

SCREWONOMICS.....Way to Implant Success

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Abstract:

Screw loosening is one of the most common and serious problem associated with the implant restorations. In order to prevent and solve this problem, the clinician must understand the screw joint mechanics. This article presents an overview on different types of implant screws, screw tightening mechanics, recommended torque values, causes, sign and symptoms of screw loosening.

Keywords : Dental implant, Preload, Torque, Screw Mechanics, Screw loosening.

Introduction

Screw loosening is one of the most common and serious problems associated with the implant restorations. There is no consistent data available on the incidence of screw loosening. Some studies report that 2% of all the screws loosen, while others report a frequency of up to 40%¹⁻³. Naert et al reported higher frequency of screw loosening in full arch restorations as compared to single tooth restorations.³ Jemt et al reported 26% loosening of gold retaining screws and 43% loosening of abutment screws over the first year on single tooth implants.⁴ Becker and Becker reported 38% loosening of single implant restorations in the posterior maxilla and mandible.⁵ As screws are used for securing abutments to implants, screw loosening may be an early warning sign of inadequate biomechanical design and/or implant occlusal overload.⁶⁻⁸ In order to prevent and solve the problem of loose screws, the clinician must understand the screw joint mechanics.

Two types of screws are commonly used for implants i.e. abutment and lab screws. Abutment/prosthetic screws are the screws used for securing abutments to implants. They can be made of pure Ti / Titanium alloy / Gold alloy. They can be coated or non-coated (Fig. 1). Lab screws are titanium screws designed to be used during the laboratory fabrication procedures where they retain abutments to the lab analogs. This is to ensure the final abutment screws are not stretched or damaged during the manufacturing process.⁹

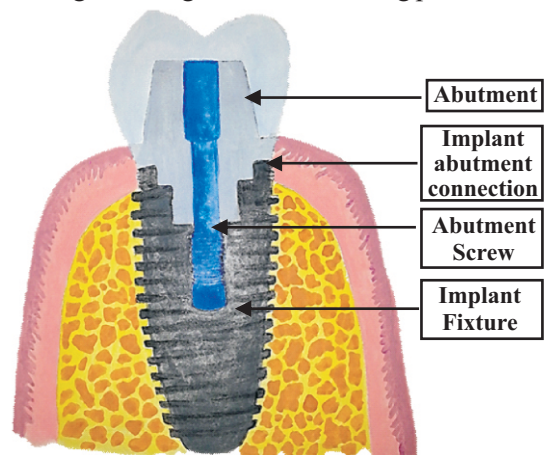


Fig. 1 : Longitudinal section of Implant-abutment connection

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Mechanics of screw tightening

When screw is tightened by applying torque, a force develops within the screw called the preload. As a screw is tightened, it elongates and produces tension. Elastic recovery of the screw pulls the abutment and implant together, creating a clamping force. Opposing the clamping force is a screw joint-separating force, which attempts to separate the screw joint. Screw loosening occurs when the screw joint-separating forces acting on the screw joint are greater than the clamping forces holding the screw unit together.¹⁰

The amount of preload present at the threads of a screw depends on the applied torque,⁵ the presence and type of lubricant, the physical properties of the materials in contact, and the settling of the screw after initial torquing.¹¹ Surface imperfections lead to increased friction and decreased preload. Removal and retorquing of the screw reduce surface imperfections, and the use of lubricants decreases friction; both result in increased preload. Increasing the preload maximizes the stability of the screw joint by increasing the clamping force.^{12,13}

Recommended Torque Values¹⁴

Type of screw	Recommended torque
Cover screw/Healing abutment	5-10 Ncm using manual screw driver
Lab screw	5-10 Ncm using manual screw driver
Abutment screw	30-35 Ncm using torque wrench

Causes of Screw loosening¹⁵

There are multiple reasons for screw loosening such as inadequate tightening, improper prosthesis fit, excessive loading and screw settling. In an effort to decrease friction and increase preload, titanium screw surface

have been treated with gold, tungsten carbon carbide and nitrides coating.

Signs and symptoms of screw loosening¹⁶

- Loose implant-supported crown.
- Mobility of the crown/bridge abutment with or without gingival inflammation.
- Possible redness or swelling of the surrounding tissues.
- Pain severity: there may or may not be any pain or discomfort around the crown; usually minimal or moderate pain.
- Manipulation of crown may illicit some rotational and possibly slight vertical movement.
- The bite may feel different or high on the implant restoration.

Screw loosening in different types of implant-abutment connections

Most in-vitro studies have demonstrated that internal connection implants are more stable than external connection implants. Sahin et al conducted a study to evaluate which type of implant abutment connection shows least occurrence of screw loosening. They found that Morse tapered geometries of connections present a better harmony and stabilization which may avoid extreme deformation of mating surfaces and microleakage.¹⁷

Conclusion

To prevent the problem of screw loosening, implant screws should be re-tightened 10 minutes after the initial torque application as a routine clinical procedure to help compensate for the settling effect. Mechanical torque gauges should be used instead of hand drivers to ensure consistent tightening of implant components to torque values recommended by implant manufacturers.¹⁸

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