

## Features of the abutment-implant connection

### Friction as an anti-rotational feature of the abutment-implant connection

Friction is a superficial condition that shows its effect only if it is accompanied by a force that can take advantage of it.

Friction creates a resisting force opposing to the relative sliding of two bodies when they are kept in contact by the pressure of a normal external force to their contact surfaces. This resisting friction force opposing to the sliding is proportional to the entity of the force that keeps the two bodies pressed together and to the friction coefficient value present in that moment between the two surfaces as well. If the contact force is missing, the friction cannot make any resistance to the sliding. The friction coefficient is expressed by a number corresponding to the ratio between the friction force resisting to the sliding and the contact force. It has to be considered that the friction action between the involved surfaces operates only according to the force that keeps in contact the reciprocal threads surfaces and the contact flats of the head, i.e. the pre-load. Therefore, if the contact between the reciprocal surfaces does not exist, also the friction resistance and consequently the braking action are missing. Therefore, the screw can loosen.

#### Why does the screw loosen?

##### Because the friction braking effect is missing!

The loss of contact between the two surfaces happens when an occasional force, that engages the screw with a load higher than the pre-load set on it with a torque wrench, takes place. In such a case, the force will cause a screw lengthening bigger than the one caused by the pre-load and for a very short moment, when the occasional force is finished, the abutment placed between the implant and the screw will be free. Lacking the contact with the abutment, also the screw will be free to loosen under the effect of residual vibrations and the friction braking action of will cease as well.



#### The connection with "self-locking tapered screw"

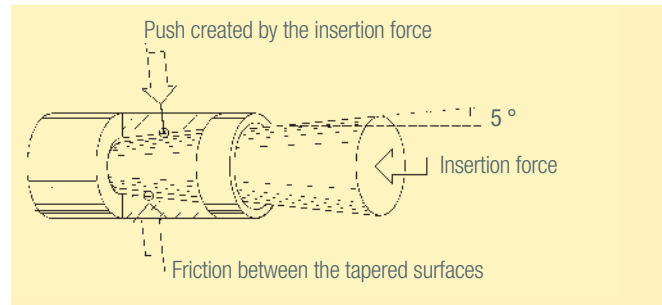


Fig. 1

#### The "Morse" effect (Fig. 1)

Inserting with pressure an element with a tapered external surface in a corresponding female element that has a hole with an identical tapered design, the friction between the two tapered surfaces, combined with the push created by the insertion force that presses them together, locks the male cone in the female one. This locking remains and keeps itself efficient also when the insertion force applied ceases. This is the "Morse" effect. The locking force, which is proportional to the insertion force, prevents the male cone from being extracted from the female one, whether trying to rotate it or by applying an axial push. A suitable tapering of the cones guarantees such "locking" that will become a safe and natural engaging system for the screw that connects the abutment to the implant.

#### The screw with self-locking tapered head

The screw with self-locking tapered head is different from the traditional screw because of the tapered design of one of its part. Moreover, the abutment has a seat with the same tapering in the hole for the connection screw. The taper of the cones is 5° (Fig. 2). Fix the screw at **35 Ncm**.

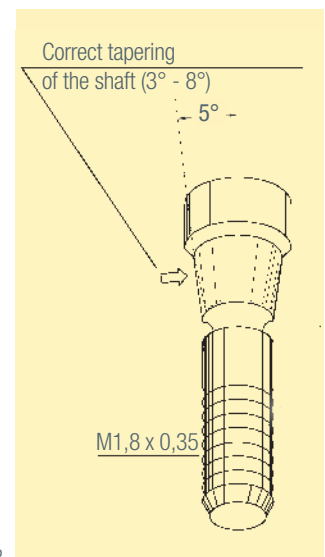


Fig. 2

**How the auto-locking Morse effect is formed on the tapered screw**

When the tightening rotation of the "tapered screw", which will tightly connect the abutment to the implant, is started, the screw thread is inserted in the implant thread until its cone touches the abutment cone. Going on with the rotating action, the screw body is forced to lengthen of an amount proportional to the torque applied on the screw.

By reaction, the screw resists to the lengthening charging itself with an axial traction that produces two important results.

The first one is that, with the application of the torque the screw has obtained an axial traction force that enables it to tightly connect the abutment to the implant. The second result, which is certainly the most important one, derives from the push that such axial force applies on the cones that are tightly pressed together.

The "Morse" effect is created by such push that, combined with the friction existing between the two surfaces of the cones, locks the screw cone inside the abutment in an embrace that can be overcome only applying an unscrewing torque on the screw of about 70% of that used for tightening. The practical tests carried out did not report any screw breakage, even when applying a torque up to 90 Ncm. The auto-locking tapered screw with diameter 1,8 mm, made of grade 5 titanium, has a resistance to the elasticity limit of 950 N; consequently, the screw can withstand axial loads up to its elastic limit without permanent deformations and loosening. Obviously, in case occasional forces charged the screw with a higher load than its resistance, the screw would break. To face such event, a specific breakage area has been foreseen well outside the implant thread in order to allow an easy extraction of the broken piece remained in the implant (Fig.3).

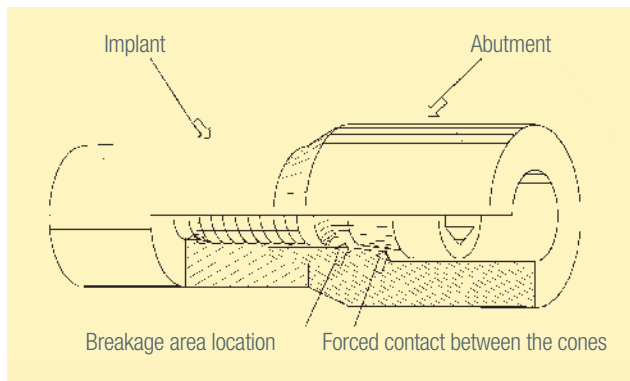


Fig. 3

**Tapered screw - Advantages**

- Safe anti-loosening device of high reliability
- Usable with all types of implants
- Breakage area on the body in case of accidental breakage
- The thread and the screw-in cavity of the head are dimensioned to resist to torque loads of more than 50 N cm
- Limited costs of the system

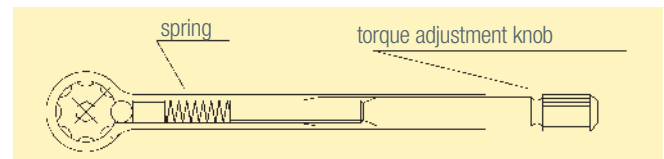


Fig. 4

**Tightening screw**

When we want to apply a high tightening torque on the screw, according to the indications of the supplier, we must necessarily have a suitable wrench (Fig. 4-5) that can be correctly registered to the desired torque, with the help of the "NEWTON" control instrument.

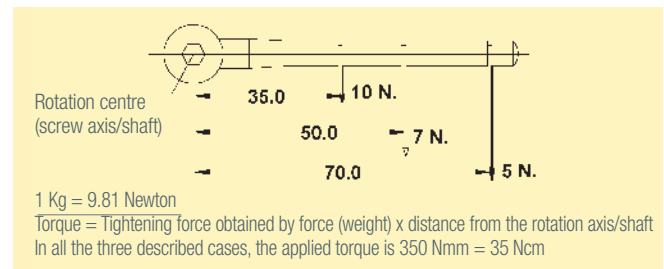


Fig. 5

The ratchet registration is carried out by screwing in or out the threaded knob placed at its end and checking the setting with the Newton control device.

The control device (Fig. 6) enables the dentist to set the locking ratchet (Fig.7) to obtain and visually verify the torque desired in that moment.

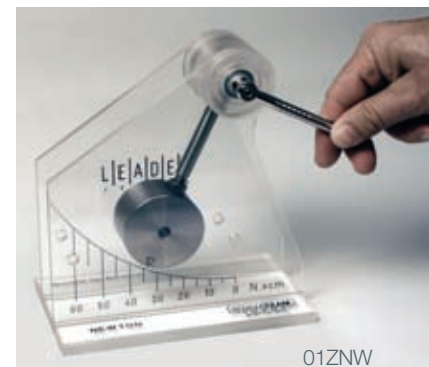


Fig. 6

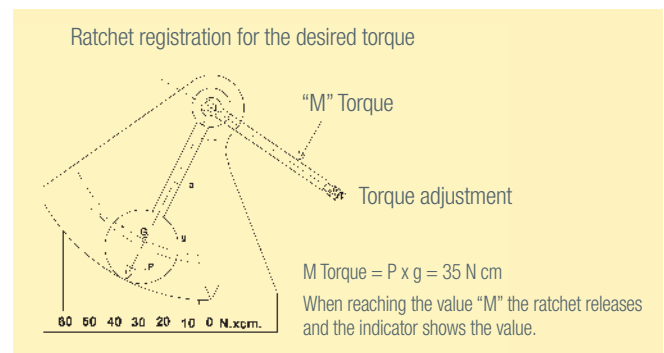


Fig. 7

**Conclusions**

The torque control device enables the setting of the ratchet to any value between 10 and 50 Ncm. The setting precision is absolutely valid because it is exclusively based on the force of gravity. Note: on request, the controlling calculations of the tightening of a tapered head screw are available with the application of a torque of 35 and 50 Ncm through a properly registered ratchet.