



BONE ASPECTS AFTER IMPLANT SITE PREPARATION USING DRILL VS UISP WITH DIFFERENT IRRIGATION FLOWS. AN IN-VITRO STUDY WITH SCANNING ELECTRON MICROSCOPY



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INTRODUCTION

The aim of this study is to analyze bone aspects after implant site preparation using Twist-Drill (TD) versus Ultrasonic Implant Site Preparation (UISP) technique with different irrigation flows. During implant site preparation irrigant solution is used to prevent bone overheating^[1-2], but different levels of irrigation may also affect cleanliness of bone surfaces.

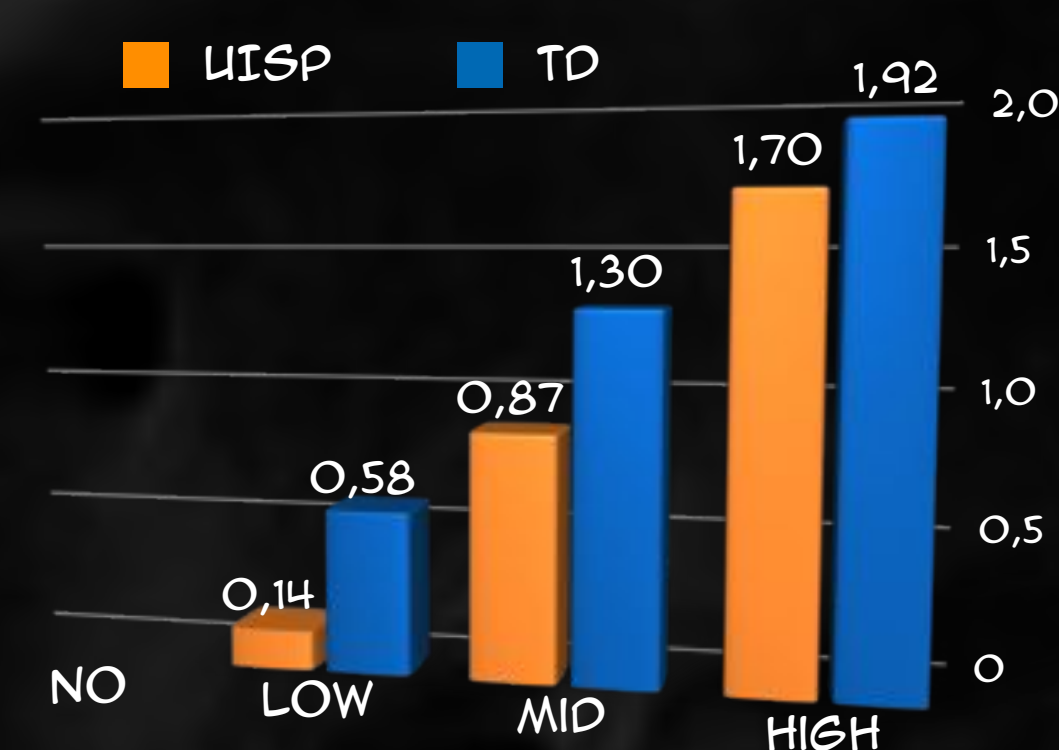
In a previous study the authors observed that UISP technique is less traumatic on bone structure at a micro and macroscopic aspect^[3], so we may expect that irrigation could improve bone cleanliness and it could bring to light other differences between the two techniques that should be analyzed in future study.

MATERIALS & METHODS

N°8 implant sites (Ø 3mm) have been prepared in four pig's ribs with different levels of saline solution flow (No, Low, Mid, High):

IRRIGATION FLOW

	TD	UISP
NO	0,00 ml/s	0,00 ml/s
LOW	0,58 ml/s	0,14 ml/s
MID	1,30 ml/s	0,87 ml/s
HIGH	1,92 ml/s	1,70 ml/s

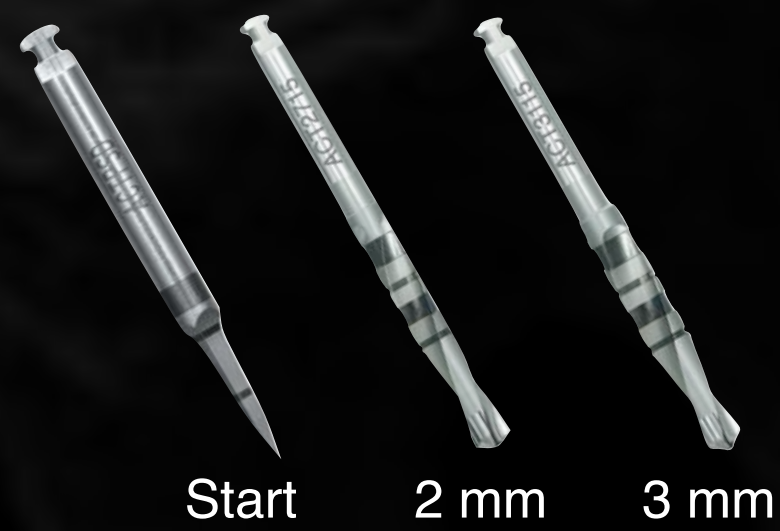


Twist-Drill protocol

- Standard Bio-Implant Twist-Drill
- Kavo 1:16 contra angle (1000 rpm)
- Satelec surgical micromotor

Sequence:

- 1.Start-Drill
- 2.Twist-Drill Ø 2mm
- 3.Twist-Drill Ø 3,0mm



Start 2 mm 3 mm

UISP protocol

Mectron® Piezosurgery 3 device
Ultrasonic inserts for implant site preparation

Sequence:

- 1.IM1 (Ø MAX 2mm)
- 2.IM2P (Ø 2mm)
- 3.IP2-3 (Ø MAX 3mm)
- 4.IM3 (Ø 3mm)



IM1 IM2P IP2-3 IM3P

SEM ANALYSIS

Samples were gold-plated with Polaron at 1.4 KV

The analysis was performed with SEM HITACHI S-2500 using secondary electron detection at 10 KV.

SEM images were collected at 20X, 50X, 100X, 250X, 500X, 1000X, 2000X and 6000X enlargements. We found images at 20X, 50X and 250X to be the most useful magnification levels for our analysis.

A comparison of surface cleanliness have been made between UISP-High and TD-High by determination of open channels in an area of 0,08mm².

We performed a count of:

- Channels Ø ≥ 4µm - (RED code)
- Channels Ø < 4µm - (YELLOW code)

DISCUSSION

The comparison of opened channels points out the great difference, in terms of cleanliness of surfaces, between the two techniques.

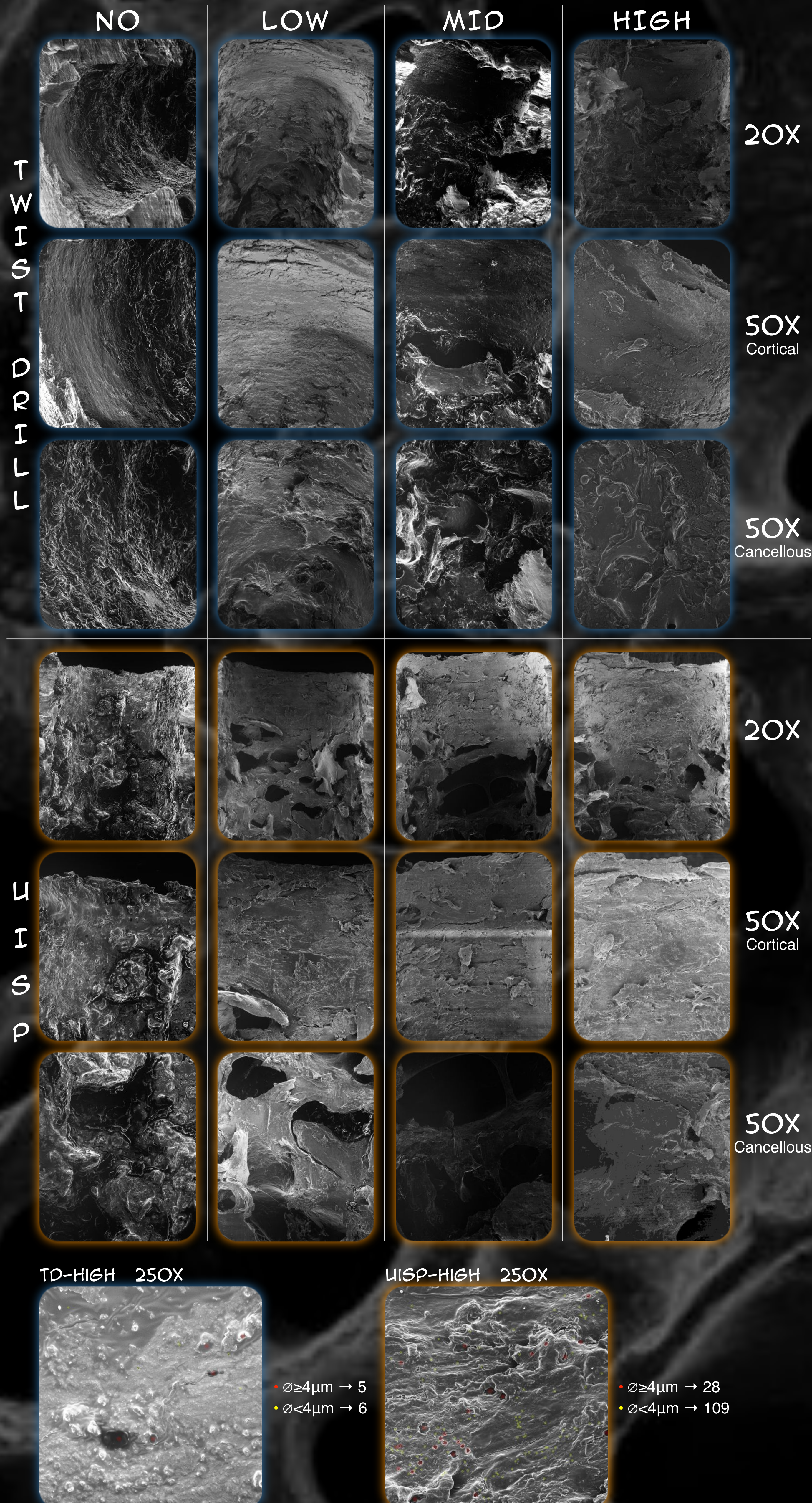
The irrigating solution was able to greatly influence the surface characteristics of bone treated with both technologies. Absence of irrigation caused an alteration of the bone structure, especially in UISP sample, in which there was a great develop of heat.

Samples of both groups showed a linear improvement of bone surface cleaning related to irrigation levels, but UISP samples showed higher levels of cleanliness. For example the UISP-Low specimen was extremely more cleaned than the TD-High one, especially in the cancellous compartment.

The number of opened vascular canals on bone walls was used to determine cleanliness of the cortical bone. In particular we analyzed a surface of 0,08 mm² in specimen relative to UISP-High and TD-High. We made a count of canals bigger than 4µm in diameter and smaller than 4µm. The first group may be related to spaces corresponding to osteocytes lacunae (Ø=4-5µm), Volkman channels (Ø from 5µm to 10µm) or Haversian channels (Ø from 20µm to 50µm). The second group may refer to osteocytes network canaliculi^[4]. In any case the presence of opened holes of any diameter can be used as an index to determine the cleanliness of bone surface.

The images of the cancellous compartment of samples analyzed show a different amount of bone remnants and particles entrapped in the medullary spaces between trabeculae. This parameter was used to determine the efficacy of the different irrigation levels

The efficient cleaning effect of UISP is probably produced by the cavitation of saline solution due to ultrasonic vibration of the piezoelectric inserts and bone micronization.



CONCLUSIONS

From this analysis we realize that:

- Irrigation is determinant for the cleaning of the implant site.
- The cleaning level obtained with UISP technique is significantly higher because of a cavitation effect and bone micronization.

This can lead to a faster bone healing and the achievement of earlier osseointegration of titanium implants^[5-6].

We also noticed that irrigation acts in a different way for the two technologies producing better results in UISP-Low than TD-High, probably because of the cavitation effect.

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