

Esthetic prosthetic resolution in Morse Taper platform

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Abstract

The issues arising from tooth loss in esthetic zones have been the subject of intense scientific dedication and clinical commitment of which purpose is to achieve favorable mechanical and esthetic stability. The advent of osseointegrated dental implants has satisfied the need for mechanical support; however, cervical bone remodeling around implants with conventional platform may significantly compromise the maintenance of peri-implant tissues, causing serious esthetic injuries. The purpose of Morse Taper implant placement goes beyond the current evolutionary trend in Implantology. It provides maintenance of peri-implant tissue characteristics and facilitates esthetic prosthesis design, thus allowing an ideal emergence profile and a natural and harmonious relationship with surrounding tissues to be achieved during the entire therapeutic process. Therefore, this literature review aims at presenting the characteristics that confer a high rate of success and longevity to prosthetic parts, ensuring greater predictability of maintenance in prosthetic rehabilitation.

Keywords: Morse Taper dental implant-abutment connection. Dental prosthesis.

How to cite this article: Molon TM, Pamato S, Pereira JR. Esthetic prosthetic resolution in Morse Taper platform. *Dental Press Implantol.* 2013 July-Sept;7(3):22-9.

» The authors inform they have no associative, commercial, intellectual property or financial interests representing a conflict of interest in products and companies described in this article.

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Submitted: May 13, 2013
Revised and accepted: June 02, 2013

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Introduction

When Brånemark et al¹ described the process of osseointegration to rehabilitate totally edentulous patients, the objective was exclusively functional. With the development of implants, patients' requirements have increased and rehabilitation has become not only functional, but also esthetic.

The daily challenge faced by dental surgeons in the search for esthetical results leads to new parameters in which esthetical predictability is able to meet patients' demand. Some parameters that previously met functionality, now request other resources, such as prosthesis planning, tri-dimensional implant positioning, analysis of esthetic cost factors, diagnostic waxing, surgical guide, management of peri-implant tissues, and even computer-based planning such as CAD/CAM.²

According to Pereira et al,³ treatment predictability results from careful and meticulous planning. In the past, professionals used to analyze where implant placement was possible, whereas, nowadays, assessment comprises the best prosthetic conditions to establish both function and esthetics, thus meeting patients' needs. This study was named as "reverse planning".

For Gomes et al,⁴ esthetical and functional outcomes led Restorative Dentistry to seek new material and components in order to meet this new demand. The weaknesses of osseointegration were the implant/prosthetic and connection/artificial crown interfaces, both of which should not only provide a more natural appearance, especially in the cervical region where the prosthetic challenges are bigger, but also achieve esthetics of surrounding teeth and supporting tissues. Thus, the market for hexagonal, octagonal and triangular connections was replaced by internal conical connections.

Internal conical connections are widely known as Morse Taper. They have become a point of reference for esthetic prosthetic resolution. The Morse Taper system comprises

characteristics of decreased bacterial contamination, minimized cracks in the implant/abutment interface, improved anti rotational stability and greater loosening torque in comparison to tightening torque.⁵

Peri-implant tissue support and connection stability are essential to preserve bone structure. For this reason, prosthetic alternatives, such as Morse Taper implants, were developed to meet the esthetic demands that could not be fulfilled by other types of connection (natural gingival contour and good prosthesis brightness).⁶

Therefore, this study aims at conducting a literature review in order to clarify the characteristics of the Morse Taper system prosthetic interface and its relationship with the esthetic results yielded by osseointegrated-implant rehabilitation.

Literature review

The Morse Taper concept

Stephen A. Morse developed a fitting mechanism that produces retention. It was used to manufacture mechanical tools and created to meet the need for retaining a bur or a mandrel inside cutting machines (drills, for example). The system acted by contact friction resulting from a male-female interface, and its effectiveness was increased by preload produced on the frictional surfaces, resulting in stability. This process coined the term "Morse Taper" in Implantodontics.⁷

Morse Taper connections allow prostheses to be produced with characteristics that closely resemble natural teeth, especially in esthetic zones. Its precise internal design provides close contact between surfaces and produces mechanical resistance similar to one-piece implants with no microgap, which results in greater horizontal force support, mechanical resistance and decreased stress points.⁸

The prosthetic component is connected to a Morse Taper implant by its interface, given that prosthetic fitting cannot be achieved in the upper portion of the implant cervical region due to absence of a prosthetic platform. This fact allowed prosthetic components of identical design to be produced for implants of different diameters, thus decreasing the amount of components stocked in dental clinics. The central bore is the same for all implants, with only a few exceptions.⁹

The Morse Taper interface did not have an anti-rotational system of any kind. However, a prosthetic index has been recently added. It is particularly used to guide single-implant prosthesis placement with perfect esthetic fitting. Indexed abutments are screw-type connections that show the position of the prosthesis in relation to the implant and do not allow any changes in prosthetic placement.⁹

Morse Taper connections provide stability as a result of contact between the component's walls and the inner surfaces of the implant. For this reason, screws are less requested. Therefore, the internal conical connection provides better mechanical stability in comparison to implants with external hex.³

Morse Taper intermediate components have the screw and the prosthesis connected in one single piece. In spite of that, they must be analyzed differently: single or screw-type connections. The screw of screw-type connections is attached to the prosthesis, which prevents the surgeon from removing the screw that penetrates the intermediate component.⁹

Some Morse Taper systems adapt to the conical walls of the intermediate abutment through fastening the screw threads. The fitting systems, however, are adapted as a result of their conical shape. For this reason, they are known as pure or frictional tapers.

In esthetic zones, Morse Taper implants must be installed from 1 to 2 mm infraosseous so as to optimize and facilitate

maintenance of tissues surrounding the implant cervical third. Insufficient amount of gingival tissue may lead to exposure of the retention system, which requires special components or customization of prosthetic abutment in order to provide rehabilitation that does not affect esthetics.⁹

Indication and contraindication

Morse Taper connections are recommended for cemented single prostheses which, after application of torque following the manufacturer's instructions, hardly loosen. It is also recommended to replace lost teeth, especially in esthetic zones where long-lasting gingival esthetics is essential to keep a beautiful smile.¹¹

Morse Taper connection yields positive results for immediate single implants. It is the first choice of treatment for immediate implants after extraction in low bone density areas with a high need for esthetic and functional outcomes.¹²

Placement of implants with Morse Taper connections is contraindicated for cases that involve high esthetic risks, patient's high expectations, high smile line, poor gingival quality, absence of papillae and low bone quality. In these cases, planning must include soft tissue graft or a different type of prosthesis. Significant angulation must be avoided.¹³

Advantages and disadvantages

Major advantages:^{11,14,15}

- » No microgaps in the implant-abutment interface.
- » Better transmission of forces at the implant-abutment interface.
- » Better stability at the implant-abutment interface.
- » Frictional retention with better distribution of forces at the inner walls of implants, which decreases physiological cervical bone resorption.
- » Platform switching with prosthetic abutments of smaller diameter in comparison to implants.

- » Immediate optimization for esthetic cases promoting soft tissue stability.

Major disadvantages:¹⁴

- » Costs.
- » Difficult technique.
- » Low versatility of prosthetic components.

Choosing a prosthetic abutment

According to Pereira,³ gingival height and its relationship with the healing abutment previously installed must be considered whenever selecting a prosthetic component.

Misch¹⁶ defined the neck of a prosthetic abutment as the limit between the prosthetic abutment crown and the portion attached to the inner part of the implant, which is completely inserted into the gingiva. In order to make a correct choice, three guidelines must be followed:⁹

Diameter of the coronary portion of the prosthetic abutment

The intermediate component must be 3.3 to 4.5 mm in diameter. The size of the crown must be taken into consideration, given that crowns of smaller diameter are usually used for anterior teeth.

Neck height

When choosing the prosthetic abutment, the distance between bone and gingival height in relation to the neck of the prosthetic abutment³ must be considered. The height of a straight intermediate component neck varies from 0.8 to 5.5 mm. In case of angulated components, it varies from 1.5 to 3.5 mm. Choice must be based on gingival height, and the following requirements must be met:

- » Bone: radiographic examinations must be taken to assess the distance between the limits of a prosthesis and the bone crest. Such distance must be of at least 1 mm, however, 2 to 3 mm are acceptable whenever possible.

This procedure aims at maintaining bone tissue through preserving the peri-implant biology as a result of care taken with the line of cementation.

- » Gingiva: In esthetic prostheses, the emergence profile must be subgingival. For this reason, the intermediate component neck must be placed 2 mm below the gingiva. Given that the inner shape is the same, should the neck of the healing cap be too high, the gingival tissue will follow its pattern. Should the neck of choice be incompatible (too low), the intermediate component will exert excessive pressure on tissues, and the patient will feel pain by compression. Thus, it is recommended that the healing cap is equal in diameter to the intermediate component and in height to the gingival tissue. The height of the intermediate component must be compatible.

Diameter of the coronary portion of the prosthetic abutment

The coronary portion of the prosthetic abutment must be 4 to 6 mm in height, depending on the interocclusal distance.

In order to make a choice, the professional can use kits developed for this purpose or try to follow the references of use. The healing abutments previously installed must be considered. Neodent (Curitiba, Paraná, Brazil) developed a device to measure Morse Taper height, thus facilitating the procedures of establishing the height of a neck. The installation driver is connected to the hexagonal prosthetic index located below the Morse Taper system, which preserves the system walls and causes them to be touched by the prosthetic component, only.

Prosthetic abutment with Morse Taper connections in esthetic zones

According to Pereira et al,³ prosthetic abutments are also known as intermediate components, transgingival abutments or abutments. The manner by which an implant is related to a prosthetic component is known as prosthetic connection.¹⁷

In order to choose a prosthetic abutment correctly, one must determine whether the prosthesis is cemented or screw-retained. Cemented prostheses are recommended to replace anterior teeth, given that they hide excess screw and, for this reason, can solve cases of non-ideal emergency profiles. They also allow the surgical location of an implant more closely related to tooth long axis, which results in more natural crowns. Screw-retained prostheses are recommended for cases to which reversibility is important. We should also analyze whether the prosthesis is single or multiple, the height and width of the interocclusal prosthetic space, the need for correction of angulation or parallelism between components, the height and quality of the transgingival tissue, as well as the distance from the limits of a prosthesis (line of cementation) to the peri-implant bone crest.⁹

Patient's esthetic requirements have led to the development of new components that not only aim at boosting resistance, but also at yielding better esthetic results. Considerable differences have been made in abutment shape, angulations, neck height, shape and material; all of which have been launched into the market and provided patients with a pleasant appearance for restoration procedures and peri-implant tissues. However, even though several types of connections and abutments are available, poor treatment planning, especially for the anterior region, may hinder esthetics.³

Universal post

There are single-body and screw-type universal posts. Single-body universal posts are one-piece components recommended for multiple prostheses and well-positioned implants. They facilitate prosthesis placement and eliminate the need for carrying out any adaptations, both in the vertical and cervical directions.^{3,9}

Screw-type universal posts are recommended for cemented single prostheses. A nucleus, to which a prosthetic

structure is adapted, is always fabricated. It can be customized in the event of implant inclination or implants in cervical contact, in which case customization of proximal areas is necessary. Universal posts are contraindicated in cases of insufficient interocclusal space and unsatisfactory tridimensional implant positioning. It can be fabricated in laboratory³ for: Cases that require significant customization of prosthetic abutments, cases in which the soft tissue area subjected to rehabilitation has different papilla height or cases in which the gingival tissue height of the vestibular surface requires a screw-type post.

On the other hand, cases with limited interocclusal space, which do not require any type of alteration, may have customization performed in the patient's mouth. Should a component have to be angulated without the need for cervical preparation, a universal post can be used and directly installed inside the patient's mouth. This component is available in two different diameters (3.3 and 4.5 mm) as well as in two different options of coronary length (4 or 6 mm).

Choice will depend on the interocclusal space available and on the area of cementation. Angulated implants are available at 17° and 30°.

Anatomical post

It is a post similar to a screw-type universal post, but with a larger amount of metal for preparation. Exposed areas can be prepared in laboratory, similarly to screw-type universal posts, or by the dental surgeon himself. One type of anatomical post is used to replace central incisors, whereas the other type is for lateral incisors. The anatomical post is recommended for single prostheses cemented in esthetic zones. It is used in cases of buccal inclination of crown emergence profiles, given that it extends that cervical area so as to facilitate the emergence profile. It is advantageous for allowing adaptations in the coronary, cervical and inner contour portions.⁹

0.2-mm customizable post

In esthetic zones, Morse Taper implants must be installed infraosseous. However, this is not always possible and results in implant exposure in the oral cavity, thus hindering placement of intermediate components due to the apparent portion of metal, in which case a 0.2-mm customizable post is recommended. It is also used in cases of lack of gingival tissue to hide the cervical portion of intermediate components or implants badly positioned, which results in proclined screw-type emergence profiles. Furthermore, it is recommended for special cases of single cemented prosthesis with issues involving implant choice or placement.⁹

It has been developed to solve complications of complex cases. Ideally, this type of post should be avoided (the reason why it is not included in Neodent products catalog) in order to prevent the product's trivialization and loss of biological benefits provided by the Morse Taper philosophy.³

Mini conical abutment

Known as Morse Taper mini-abutment, MirusCone, Micruscone, Mini-abutment, Multi-unit, Micro-unit or UMA, it is an option for screw-retained multiple prostheses. It is offered in accordance with the aforementioned options of transgingival abutments and angulations. Mini conical abutment is contraindicated for single and/or cemented prostheses and in cases of insufficient interocclusal space as well as unsatisfactory tridimensional implant positioning.^{9,18}

Straight mini conical abutment is recommended for multiple prosthesis implants, given that no anti-rotational component is included in the prosthetic cylinder, as the anti-rotational feature may hinder prosthesis cementation as a result of lack of parallelism between implants. A minimal interocclusal space of 4.4 mm must be achieved as from the mucosal level.^{3,19}

As for implants inclined in the buccopalatal or mesiodistal direction in multiple prostheses, angulated mini conical abutment is recommended to achieve proper insertion axis for the prosthesis or to solve esthetic issues involving proclined implant emergence profiles. However, the type of load applied to inclined implants remains unchanged. This component is available at 17° and 30°. This type of angulation requires enough gingival tissue to hide the collar of angulated components and, thus, favor esthetics. In cases of mini conical abutment, the screw is connected to the intermediate component (fixed screw), whereas in cases of angulated mini-abutment the screw goes through it.³

Neodent developed an abutment for cases of reduced interocclusal space. It is known as CM micro abutment. It is recommended for screw-retained multiple prosthesis with a minimal interocclusal space of 3.5 mm as from the mucosal level, as well as for implants near each other.¹⁹

Esthetic aspects related to tissues

The Morse Taper system is highly advantageous for esthetic zones, given that these situations normally require that the line between the intermediate prosthetic component and the implant be hidden. The Morse Taper system decreases the minimally required distance between implants as well as between teeth and implants, thus promoting maintenance of papillae, given that the correct distance between implants or between an implant and a natural tooth is essential to yield favorable esthetic results.²⁰

According to Herman,²¹ gingival esthetics around teeth is based on the invariable vertical dimension of healthy periodontal tissues, also known as biological distance. They are responsible for bone and gingival tissues protection and act as an important barrier between an organism's inner and outer environment. Such protection structures are also found around dental implants. Peri-implant tissues allow regeneration of the epithelium and connective tissue

with formation of gingival sulcus, junctional epithelium and connective tissue attachment fibers. In other words, the dimensions of biological distances between implants are similar to the biological distances around natural teeth.

Nevertheless, radiographic examinations of different implant systems reveal different peri-implant standards. Thus, the dimensions of biological distance seem to differ among implant systems due to the presence or absence of peri-implant resorption, as the biological distance depends on the location of the alveolar bone crest. The Morse Taper system preserves bone tissue, even after prosthetic abutment placement.²¹

A thorough evaluation of the type of gingival covering, soft tissue thickness (maintenance of gingival levels may not be ensured in cases of thin gingival biotype) and amount available are key to yield successful esthetic results. With regard to bone height and width, another factor plays an important role in determining the success by means of clinical and radiographic evaluations of hard and adjacent structures of implant sites:²²

The absence of peri-implant inflammation and substantially reduced bone loss are largely responsible for maintaining esthetics in the long-term. Thus, Morse Taper connections represent the possibility of optimizing such problems, given that they are able to prevent bacterial biofilm accumulation and, as a consequence, gingival saucerization and inflammation.⁶

Interproximal papilla loss is directly associated with bone resorption around implants and intermediate components. Such loss may result from surgical trauma, overload, peri-implantitis, anatomical shape of the cervical region, implant surface features, biological adaptation, presence of microgap and the type of connection between the implant and the prosthesis, all of which can result in esthetic and speech issues as well as in potential food impaction.²³

In cases of insufficient thickness of keratinized mucosa, peri-implant cosmetic surgery is recommended, which is essential for esthetics and proper oral hygiene. Should soft tissues partial loss be associated with high smile line, the case is extremely unfavorable and difficult, and requires reconstruction of the remaining soft and hard tissues.²⁴

Conclusion

The Morse Taper system has significantly more prosthetic advantages in comparison to hex implants, especially for anterior single teeth for which long-lasting gingival esthetics is extremely important. Additionally, the system presents more clinical, biological as well as biomechanical advantages. Therefore, it is reasonable to conclude that the Morse Taper platform is key to achieve high success rates and longevity of prostheses. Furthermore, it provides greater predictability in maintaining peri-implant conditions in anterior teeth rehabilitation.

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