POROUS IMPLANT WITH NON-POROUS THREADS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to bone implants and, in particular, to a threaded dental implant with improved osseointegration.

2. Description of the Related Art

Dental implants are commonly used as anchoring members for dental restorations to provide prosthetic teeth at one or more edentulous sites in a patient's dentition at which the patient's original teeth have been lost or damaged. Typically, known implant systems include a dental implant made from a suitable biocompatible material, such as titanium. The dental implant is typically threaded into a bore which is drilled into the patient's mandible or maxilla at the edentulous site. The implant provides an anchoring member for a dental abutment, which in turn provides an interface between the implant and a dental restoration. The restoration is typically a porcelain crown fashioned according to known methods.

Many current dental implant surgeries are performed in two stages. In the initial or first stage, an incision is made in the patient's gingiva at an edentulous side, and a bore is drilled into the patient's mandible or maxilla at the edentulous site, followed by threading or impacting a dental implant into the bore using a suitable driver. Thereafter, a cap is fitted onto the implant to close the abutment coupling structure of the implant, and the gingiva is sutured over the implant. Over a period of several months, the patient's jaw bone grows around the implant to securely anchor the implant in the surrounding bone, a process known as osseointegration.

In a second stage of the procedure following osseointegration, the dentist reopens the gingiva at the implant site and secures an abutment and optionally, a temporary prosthesis or temporary healing member, to the implant. Then, a suitable permanent prosthesis or crown is fashioned, such as from one or more impressions taken of the abutment and the surrounding gingival tissue and dentition. In the final stage, the temporary prosthesis or healing member is removed and replaced with the permanent prosthesis, which is attached to the abutment with cement or with a fastener, for example. Alternative single stage implants with integral emergence profiles or one-piece implants with integral abutments may be used that extend through the transgingival layer so that the gingiva need not be reopened to access the implant.

Patients prefer to leave after initial surgery with some type of restoration and healing of both soft and hard tissue may be improved if the implant is loaded after surgery. Post-surgical loading, even if less than a full load of occlusion, however, is sufficient to displace the implant. Thus, threads may be used to secure the implant directly to the bone to achieve initial stability.

One way to improve osseointegration onto an implant, and in turn improve the long term stability of the implant, is to provide a porous material on the implant that the bone can grow into. Such a porous material may also increase short term stability for immediate loading due to a large friction coefficient with surrounding bone. Providing a porous material only on the surface of the implant, however, results in bone growth only near the surface of the implant. The final stability of the implant would be significantly increased if bone growth extends deeper than just near the surface of the implant. Such a porous structure, however, may not provide sufficient strength to use as threads on a screw-type implant to resist mastication forces. Thus, a porous implant is desired

that provides sufficient initial and long-term stability when embedded in biological tissue, such as bone.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an elevational view of a dental implant in accordance with the present invention;

FIG. **2** is a cross-sectional view of the dental implant of FIG. **1** in accordance with the present invention;

FIG. **3** is an exploded view of the dental implant of FIG. **1** in accordance with the present invention; and

FIG. **4** is an enlarged fragmentary view of the portion of the porous tantalum forming the dental implant of FIG. **1** in accordance with the present invention.

DETAILED DESCRIPTION

Referring to FIGS. **1-3**, an implant **10** may be used to anchor prosthetic devices to bone. In one form, implant **10** is a dental implant for anchoring an abutment or other dental prosthesis to a jaw bone. The implant **10** generally defines a longitudinal axis L**1** (shown in FIG. **2**) and includes a shaft **12** made of a porous material for improving osseointegration onto the implant **10** as explained in greater detail below. The shaft **12** has an exterior surface **14** and at least one non-porous thread **16** winding around, and engaging, the exterior surface **14**, and extending outwardly from the exterior surface **14** for engaging bone. While the illustrated shaft **12** is substantially porous, shaft **12** could have a non-porous, axially extending core. Such a core could be made of titanium, ceramic or other non-porous material.

Implant **10** includes a non-porous head portion **18** located at a coronal end portion **20** of the shaft **12**. The non-porous head portion **18** is made of a suitable biocompatible material, such as titanium, although the head portion may also be made of other biocompatible materials such as at least one of the following: titanium alloy, stainless steel, zirconium, cobalt-chromium molybdenum alloy, ceramic, a polymer, and a composite material.

Referring to FIG. **2**, the head portion **18** forms an axial bore **22** for receiving the bottom of an abutment and/or an abutment connector extending out of the abutment to secure the abutment to the implant **10**. For this purpose, the bore **22** is internally threaded to receive the abutment connector, and has an anti-rotational flat or surface **24** (such as a hexagon, for example) to receive a corresponding interface from the abutment.

The head portion **18** has an apical extension **26** to contain the bore **22** entirely in the stronger, solid material of the head portion **18** rather than the porous material at the shaft **12**. The exterior exposure of the porous material is then maximized by placing the extension **26** in a coronally accessible cavity **28** formed at the coronal end portion **20** of the shaft **12**. Alternatively to the bore **22**, the head portion **18** may provide a male interface for a separate female abutment. In this case, although the extension is not needed to form a bore, it may be used, nevertheless, to provide extra surface area for the shaft **12** to be press-fit against the head portion **18**. In yet another alternative, the implant **10** may be a one-piece implant where the head portion **18** also includes an integral abutment or the implant **10** may be a single-stage dental implant with an integral transmucosal portion.

In the illustrated form, the helical thread **16** includes three helical parallel threads **16***a*,**16***b*, and **16***c* although more or less may be provided. One or more coils **30** of the threads **16***a*,**16***b*, and **16***c* are formed integrally with a main body **32** forming the head portion **18**. The threads **16***a*,**16***b*, and **16***c*