RELATIVE CONTRIBUTION
OF HAPTIC TECHNOLOGY
IN IMPLANTOLOGY

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Teaching implantology

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
Implantology education: simulation as a teaching strategy

- "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)

-Instruction DGOS/PF2 n° 2013-383 du 19 novembre 2013 relative au développement de la simulation en santé
- http://www.has-sante.fr/portail/jcms/c_930641/fr/simulation-en-sante
Teaching implantology: haptic simulation

- **Haptic**: « relating to the sense of touch »
- **Aim**: provide the most realistic tactil 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 technic
  - Reduce the cost of training
School of surgery, Nancy
Haptic simulator device: general view

Virteasy®
Simulator: Composition and interface
Haptic device

Haptic force feedback arm
Phantom®, dummy contra angule
Haptic simulator, workstation

Worksation and use of Simulator
Simulator: planification tools

Planification and summary of implant planification in the simulator.
Simulator: assistance for drilling procedures

Centering aid

Angulation aid
Simulator: assistance for drilling procedures

Centering aid

Angulation aid
Simulator: virtual aspect of drilling

Virtual drill and contra angulated

Aspect of virtual implant
Simulator: virtual aspect of drilling

Virtual drill and contra angle
Aspect of virtual implant
Simulator: assessment of drilling procedures

Blue: planification
Red: realisation

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

- **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 in DFGSO3 (3rd year dental) that performed an 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

- 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

Results for centering and angulation deviation
Results: (1) impact of simulation training on the skills of the operator

Results for drilling depth and perforation
Results: (1) impact of simulation training on the skills of the operator

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.

**Results for time and perforation**

- **Mean total duration**
  - Novice
  - Simulator
  - Experienced

- **Drill (percentage) without perforation**
  - Novice
  - Simulator
  - Experienced
Results: (3) subjective assessment of the simulator

Visual ergonomics issues

1= very bad / 7= very good

What do you think about the realism of the virtual health? 5.1
What do you think about the realism of instruments? 5.95
What do you think about the realism of the jaw? 5.2
What do you think about realism teeth? 5.65
What do you think of the graphics quality of the Virteasy interface? 5.4

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

What do you think the overall quality of the haptic device? 5.6
What do you think about support points offered by Virteasy? 3.85
What do you think about working positions? 4.5
How do you find it easy to position on the drilling area? 4.7

Positioning ergonomic issues
Support points should be improved. (3.85 / 7)
## Drilling sensations issues

1 = very bad / 7 = very good

<table>
<thead>
<tr>
<th>Question</th>
<th>Score</th>
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<tbody>
<tr>
<td>What do you think about the match between 3D interface and the feeling of your hand?</td>
<td>5.65</td>
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<tr>
<td>What do you think of the feeling of force applied on haptic device to drill the jaw?</td>
<td>5.55</td>
</tr>
<tr>
<td>What do you think of the feeling of spongy bone with haptic device?</td>
<td>5.85</td>
</tr>
<tr>
<td>What do you think of the feeling of cortical with haptic device?</td>
<td>5.75</td>
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<td>What do you think about jaw touch sensation?</td>
<td>5.55</td>
</tr>
<tr>
<td>What do you think of the freedom of movement (natural) offered by the arm force feedback?</td>
<td>4.9</td>
</tr>
<tr>
<td>What about the sensation of virtual drilling and the resin model (1 = same, 7 = very different)</td>
<td>4.2</td>
</tr>
<tr>
<td>Realism drilling simulator (force feedback) (1 = not realistic / 7 = very realistic)</td>
<td>6.0</td>
</tr>
</tbody>
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**Drilling sensations issues:**

Overall very positive.

**Mean score of 5.43**
Discussion, conclusion

- 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


- 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

THANK YOU FOR YOUR ATTENTION

Relative Contribution of Haptic Technology to Assessment and Training in Implantology
(Impact Factor = 2.88)