A Prototype for the Acquisition and Analysis of the 3D Mandibular Movement

Santos, Isa C.T. [1]; Tavares, João Manuel R. S. [1];
Mendes, Joaquim G. [1]; Paulo, Manuel P. F. [2]
[1] *Faculty of Engineering of Porto University, Porto, Portugal*
[2] *Faculty of Dental Medicine of Porto University, Porto, Portugal*

INTRODUCTION:

In Dental Medicine is essential to know the mandibular cinematic to simulate the temporomandibular joints, to position teeth moulds in articulators, and to reproduce the mandibular movements in order to insure a satisfactory occlusion.
Currently, both commercial and custom made devices are considered expensive and difficult to use in common clinical situations. Considering these disadvantages, it was developed a new system for the acquisition, visualization and analysis of the 3D mandibular movement that is economical, easy to use and sufficiently precise, [1, 2].

METHODS:

The development of the prototype system began with the choice of the technology to use in the 3D mandibular movement acquisition, because the device support structure would strongly depend on it. Hence, electromagnetic sensors were used to measure the magnetic field created by a small magnet placed inside the patient's mouth (near to the incise point), [2].
After choosing the technology to use, it was necessary to design the support structure for the acquisition system, [1]. Instead of creating a new device structure, a common facial arc used in Dental Medicine was adapted as the main support structure; thus, we chose the *Arcus* facial arc from *Kavo*.
As the selected arc was primary conceived to make static measurements, the first step in its adaptation was the redesign of the pieces that could difficult the dynamic measurement or harm the patient, [1]. Thus, the auricular pieces were redesigned.
For the acquisition of the sensors signals it was used a data acquisition device (DAQ) with plug-and-play USB connectivity, the NI USB-6008 model from *National Instruments*, [2].
To make easy the acquisition and analysis of the 3D mandibular movement using a personal computer, it was build a new computational application with an adequate graphical interface using the developing tool *LabVIEW* from *National Instruments*, [1, 2].
To know the 3D trajectory of the magnet was necessary to convert the output voltage of the three electromagnetic sensors used in 3D cartesian coordinates. To solve this problem, a neural networks approach was used, [2].

RESULTS/DISCUSSION:

The prototype system developed has adequate precision and can be produced at low price. So we think that it is a good help for medical doctors to detect and define good treatment plans for problems of dental occlusion.

REFERENCES:

[1] - Santos, I.C.T.; Tavares, J.MR.S.; Mendes, J.M.; Paulo, P.F.P.: A Prototype System for Acquisition and Analysis of the 3D Mandibular Movement. M2D - 5th International Conference on Mechanics & Materials in Design, FEUP, Porto, Portugal (2006)
[2] - Santos, I.C.T.; Tavares, J.MR.S.; Mendes, J.M.; Paulo, P.F.P.: A System for Analysis of the 3D Mandibular Movement using Magnetic Sensors and Neuronal Networks. Workshop Artificial Neural Networks and Intelligent Information Processing (ANNIIP), Setúbal, Portugal (2006)