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Benefits of intraoral cobotic scanning in the dental CAD/CAM chain

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Introduction

- In the last years, the **modernisation** of the **digital impression** has been made possible thanks to **digital intra-oral scanners (IOS)** and **additive manufacturing** machines, which are increasingly used in dentistry, and enable the **quality** of **dental care** to be improved.
- STL files** obtained with IOS are the **first step** in digital manufacture of **dental prostheses**.
- Effective patient care are reflected in **precision**, **accuracy** and **fidelity** of CAD files [1-2].
- Many factors are involved, including the practitioner [3].

Objectives

- Define a **repeatable** and **reproducible** experimental measurement protocol with the cobot.
- Programming** the cobot to teach the practitioner the scanning gesture.
- Carrying out a **test campaign**.
- In vitro experiments :
Experiment 1: Scanning for an entire dental with spheres on the second molars and first premolars.
Experiment 2: Scanning for an entire dental arch.

Materials & Methods

Cobot UR5e HMI-MBS:

- Robotiq Wrist Camera
- Robotiq 2F-85 Adaptive Gripper

Reference object for Experiment 1:



Reference object for Experiment 2:

Frasaco and articulator.



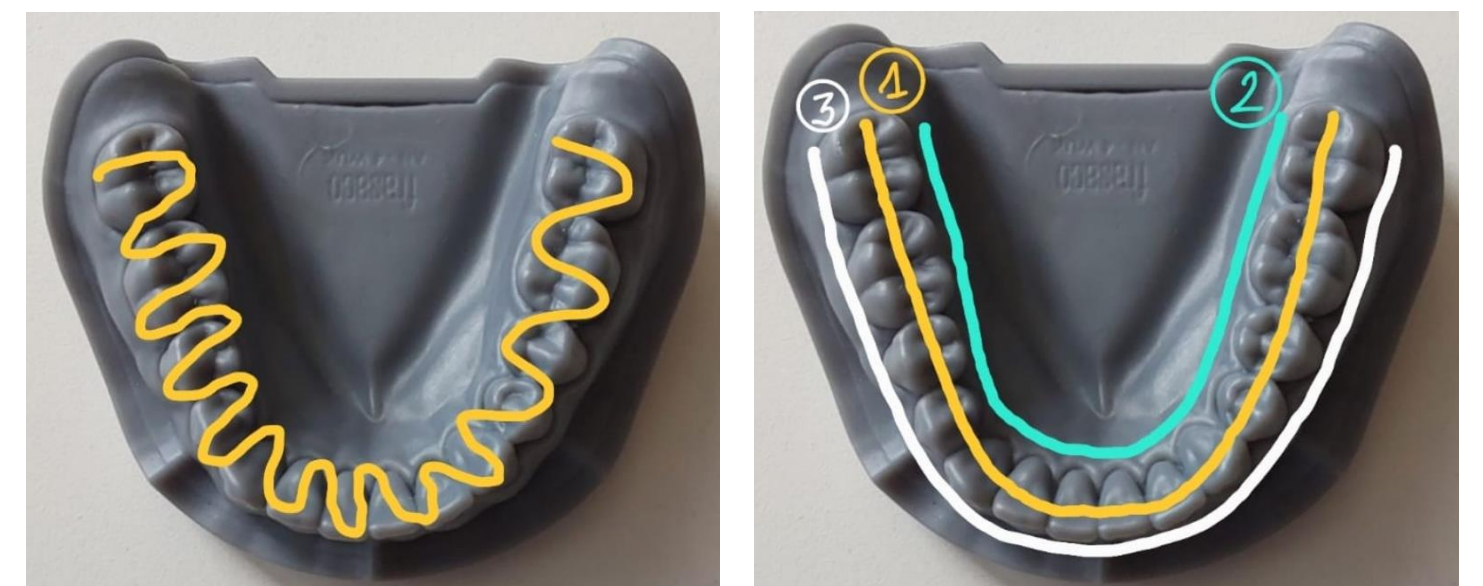
Software:

- Creation of the trajectory on Solidworks.
- Simulation and adjustment on RoboDK.

Care Stream CS3800 IOS:

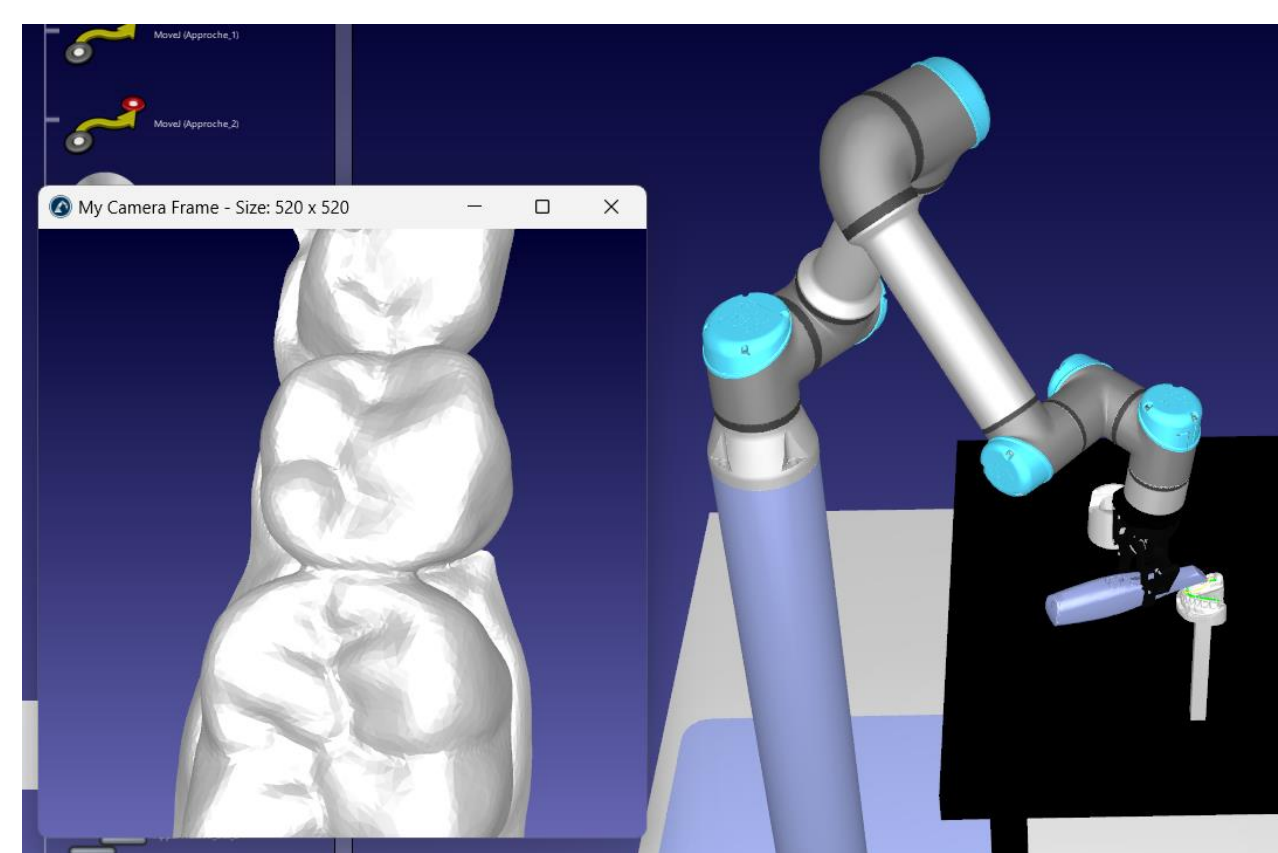
Using only the wireless side with its standard tip.

Tested trajectories:



Results

- Trajectory reproducibility
- Cobotic scan
- STL files
- Complete simulation environment for scanning
- In vitro scanning



Perspectives

- Comparison** of the **results** obtained (accuracy, precision and fidelity of CAD files) with those obtained by the practitioner.
- Vision** of cobots in dentistry in the future, in **autonomous** or **collaborative** form.

[1] Troizier Cheyne M, Lebon N, Laverne F. (2023). "Impact of Intra oral Scanner Sleeves on STL File Accuracy: A Metrological Approach". Computer Aided Design and Applications, 21(4), pp.567-580. 10.14733/cadaps.2024.567-580. hal-04284162.

[2] L. Dupagne, L. Tapie, N. Lebon, B. Mawussi, Comparison of the acquisition accuracy and digitizing noise of 9 intraoral and extraoral scanners: An objective method, The Journal of Prosthetic Dentistry, Volume 128, Issue 5, 2022, 1032-1040, <https://doi.org/10.1016/j.prosdent.2021.02.005>.

[3] Thomas AA, Jain RK. Influence of Operator Experience on Scanning Time and Accuracy with Two Different Intraoral Scanners - A Prospective Clinical Trial. Turk J Orthod. 2023; 36(1): 10-14.

[4] Crétot, M. (2003). L'arcade dentaire humaine: morphologie. Editions CdP-Groupe Liaisons.