



# RELATIVE CONTRIBUTION OF HAPTIC TECHNOLOGY IN IMPLANTOLOGY

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Master 2R BIMC/ ISSM, Nancy le mardi 25 juin 2013

# Teaching implantology

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**Development of training in implantology:** In Europe average time initial implant training in 2008 : 36h ➡ 2013: 74h

**Initial training:** More theoretical courses, slideshows, videos, and practice

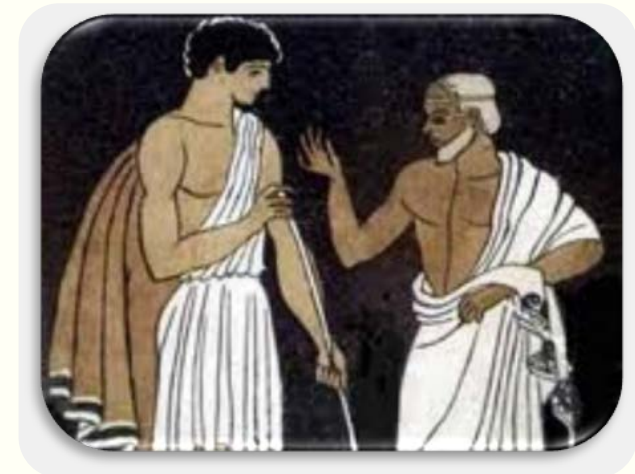
**Continuing education:** short, industrial, no certification, fewer place for post doc

**Lack of teachers:** Passing a “halstedien” model, “one master one student to a model “one master several students”

Development of new educational strategies: progressive course, autonomous, secure



## Simulation



*European Journal of Dental Education Vol. 18 Issue s1 Special Issue: Implant Dentistry University Education: Opportunities and Challenges March 2014 Volume 18, Issue Supplement s1 Pages 1–69*

*\*Koole S, Vandeweghe S, Mattheos N, De Bruyn H. Implant dentistry education in Europe: 5 years after the Association for Dental Education in Europe consensus report. Eur J Dent Educ. 1 mars 2014;18:43-51.*

# Implantology education: simulation as a teaching strategy

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- **« Never the first time on the patient »**  
(Action 48 du PNSP)
- Simulation in Health is an innovative teaching method [...] It allows the practice of a technical or invasive procedure is not "learned" on a patient.
- It is validated by the HAS as a method of continuing professional development (CPD)



# Teaching implantology: haptic simulation

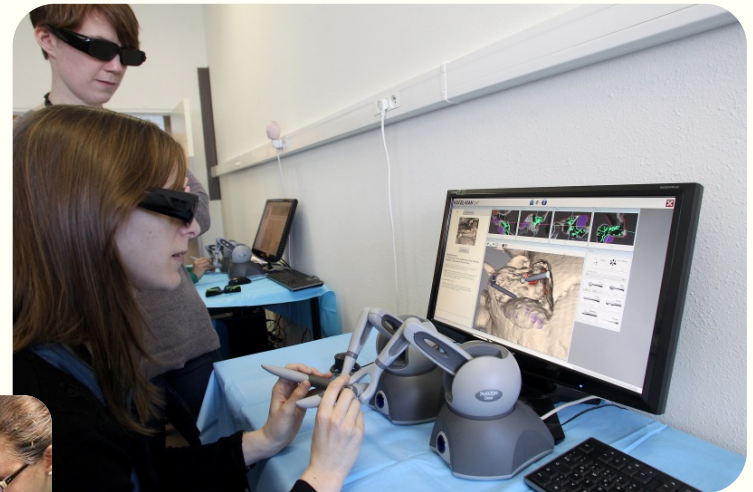
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- **Haptic:** « relating to the sense of touch »
- **Aim:** provide the most realistic tactile sensation
- As part of the initial training, haptic simulation as a teaching tool should allow to:
  - Promote training in implantology
    - Secure the interventions
  - Suggest an objective assessment
    - Develop self-training
  - Offer a realistic approach to the surgical technique
    - Reduce the cost of training



# School of surgery, Nancy

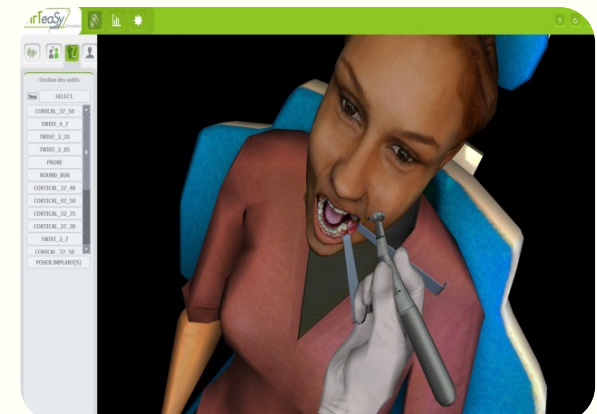
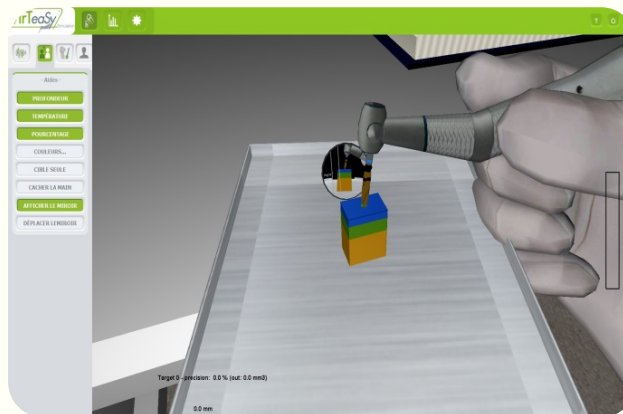
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# Haptic simulator device: general view



Virteasy®  
Simulator: Composition and interface





# Haptic device

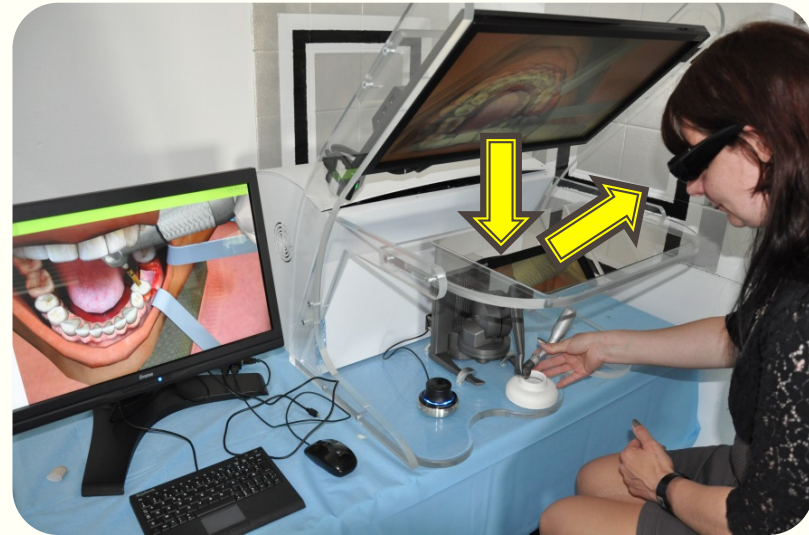
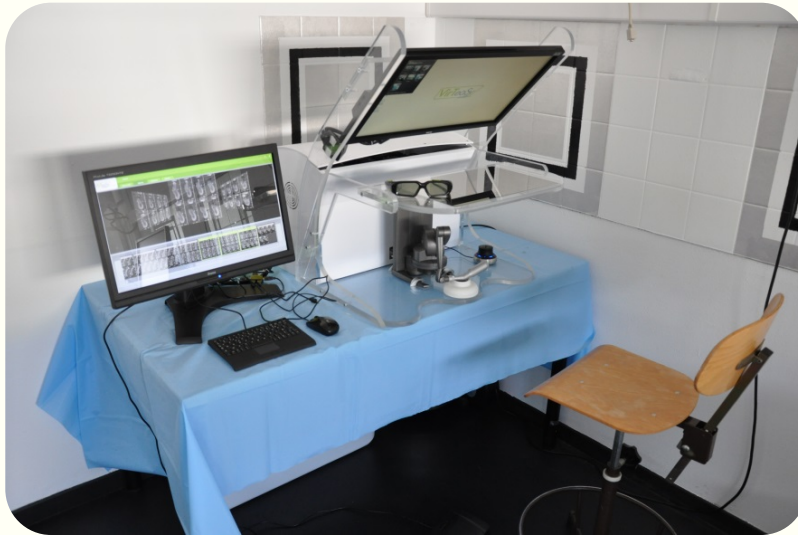
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Haptic force feedback arm  
Phantom®, dummy contra angled

# Haptic simulator, workstation

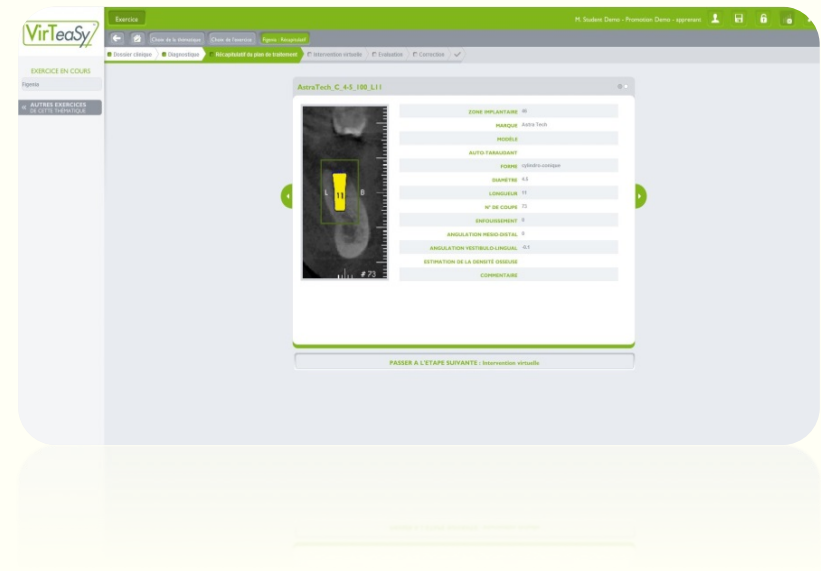
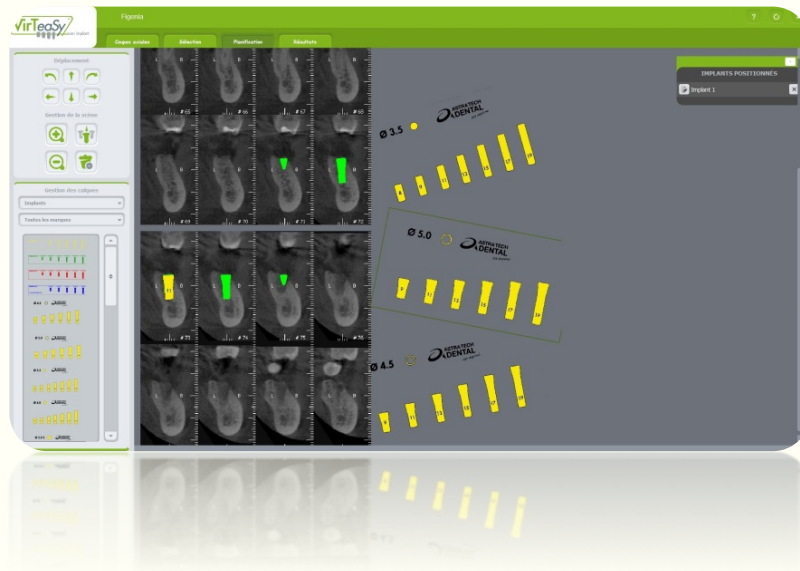
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Workstation and use of Simulator



# Simulator: planification tools



Planification and summary of implant  
planification in the simulator.

# Simulator: assistance for drilling procedures

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Centering aid



Angulation aid

# Simulator: assistance for drilling procedures

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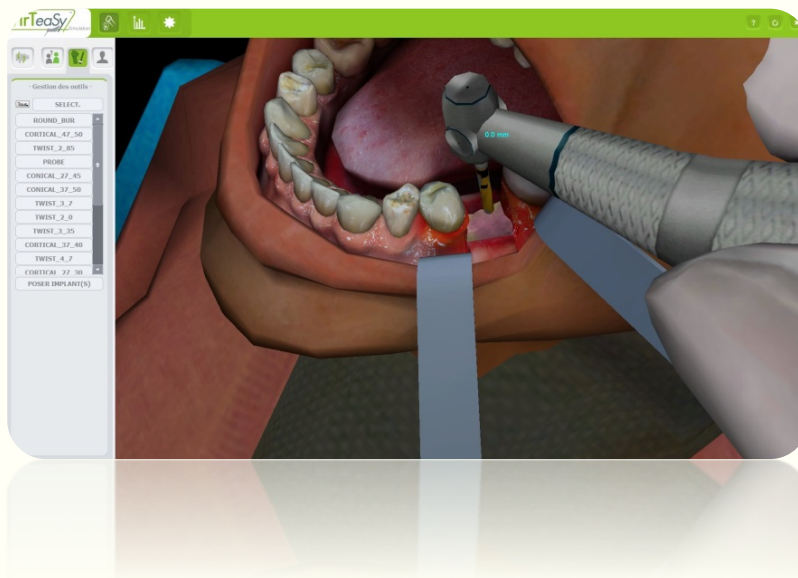
Centering aid



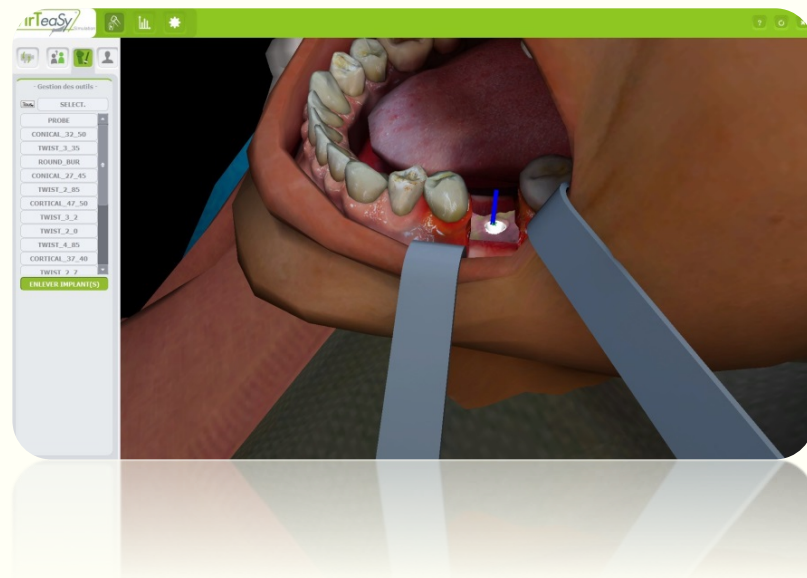
Angulation aid

# Simulator: virtual aspect of drilling

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Virtual drill and contra  
anguled

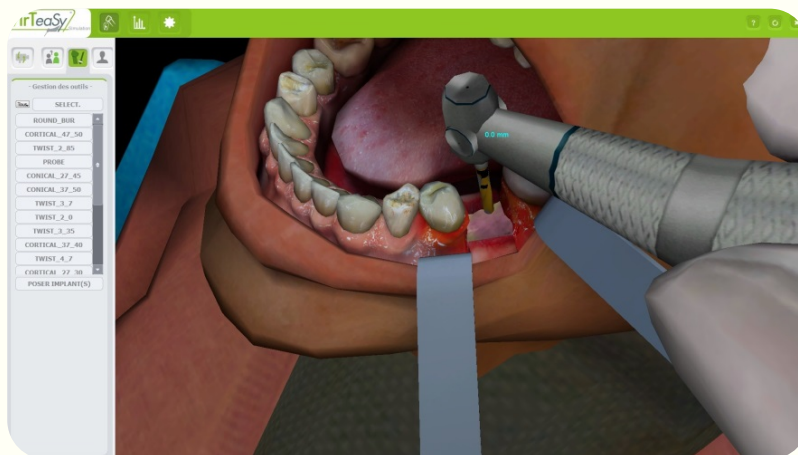


Aspect of virtual implant

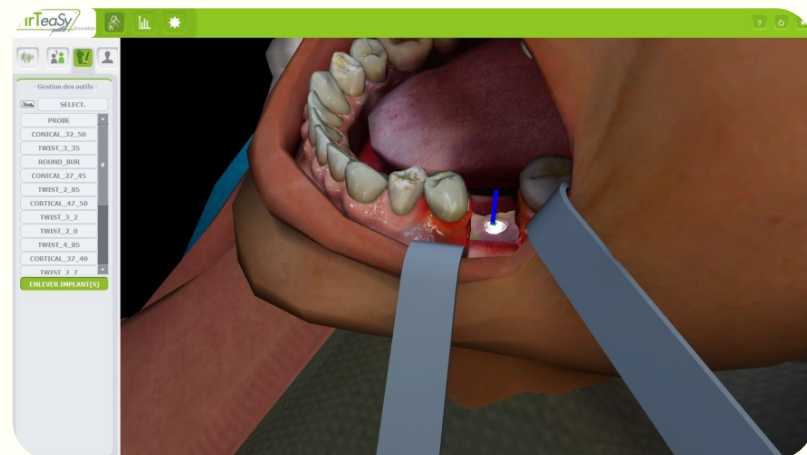


# Simulator: virtual aspect of drilling

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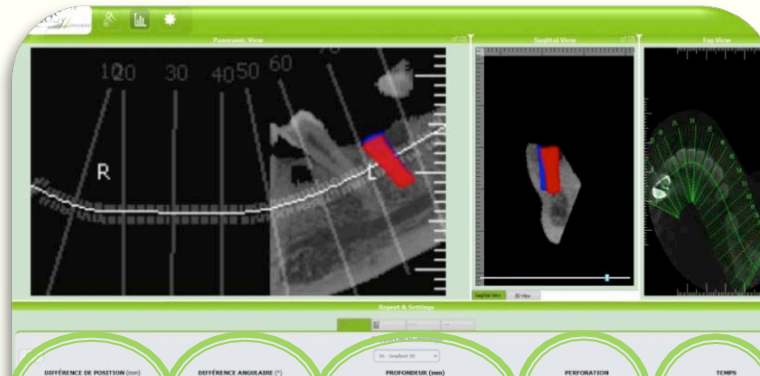
Virtual drill and contra angle



Aspect of virtual implant

# Simulator: assessment of drilling procedures

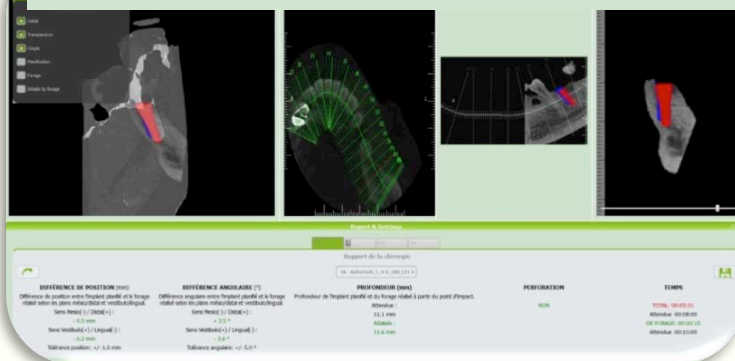
**Blue:**  
planification  
**Red:**  
realisation



Rapport de la chirurgie

36 - Implant 36

DIFFÉRENCE DE POSITION (mm)	DIFFÉRENCE ANGULAIRE (°)	PROFONDEUR (mm)	PERFORATION	TEMPS
<p>Différence de position entre l'implant planifié et le forage réalisé selon les plans méso/distal et vestibulo/lingual.</p> <p>Sens Mésio(-) / Distal(+): <b>+ 2.4 mm</b></p> <p>Sens Vestibulo(+) / Lingual(-): <b>- 0.3 mm</b></p> <p>Tolérance position: +/- 1.0 mm</p>	<p>Différence angulaire entre l'implant planifié et le forage réalisé selon les plans méso/distal et vestibulo/lingual.</p> <p>Sens Mésio(-) / Distal(+): <b>- 6.2 °</b></p> <p>Sens Vestibulo(+) / Lingual(-): <b>+ 16.0 °</b></p> <p>Tolérance angulaire: +/- 5.0 °</p>	<p>Profondeur de l'implant planifié et du forage réalisé à partir du point d'impact.</p> <p>Attendue : <b>11.6 mm</b></p> <p>Réalisée : <b>10.9 mm</b></p>	<p>OUI</p>	<p>TOTAL: 00:01:02</p> <p>Attendue 00:08:00</p> <p>DE FORAGE: 00:00:05</p> <p>Attendue 00:10:00</p>

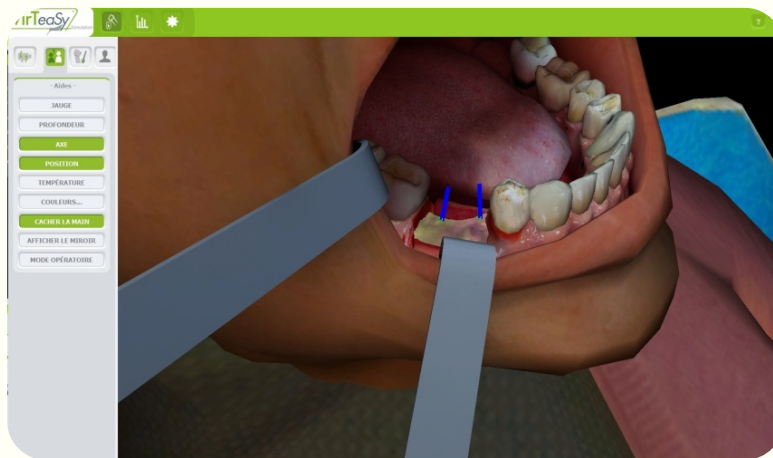


**Good preparation**

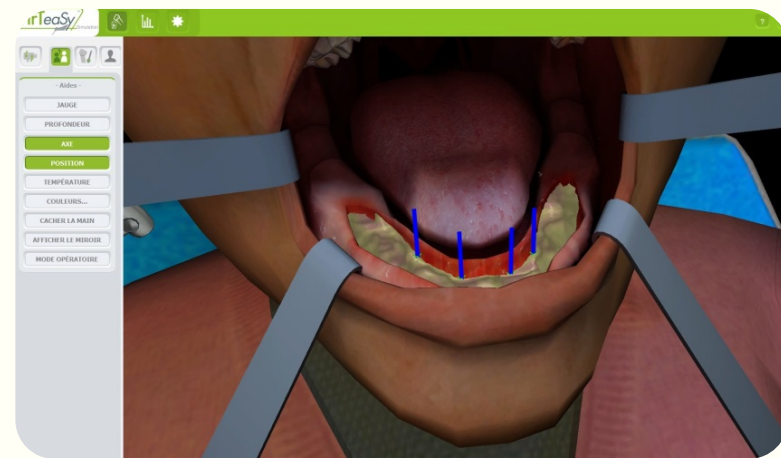


**Poor preparation**

## Simulator: exemple of other exercices



2 implants placement  
(partially edentulous)



4 implants placement in full  
edentulous arch



## Aim of the study



Check the impact of Virteasy® as a teaching tool and progression in implantology

3 parts:

- 1) Impact of simulation training on the skills of the operator
- 2) Comparative study of three groups of operators: evaluation of drilling parameters on the model from the scanner cuts simulator
- 3) Subjective assessment of the simulator through a survey





# Materials and methods: study population

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## **«Novice » group (N=20, 10 ♀,10 ♂, average age 21,15 years)**

- Students enrolled in DFGSO3 (3rd year dental) that received a theoretical course using a Powerpoint® presentation.

## **«Simulator» group (N=20, 10 ♀,10 ♂, average age 21,5 years)**

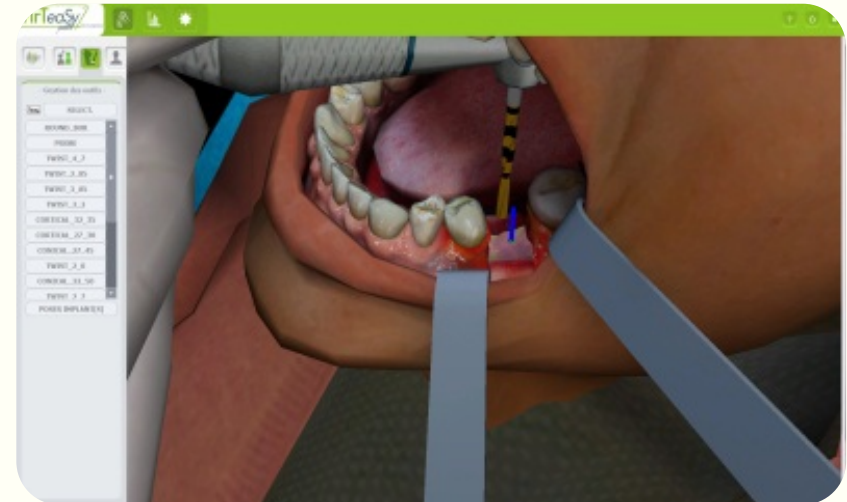
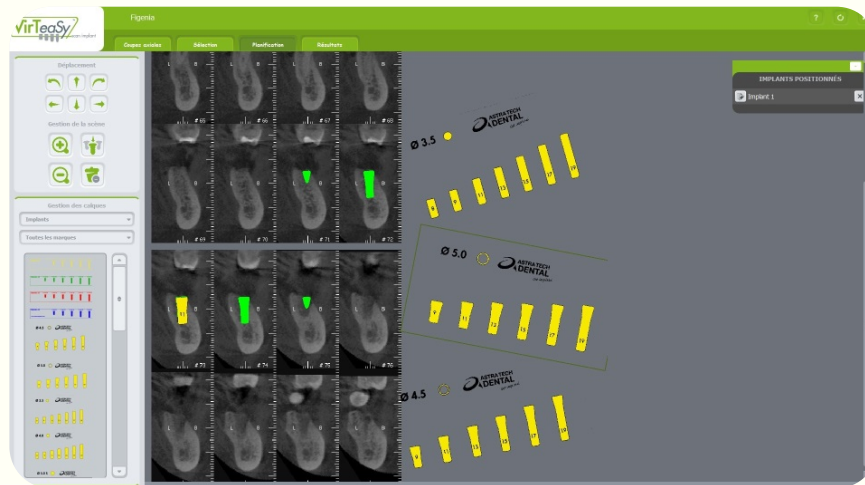
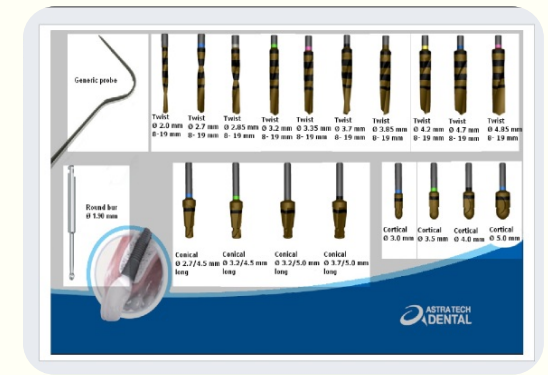
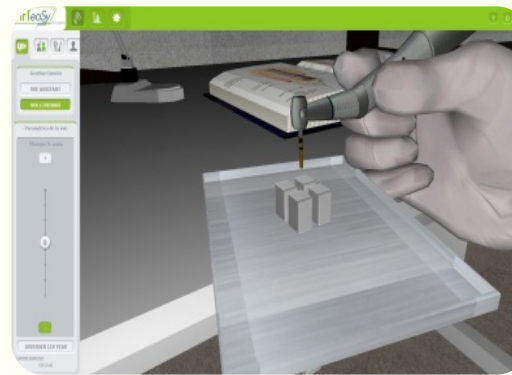
- Students enrolled DFGSO3 (3rd year dental) that performed a 8 sessions course on the simulator Virteasy® in addition to the theoretical presentation.

## **«Expert » group (N=20, 11 ♀,9 ♂, average age 39,25 years )**

- Licensed practitioners having already raised at least 15 implants, which receive a theoretical course using a Powerpoint® presentation.

# Materials and methods: simulation training

- Familiar with the simulator (exercise typology density)
- Exercise implant placement at a lower first molar left 8 sessions
  - 4 times with virtual assistance (positioning and angulation)
  - 4 times without using angulation assistance



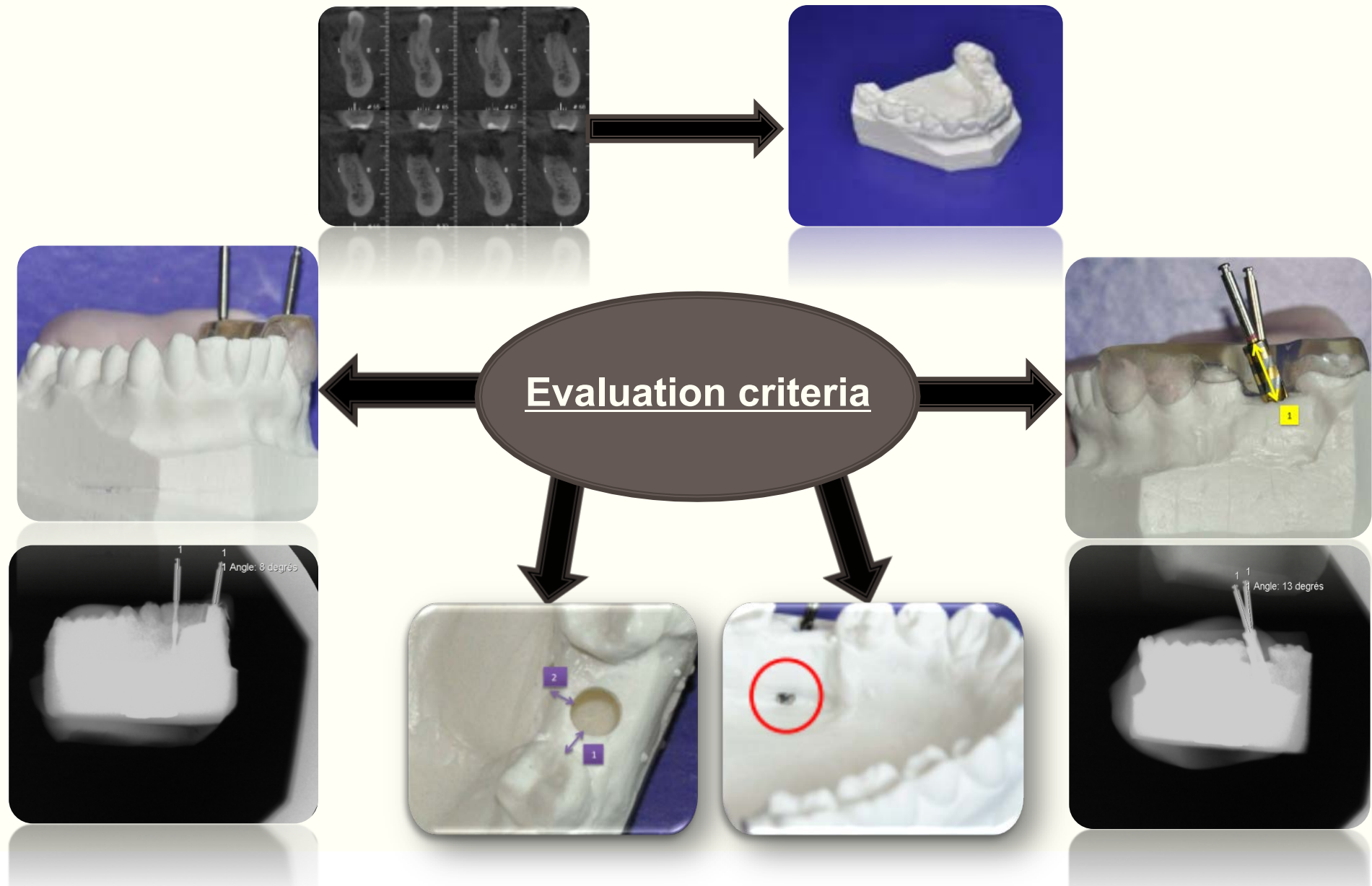
# Materials and methods: evaluation of simulator exercise

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## ■ Assessment parameters on simulator:

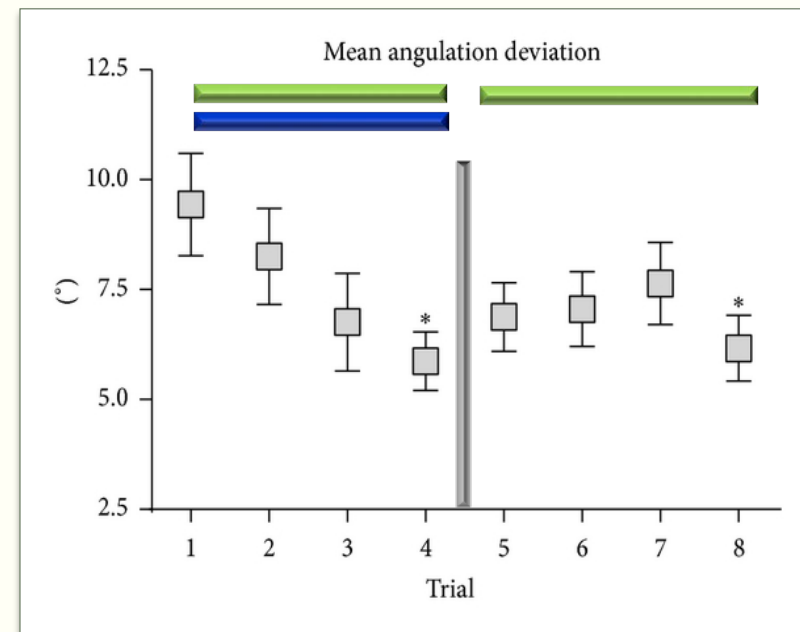
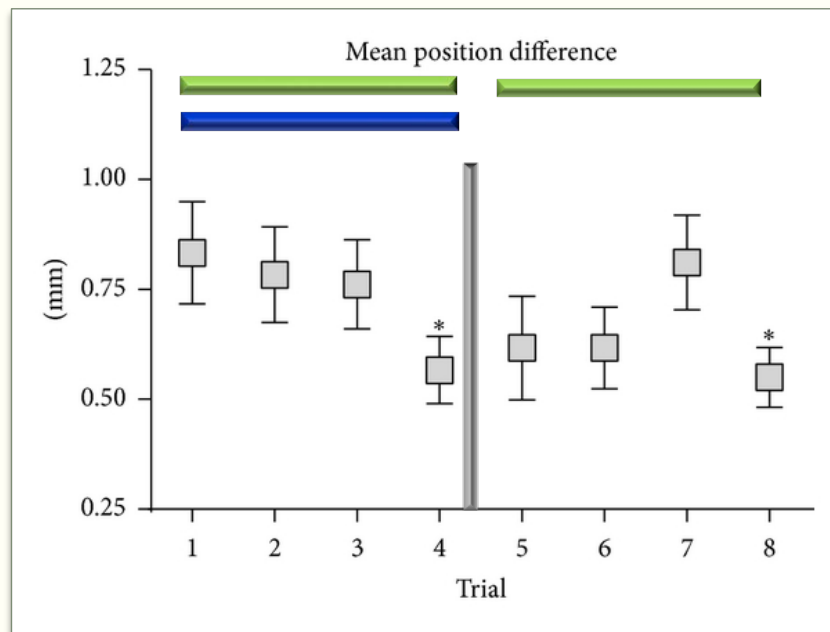
- Position difference
- Angulation difference
  - Perforation
  - Drilling depth
  - Total duration
- Drilling duration

# Materials and Methods: Resin Model and Evaluation Criteria





# Results: (1) impact of simulation training on the skills of the operator

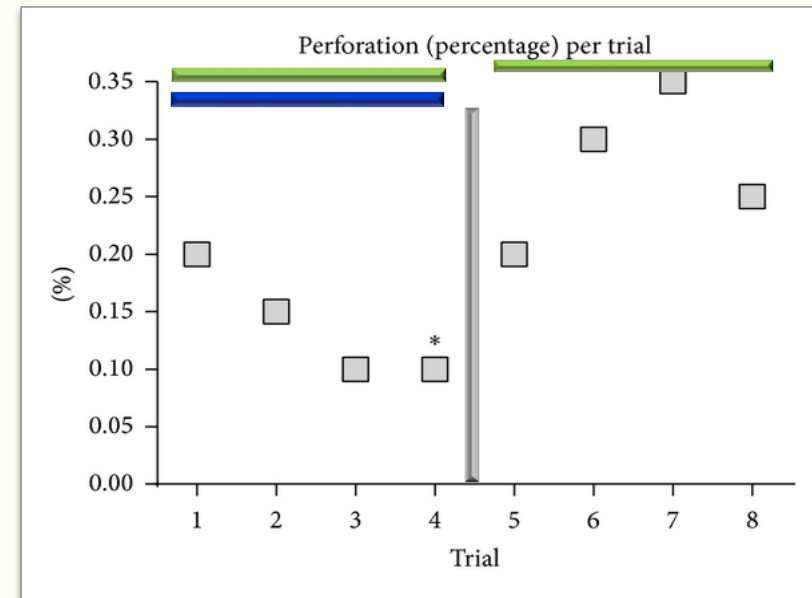
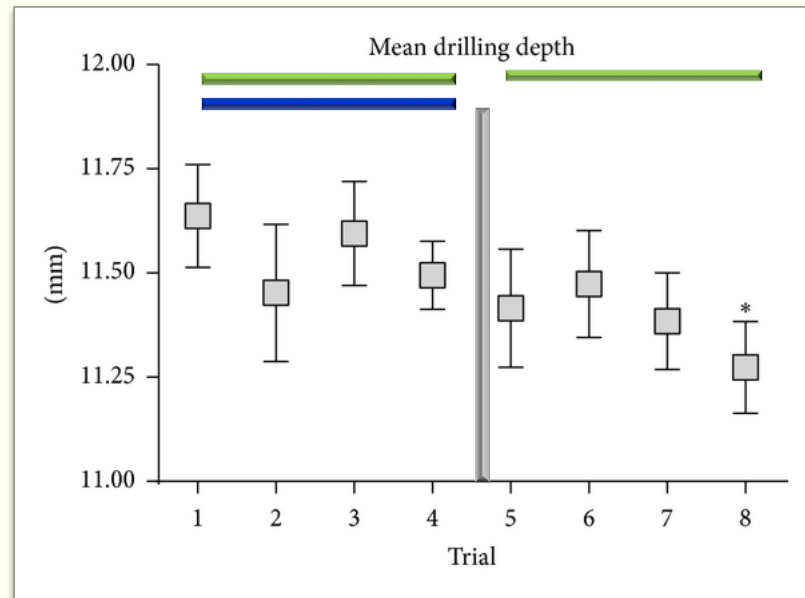


Angulation aid

Centering aid

Results for centering and angulation deviation

# Results: (1) impact of simulation training on the skills of the operator

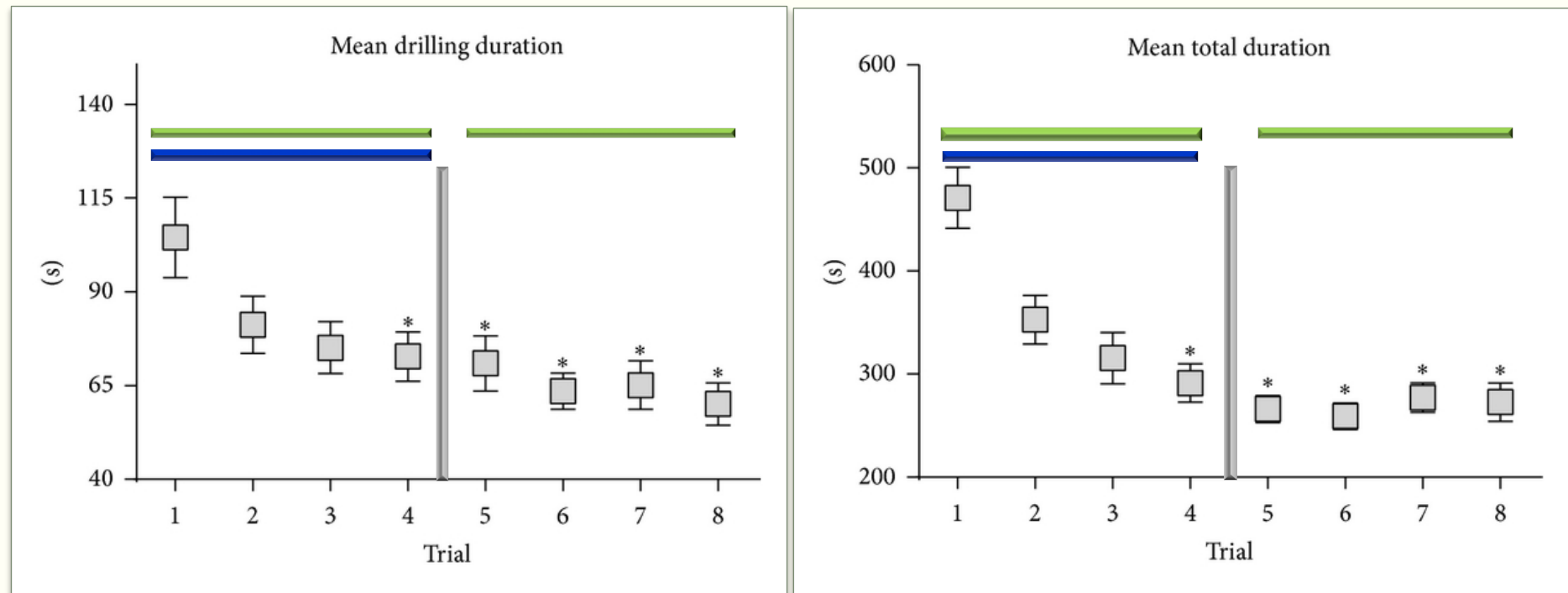


Angulation aid

Centering aid

Results for drilling depth and perforation

# Results: (1) impact of simulation training on the skills of the operator

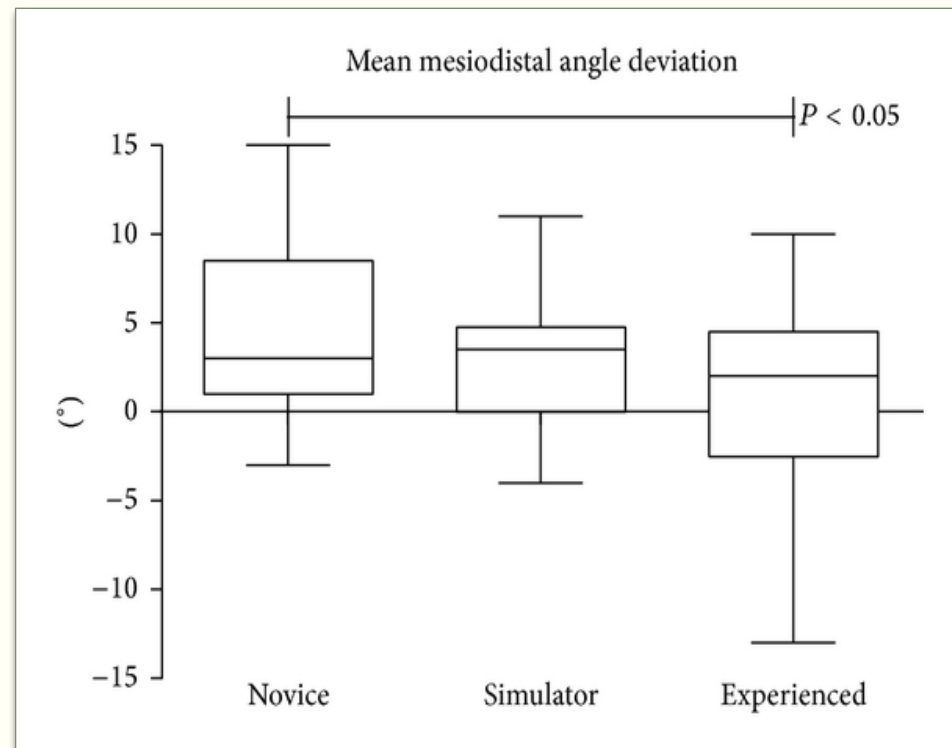
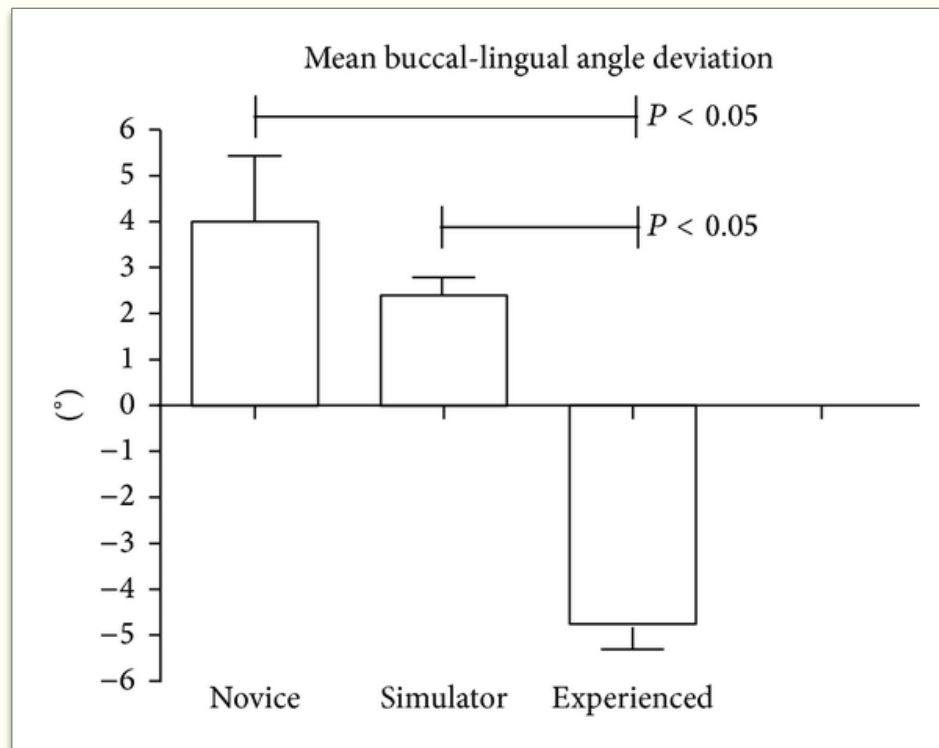


Angulation aid

Centering aid

Results for time (drilling and total)

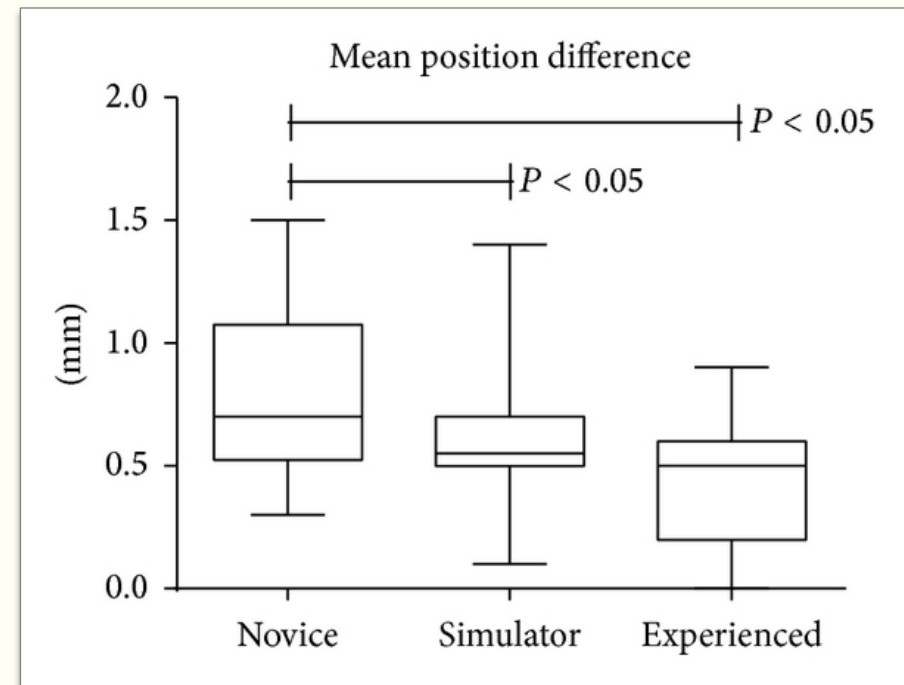
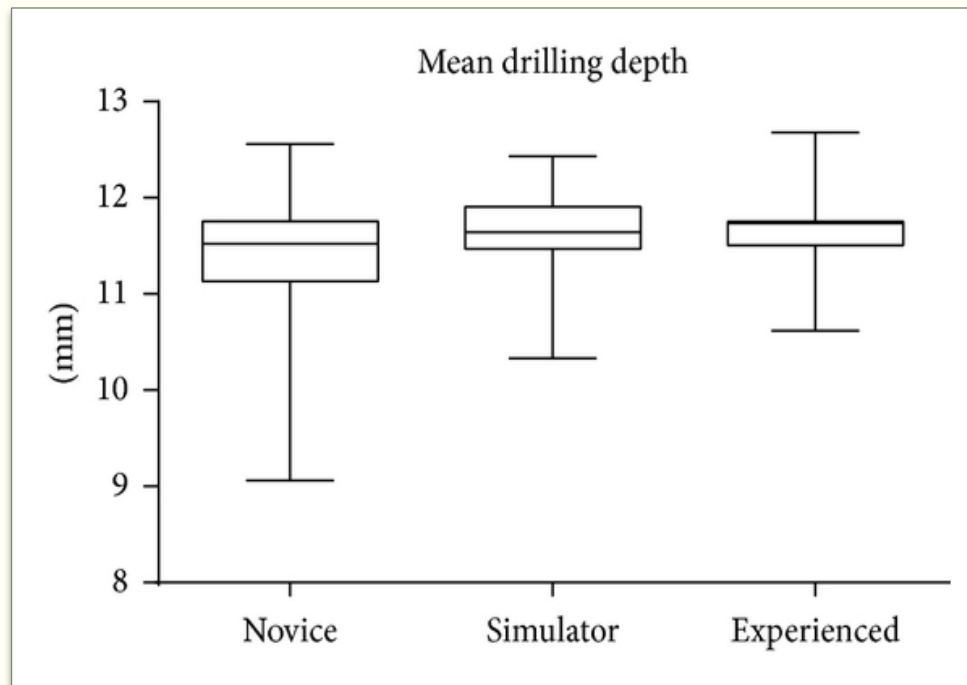
## Results: (2) Comparative study of drilling parameters on the model resin from cuts scanners simulator



Results for buccal-lingual and mesiodistal angle deviation



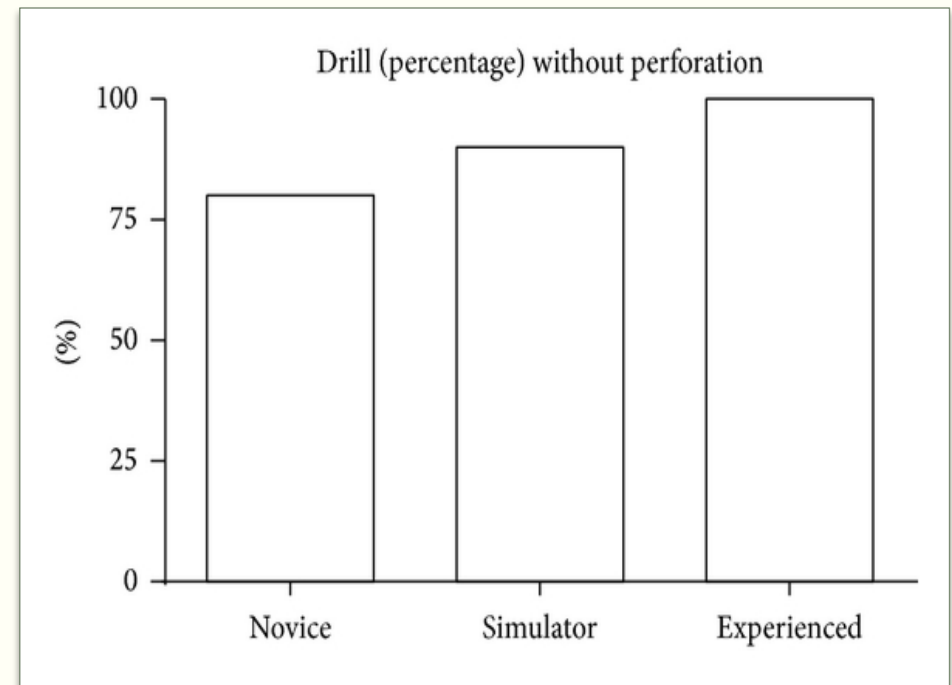
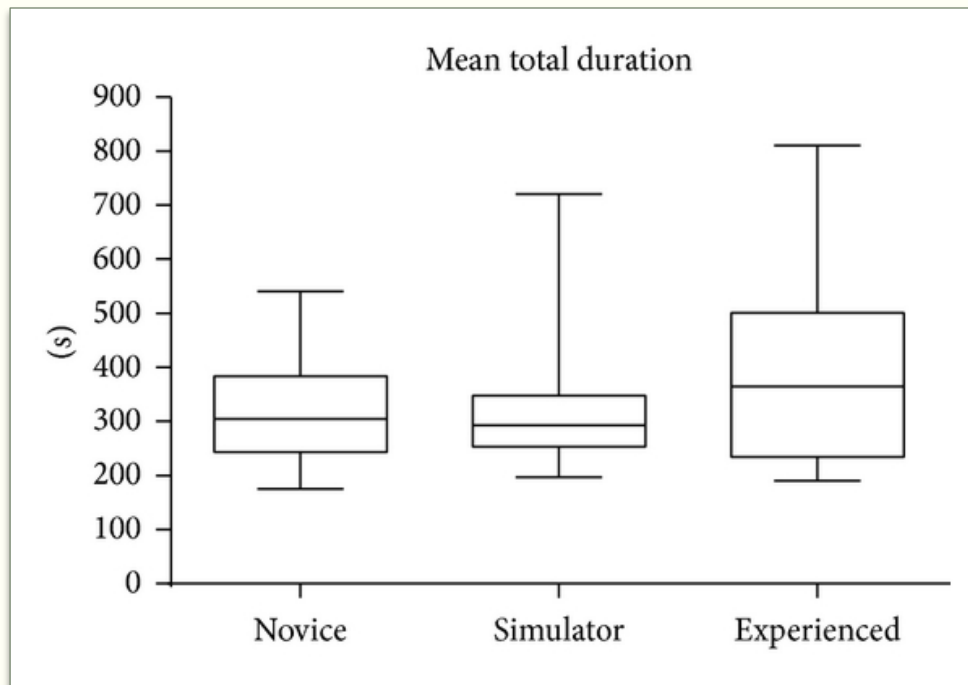
## Results: (2) Comparative study of drilling parameters on the model resin from cuts scanners simulator



Results for drilling depth and centering

## Results: (2) Comparative study of drilling parameters on the model resin from cuts scanners simulator

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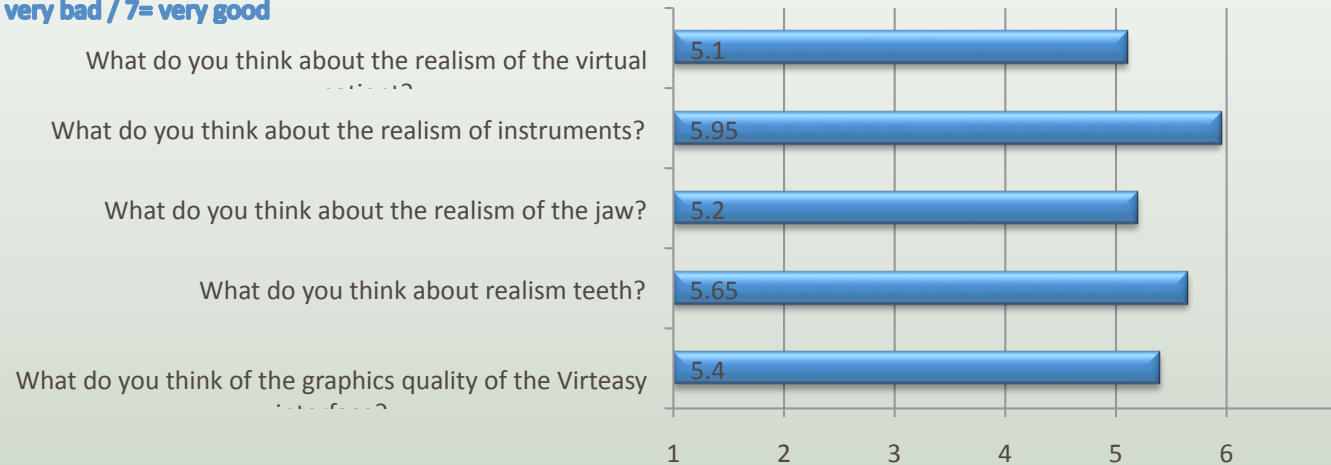


Results for time and perforation

# Results: (3) subjective assessment of the simulator

## Visual ergonomics issues

1= very bad / 7= very good

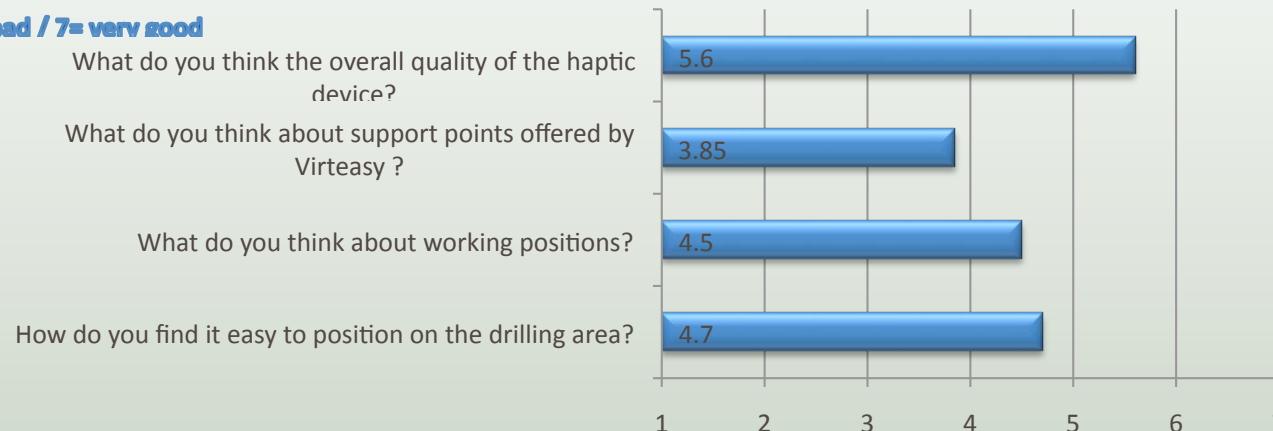


### Visual ergonomics issues:

Very satisfying? Mean score 5.1 to 5.95. Highest score (5.95 / 7) for the instruments representation.

## Positioning ergonomics and interface issues

1= very bad / 7= very good



### Positioning ergonomic issues

Support points should be improved. (3.85 / 7)

# Results: (3) subjective assessment of the numerical simulator

1= very bad / 7= very good

## Drilling sensations issues

What do you think about the match between 3d interface and the feeling of your hand?

5.65

What do you think of the feeling of force applied on haptic device to drill the jaw?

5.55

What do you think of the feeling of spongy bone with haptic device?

5.85

What do you think of the feeling of cortical with haptic device?

5.75

What do you think about jaw touch sensation ?

5.55

What do you think of the freedom of movement (natural) offered by the arm force feedback?

4.9

What about the sensation of virtual drilling and the resin model (1 = same, 7 = very different)

4.2

Realism drilling simulator (force feedback) (1 = not realistic / 7 = very realistic)

6

## Drilling sensations issues:

Overall very positive.

Mean score of 5.43



# Discussion, conclusion

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- ADEE: Prague 2008\*, Budapest 2013\*
  - Harmonize training at European level
  - At all levels (Under Graduate, Post Graduate, Continuing professional development)
  - Virteasy®, first haptic simulator in implantology
- In our study we:
  - Distinguished the three populations with a basic exercise on resin model based on a simulator exercise
  - Observed an increase performance in the "Simulator" group
  - Identified some deficiencies and settings to improve the simulator
- Suebnukarn S. & al. (2010,2011), Buchanan J.A & al. (2004), Von Sternberg N & al. (2007), Marras I & al. (2008)...
- Interest in the educational journey: (3rd, 4th, 5th year, Post doc, CPD) yes but requires support (Briefing / Debriefing) (HAS September 2012)
- *Perspective: Modeling and Virtual Training preoperative*

Mattheos N, Albrektsson T, Buser D, De Bruyn H, Donos N, Hjørting Hansen E, et al. Teaching and assessment of implant dentistry in undergraduate and postgraduate education: a European consensus. *European Journal of Dental Education*. 1 févr 2009;13:10-17. 2.

Mattheos N. Teaching and learning in implant dentistry: reflecting on achievements and challenges. *Eur J Dent Educ*. 1 mars 2014;18:1-2.



# THANK YOU FOR YOUR ATTENTION

JOSEPH D, JEHL J-P, MAUREIRA P, PERRENOT C, MILLER N, AMBROSINI P, BRAVETTI P et  
TRAN N  
Relative Contribution of Haptic Technology to Assessment and Training in Implantology  
BioMed Research International Volume 2014 (2014), Article ID 413951, 9 pages  
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