fracture of the abutment screw (healing abutment or prosthetic abutment)[17].
5. The clinician can control the final crown margins, the gingival contours and the angulation of the crown preparation with a bur in a quick and easy manner.
6. The OPI follows the conventional crown and bridge procedure (preparation, temporization, impression and cementation).

DISADVANTAGES OF ONE PIECE IMPLANTS

After placement of OPI it is not possible to change the abutment angulation so precise placement of implant is very important. Some of the disadvantages of OPI are

1. It cannot be used in case of tilted abutments in which tilt is more than 10-15°[12].
2. In posterior edentulous areas as heavy occlusal loads are applied over the restoration immediately[7,10].
3. It allows only the use of knife edge margin for the final prosthesis as providing chamfer of shoulder to final restoration leads to structural weakness in the final restoration[7].

SURGICAL PROTOCOL

The original Branemark concept of osseointegration advocated a two-stage surgical procedure. The implant is inserted into the bone after raising a soft tissue flap, which is subsequently repositioned to cover the implant during healing. Following a healing period, a second surgical intervention is done. A new flap is raised and a trans-mucosal abutment is screwed onto the implant to allow the prosthesis to be connected[18]. With improved biomechanics, advances in material and surface treatments of OPI, it is possible to achieve and maintain osseointegration with one-stage surgical procedure. The surgical protocol for placement of a one-piece implant includes both flap and flapless procedures. Visualization of the surgical field with flap elevation may reduce the risk of bone fenestration and dehiscences; however, flap elevation is associated with some degree of patient morbidity and discomfort. Furthermore, flap surgery for implant placement may negatively influence implant esthetic outcome, especially in the anterior maxilla. Flapless procedures have been used for some time with tooth extractions and site preservation and have shown reduced morbidity[19].The advantages of flapless surgical procedure over flap procedure are[10,12]

1. Decreased post-operative discomfort and swelling.
2. Minimal bleeding at the surgical site and no need of sutures.
3. Reduction in surgical and healing time.
4. The esthetic results are better than two piece implants.
5. Demonstrates biological width similar to natural tooth.

PROSTHETIC PHASE

Conventional TPI require a healing abutment around which soft tissue have to heal after 2nd stage surgery and they require separate different prosthetic components, impression copings and implant analogue for laboratory models. OPI comes with an in built abutment. One piece implant has friction fit healing abutment. The abutments are prepared with proprietary TC burs following the principles of FPD preparations with which all are familiar and comfortable. Impression procedure is identical to the crown and bridge work, require gingival retraction and impression making with suitable impression techniques. Presence of friction fit abutment eliminates the cement or acrylic resin forced below the soft tissue margin of provisional restoration and contact of acrylic resin and monomer with raw wound edges. Laboratory phase of making restoration is also easy, and simple similar to that of the conventional FPD technique with which many dental commercial laboratories are familiar with[20].

SUCCESS RATE OF ONE PIECE IMPLANTS

Various clinical studies have proved that OPI has a good success rate. Sohn D et al[7], Siepenkothen T[12], Froum SJ et al[21] recorded a 100% success rate in OPI. Engquist et al[22] reported a higher success rate of 97.5% for TPI as compared to 93.2% for OPI. Ostman et al[23]. also reported that OPI had a success rate of 94.8% as compared to 98.7% in TPI. A minimum success rate of 93.2% and a maximum success rate of 100% was reported for OPI[19]. The cumulative survival rate in OPI is above 98-100% as shown by various studies[6,7,12,13,24].

CONCLUSION

Implant dentistry has been in constant development since the introduction of dental implants by Branemark in the 1970s. Several improvements have been seen in many implant-related aspects, such as surfaces, thread designs, and placement protocols. One-piece implants are becoming more and more popular in the last few years. The absence of a microgap between the implant and the prosthetic abutment at the bone crest level offers one-piece implants many clinical and technical advantages like strong unibody design, no split parts, single stage surgery with either flap or flapless approach and simple prosthetic technique.

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