REPORT B

About Brand X tips

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Satelec, a Company of ACTEON Group

1 Introduction

1.1 Background

Over 30 years, Satelec has developed Piezo-electric stand alone ultrasonic generators designed for dental treatment such as scaling, non surgical periodontal treatment and endodontic applications. Thanks to his micromechanic's knowledge, Satelec developed also a complete instrument range to be associated with his generators. These instrument, (tips) respect the tooth's anatomy and vibrate in perfect harmony with the handpiece.

Following several complaints received from the field regarding the ultrasonic power which was too weak , our quality department analyzed the defective handpieces that our customers have sent back. Most of the time, we discovered that he handpiece had worn or broken threading. (see fig 1 & 2)

Our customers explained that, instead of buying genuine Satelec tips, they bought cheaper tips arguing that their manufacturers ensured that these tips were fully compatible with Satelec's handpieces.

Fig 1: Worn threading

Fig 2: Broken threading

1.2 Purpose

Our quality and development departments conducted investigations to identify the root cause leading to damage our handpieces's threading.

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1.3 Method

To identify accurately the potential root cause, we focus our investigation toward three main parameters:

- ⇨ The threading
- ⇨ The tools provided to screw the tips onto the handpiece
- ⇨ The selected materials used for the tips

1.4 Material

We conducted the investigation at Merignac's facility the week 43, (from October 25th to October 29th 2010), and used the equipments below:

- ⇨ Satelec's amplifiers X12307 from manufacturing batch 601404
- ⇨ Torque-meter Mecsin 10 Nm SNB5B07 (date of calibration May2010)
- ⇨ Camera "Icone MN 60" to take the pictures
- ⇨ Magnifying glass
- ⇨ Profile projector
- ⇨ Calibrated gauges Ø2.5 & Ø2.55mm A1D18 (date of calibration September 2010)
- ⇨ Gauge of threading E/NEP M3x0.6 H N°M40
- ⇨ Threading ISO standard E 03-001 (ISO 68) and E 03-051 (ISO965)
- ⇨ Microhardness meter LEICA VMHT 30
- ⇨ Trinitron Monitor Sony FT9929194
- ⇨ Sony CCD camera 404896

1.5 Tips

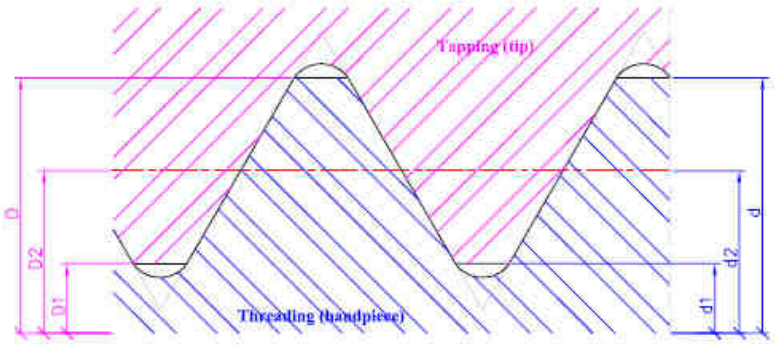
To perform our investigation, we used the following tips:

- ⇨ Brand X Tips N°1
- ⇨ Brand X Tips N°2

2 Reminder about threading and tapping

The assembly drawing below shows the interaction between the tapping and the threading.

- ⇨ The threading manufactured by Satelec is in blue
- ⇨ The tapping of the tip is the pink area.



2.1 Observation regarding the tip's tapping

The Calibrated gauge Ø2.5 can be easily introduced inside the tapping of the Brand X Tips N°1
The Calibrated gauge Ø2.55 cannot be introduced inside the tapping of the Brand X Tips N°2

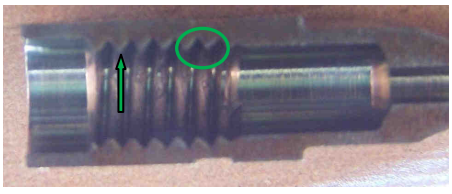
- ⇨ According to the ISO standard NF E 03-051 (ISO 965), the diameter **D1** should not exceed Ø2.51mm
- ⇨ There is a discrepancy between the **D1** diameters of the Brand X Tips N°1

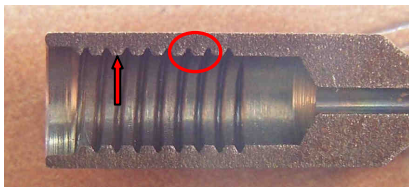
The threading gauge E can be easily introduced inside the tapping of the Brand X tips N°1
The threading gauge NEP cannot be introduced

- ⇨ The internal hole has been machined with an oversized diameter.

As D1 diameter is the most important parameter, we proceeded to a cross-cut section to confirm these initial observations and get a better understanding of the tapping. Below are the pictures captured with the camera.

Satelec	Brand X Tips N°1	Brand X Tips N°2





The arrows show the truncation of the tapping (D1). As we can see, for the Brand X Tips N°1, the truncation is important. It seems that, before tapping, the internal hole has been machined with an excessive diameter.The dimensions we measured do not match with the ISO standard.

Conclusion:
If screwed onto a worn handpiece, the threading of these tips does not enable to get a sufficient retention. As these tips are not maintained, or very little, there are not able to transmit the power coming from the handpiece, decreasing the efficiency of the ultrasonic device.

2.2 Wrenches

We checked the dimensions between the clamping plates of the wrenches delivered with the Brand X tips 1, and found sizes going from 3.07 to 3.1mm.

As these wrenches are pretty long, (67mm), in order to evaluate the strength developed during screwing, with the torque-meter we took the measurement and found value going from 2.2 Nm to 2,5 Nm.

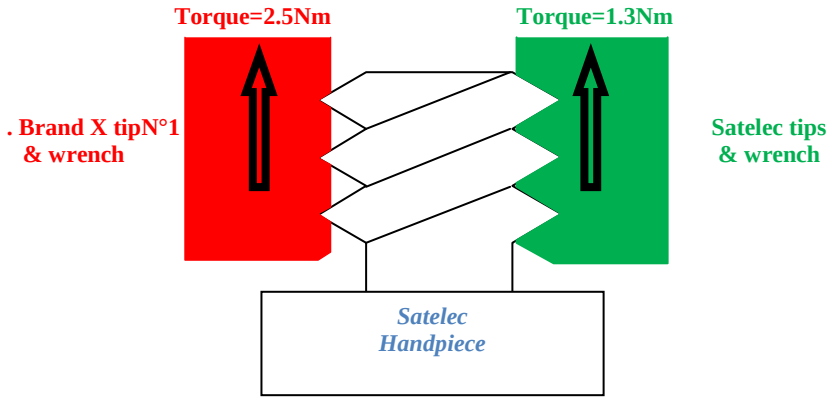
⇨ In comparison, our dynamometric wrench is set at 1.3nm!

After 10 screwing, unscrewing, the previous 3.1mm dimensions between the clamping plates raised up to 3,47mm.

⇨ This demonstrates that the wrench is not suitable for the purpose which it was designed

Conclusion:

These measurements show that the keys provided with Brand X tips apply a clamping torque too important on the threading. Moreover, the observed truncation provides an insufficient contact between the walls of the tapping and the threading. This amplifies the excessive torque effect which is applied onto a small contact surface.The combination of these two anomalies is destructive for the threading of the handpiece, as shown below:



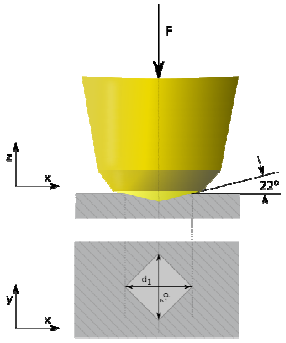
This explains the deformation observed on the wrench and the tips due to excessive screwing torque, there is concern that repeated use will not only deteriorate the tapping of the tips, but also the threading of the handpiece.

3 Material

3.1 Vickers hardness

As we did not get the same observation with the Brand X Tips N°1 , we performed hardness measurement onto the materials. The Vickers hardness measurement is done with a standard diamond pyramid probe with a square base. The apex of this probe has, between its sides, an angle equals to 136 degrees.

The impression we get is a square shape which we measure the two diagonals d1 and d2 using an optical device. The result d is obtained by averaging the value of d1 and d2 and then used to calculate the Vickers hardness value HV. The strength and duration applied as described in ISO standard.



$$HV = \frac{2F \cdot \sin\left(\frac{136°}{2}\right)}{g \cdot d^2}$$

3.2 Vickers hardness results

The tips which are to be measured hardness are locked, and then, their surface is hurt using a diamond probe. The applied torque is 2942mN during 10s. The diagonals measurement of the impacted prism is then recorded and used to determine the Vickers hardness.

.Brand X Tips N°1 (for 5 tips)

Tips					
Vickers harness	*85.8*	*77*	*82.45*	*80*	*76.7*

. Brand X Tips N°2 (for 5 tips)

Tips					
Vickers harness	*47.1*	*47.8*	*47.85*	*46.7*	*45.8*

Satelec tips

Tips	*N°1 1*	*DT2 201033*	*CS2 200848*
Vickers harness	*39.6*	*39*	*58.8*

4 General Conclusion

Regarding the Brand X Tips N°1

The Brand X Tips N°1 have got a stronger hardness value than the Brand X Tips N°2 and Satelec tips. As the wrench delivered with these tips applies an excessive torque, and as the tapping doesn't comply with the standard, it is critical to use these tips with Satelec handpiece and due to the material used there is concern that repeated use deterioratse the threading of Satelec's handpiece.

Regarding the Brand X Tips N°2

As the Brand X Tips N°1, the wrench delivered with Brand X Tips N°2 also applies an excessive torque, and as the tapping dosen't comply with the standard, the user should avoid using these tips with Satelec handpiece.

Even if it is less critical than the Brand X Tips N°1(as the material is not hard as those used) repeated use deteriorates the threading of Satelec's handpiece and also the tapping of the tips.