

NEWSLETTER - JUNE 2004

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1. OTAGO FACULTY OF DENTISTRY

Ionut, Mike and Jules have had a paper, entitled MANDIBULAR STIFFNESS IN HUMANS: NUMERICAL PREDICTIONS, accepted in the Journal of Biomechanics. Our study looks specifically at the chin, a feature unique to humans. We evaluate the effect of mandibular symphyseal design on biomechanical effectiveness during unilateral chewing. A simple model of three symphyseal shapes (chin, flat symphysis and lingual buttress), was built to represent human, Neanderthal and higher primate symphyseal shapes and these were subjected to wishboning and torsional forces (Fig 1). Additionally, an anatomically detailed reconstruction was made of the CT scan of an actual human mandible, which was then also morphed into a chinless model. The results of a 3-D Finite Element Analysis show firstly, that none of the three different symphyseal shapes is biomechanically more advantageous than the others. Secondly, we show in a CT derived model, that the presence of a chin does not confer significantly improved stiffness to torsional or flexural loading. These results indicate that the acquisition of a chin in modern humans is not related to the functional demands placed upon the mandible during mastication, but suggest that it developed in response to other biomechanical demands.

2. MASSEY TEAM PROGRESS REPORT

Since February 05, Jzsef-Sebastian Pap revised the robotic jaw model to ensure it is as close as possible to the human jaw system. For position and orientation of the masseter, temporalis and pterygoid muscle group, see Figure 1. Furthermore he received a scanned CT-model from Ionut Ichim, which is used for simulations in SolidWorks and Cosmos/Motion. To estimate the maximal moving angles, velocity and acceleration of actuators during the mastication process, 2D-data provided by INRA France were

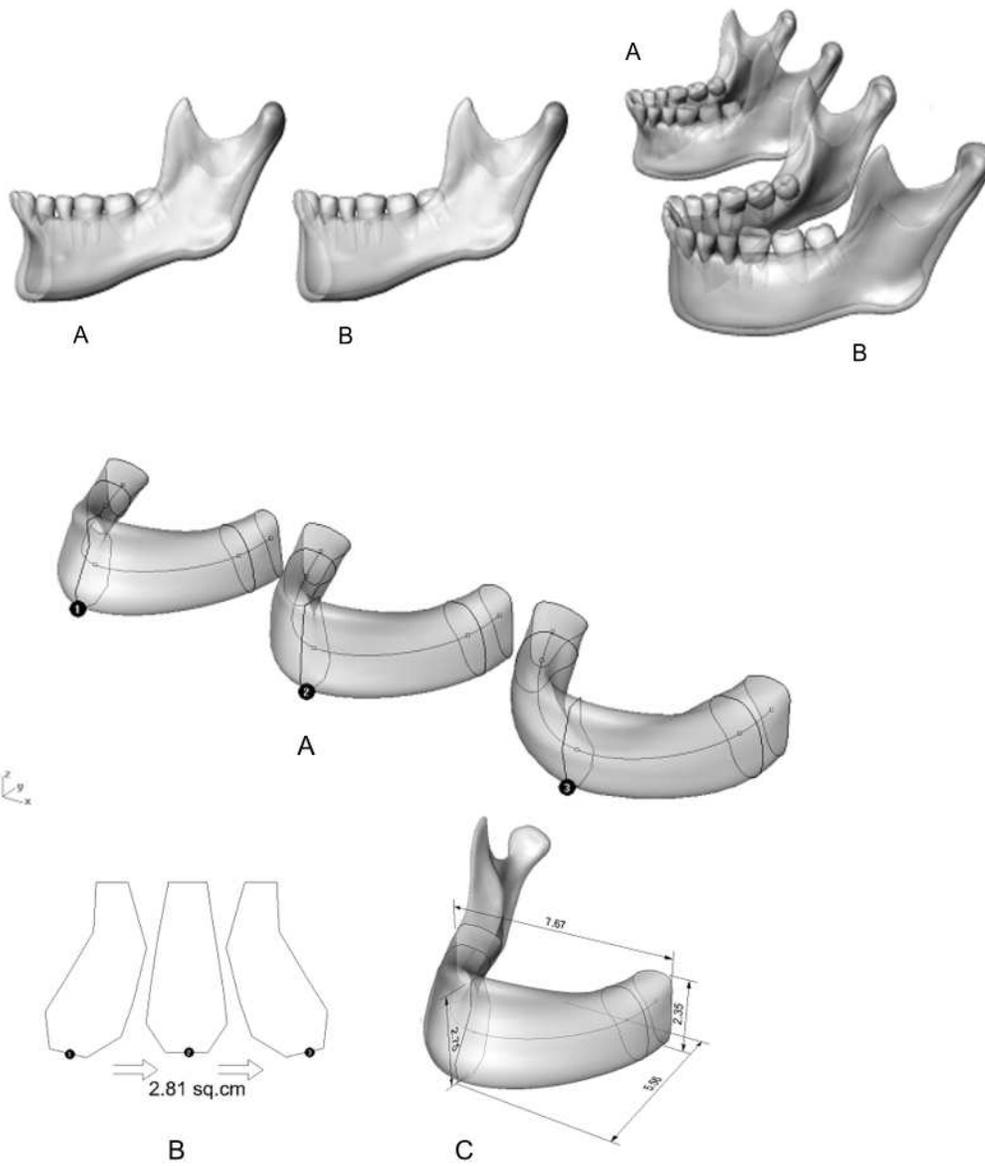


Figure 1: Theoretical models for symphyseal shapes (A1 chin; A2 flat; A3 simian shelf), cross-sectional mid-symphyseal shapes (B) and dimensions of anterior and posterior corpus height and depth (C).

used. Based on these specifications, he designed an actuator, which contains a ball spindle, a gear box, and a DC servo motor (Figure 2(b)). He is currently waiting for all parts to arrive, so that he can go on with experiments. At the moment he is comparing the proposed actuator with two other interpretations of a mechanical actuator. The next step is to design a mechanical jaw and related to this he will go down to the Otago University, Dunedin August 05. He will also present the current results of his work at the ANZ IADR conference in Queenstown.

Adrien Lauranceau-Maineau and Thibaud Roquier joined the Massey team as practicum students from France in the end of June 05. Both work for three months at the Palmerston North campus on feedback control of the proposed actuator as well as teeth sensing. Adrien is doing some research on force sensors and Thibaud works on displacement and velocity sensors.

Jonathan Torrance, who has been working on robotic kinematics and dynamics and design motion control system, took a break until the end of this year due to illness. He will come back in the beginning of next year.

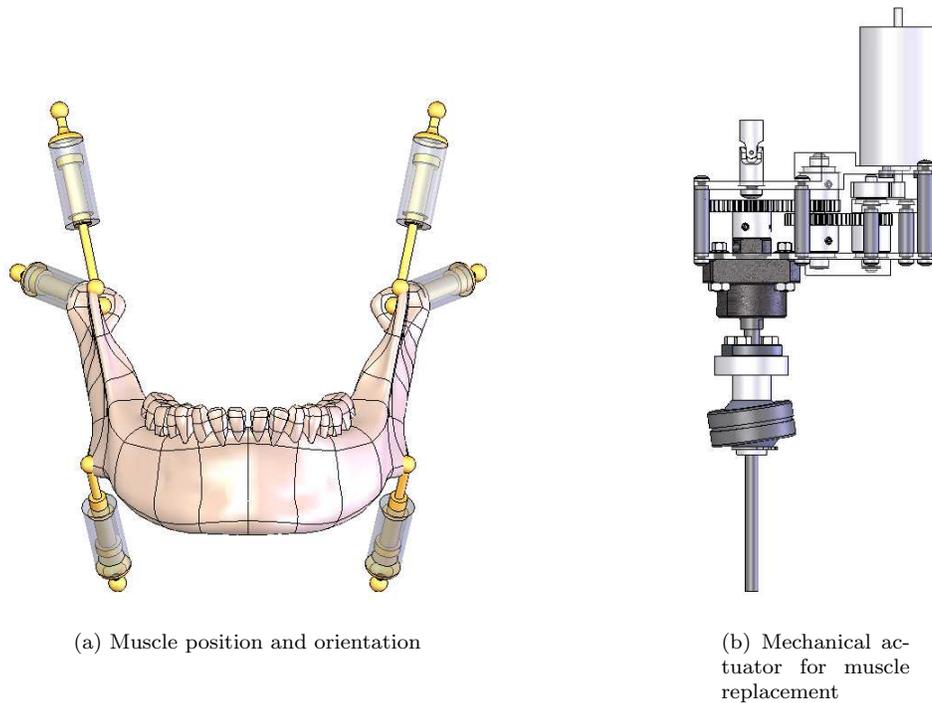


Figure 2:

3. BIOENGINEERING INSTITUTE AT THE UNIVERSITY OF AUCKLAND.

Kylie and Oliver met to discuss and work out an outline for a joint paper on describing the technique and methodology of collecting dynamic chewing data using motion capture. A literature search exhibited that there is a Japanese group using a similar technique and methodology. Unfortunately, there exist several papers referring to this technique, but the one describing the exact set-up, which might reveal

differences to our technique, could not be found anywhere. We requested this article as an “interloan” from the University of Auckland library. This was some 2 months or so ago, and we have not heard back from them yet.

Ionut came to Auckland the end of May. He explained the drawbacks of his current model used in the paper mentioned above. One of Ionut, Mike, and Jules concerns is that, because of their software package, they can only use an isotropic material law for the mandible. Oliver is quite confident that CMISS (the software package developed at the Bioengineering Institute) can eliminate these concerns. Ionut left the data for their test mandible, but to get our geometry fitted to his data, we still need to work out several landmark points. It is possible with our software package to assign different material properties, even within one element. This should allow us to study, (hopefully) reproduce and compare these results with the current results. This should lead to a nice additional and joint paper showing validation to Ionut, Mikes and Jules current work, by reporting on another set of numerical results using a different finite element discretization.

4. ANNOUNCEMENT OF THE 45TH ANZ DIVISION OF THE INTERNATIONAL ASSOCIATION FOR DENTAL RESEARCH MEETING (25-28 SEPT, 2005) IN QUEENSTOWN.



**45th Annual Meeting of the
AUSTRALIAN / NEW ZEALAND DIVISION OF THE
INTERNATIONAL ASSOCIATION FOR DENTAL RESEARCH**

Sunday 25th ~ Wednesday 28th September 2005



Millennium Hotel, Queenstown, New Zealand

Keynote Speakers:
Prof Jimmy Steele, University of Newcastle upon Tyne, UK
Prof Lakshman Samaranayake, University of Hong Kong

Symposia:
Oral health of older adults
Oral microbiology: novel approaches to preventing oral microbial diseases
Dental education and AASD symposium
Fluorosis/enamel defects in child populations in Australia and New Zealand
Craniofacial biomechanics
Oral implantology
Biomaterials

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On-line registration opens: 1 February 2005
Early-bird registration deadline: 26 August 2005

On-line abstract submission opens: 1 February 2005
Abstract deadline: 12 August 2005

See you there!



Colgate