



A clinical comparison of horizontal and transverse condylar inclinations derived from 3D mandibular tracking devices

Ankita Nigam MDS, Jason Lee DMD MMSc, Sang J Lee DMD MMSc

Department of Restorative Dentistry and Biomaterial Sciences, Harvard School of Dental Medicine, Boston, MA, USA

STUDY OBJECTIVES

The posterior determinants of occlusion comprise of horizontal condylar inclination(HCI), transverse condylar inclination (TCI or Bennett angle) and Bennett side shift (Immediate mandibular lateral translation). These determinants affect the occlusal morphology of the teeth. A method to obtain these determinants using a conventional mechanical articulator and static interocclusal record was introduced by Christensen in 1905. With the evolution of digitalization multiple efforts to develop dynamic jaw tracking devices have been tried.

With the advent MODJAW's Tech In Motion a 4 D optical digital jaw tracking device in motion, it is now possible to record the dynamic jaw motion with articulation which takes account of the kinematics of each patient's mandible in the design of prostheses. It is possible to demonstrate real time motion within minutes, record and calculate posterior determinants of occlusion along with envelope of function. It is also possible to predict and evaluate the mandibular functional movements of the future restorative prosthesis in real time.

This research study aims to investigate and compare posterior determinants of occlusion (Sagittal and Transverse condylar inclination, Bennett side shift) derived by mechano-electronic device CADIAX Compact 2 Gamma system and MODJAW's Tech In Motion. We aimed to test the clinical viability of using new system while minimizing the challenges of old system so that it can be utilized to integrate the information in a complete digital workflow for diagnosis, treatment planning, execution and to have predictable prognosis.

MATERIALS AND METHODS

Materials: 3Shape TRIOS® intraoral scanner, CADIAX compact 2 Gamma system (GAMMA; Medizinisch-Wissenschaftliche Fortbildungs-GmbH, Austria) and MODJAW's Tech In Motion (Modjaw; Sainte-Helen-du-Lac, France).

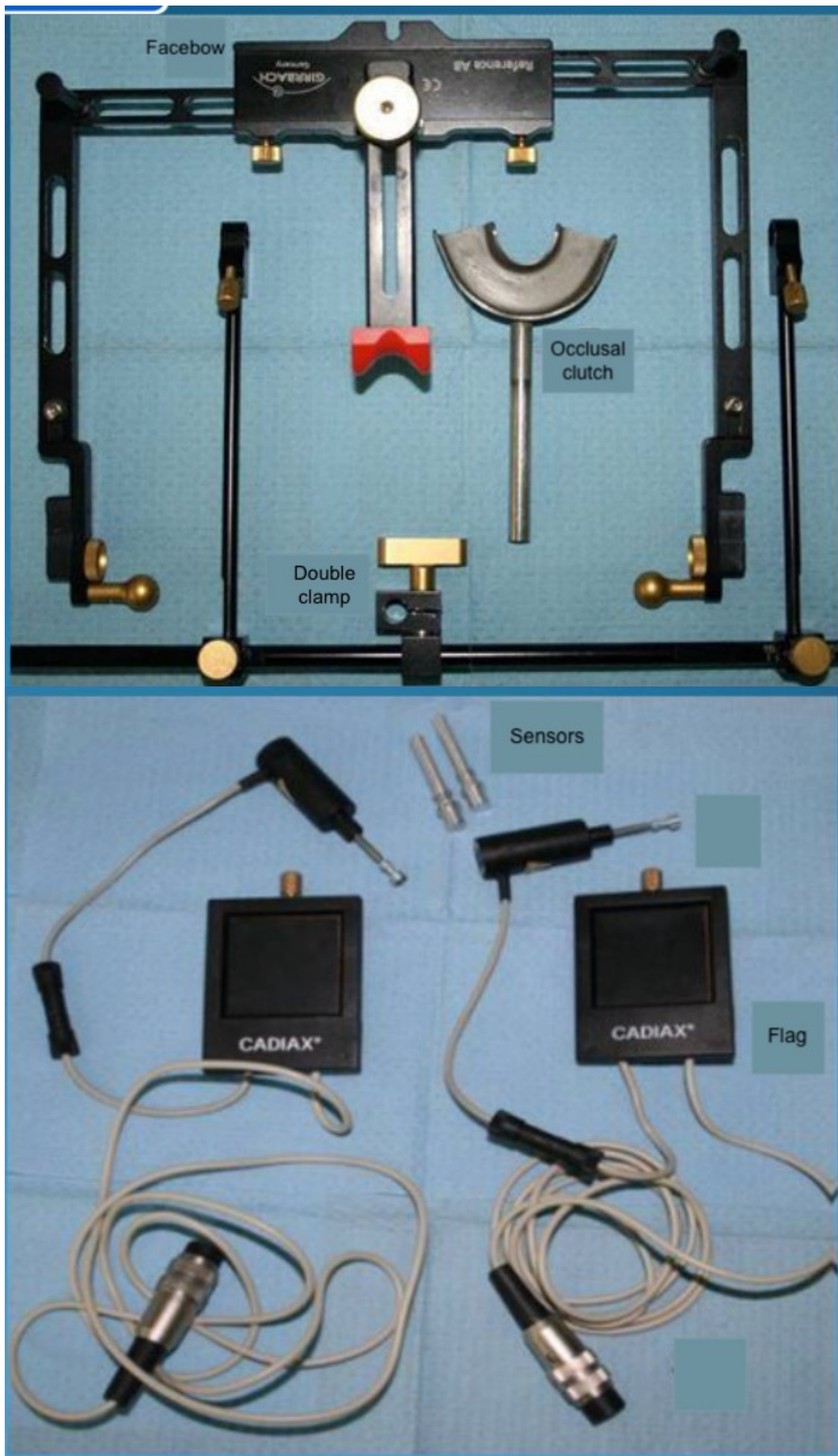


Figure 1: CADIAX with accessories



Figure 2: MODJAW with accessories

Phase I: Mechano-electronic device (CADIAX compact 2 system) The occlusal clutch is filled 2/3 with polyvinyl siloxane bite registration material (Exabite II NDS; GC America) and attached to the lower jaw dentition. The assembly is arranged on the subject in a comfortable position as per manufacturer's instructions and mandibular movements are performed.

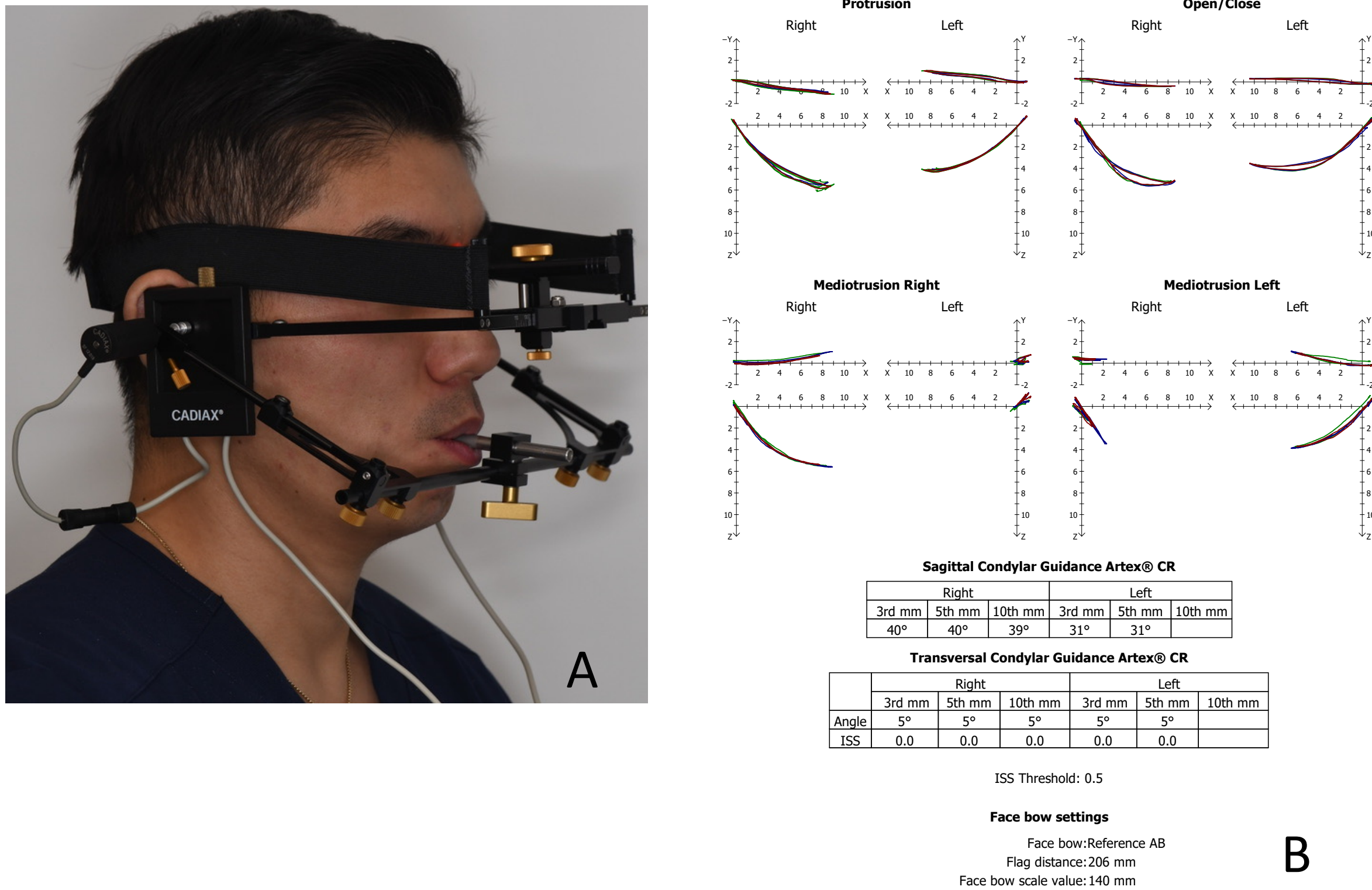


Figure 1. CADIAX Set up A) Assembled on a subject B) Screenshot of the graphical representation.

Phase II: MODJAW's Tech In Motion (Modjaw) : The 3D models of dental arches in STL file format are loaded to create a subject record. Acquire the anatomical reference points and check the visibility of the stylus, tiara and butterfly fork by camera. Ensure the subject is in a reproducible position as during the occlusal scan. Check the matching precision and choose a movement to perform. Record the protrusion, open and close, pure rotating condyle and lateral excursions.

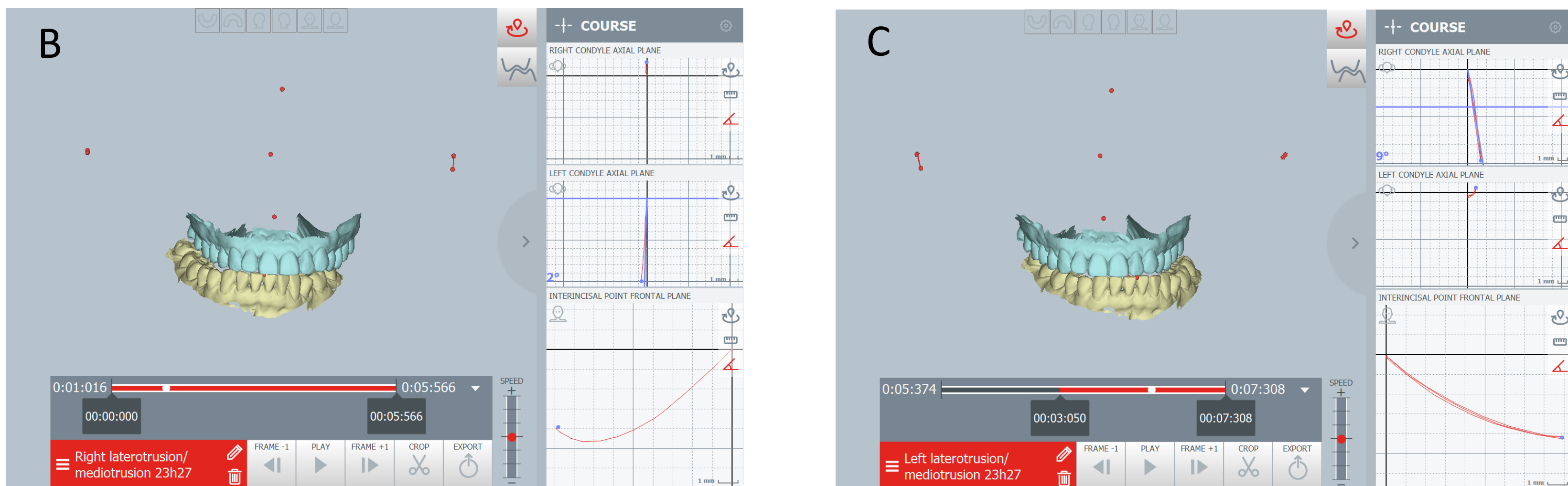


Figure 2. Subject recorded with MODJAW. A) Protrusion B) Right laterotrusion C) Left laterotrusion.

Phase III: Data analysis and statistics: The subject's mandibular movements in protrusion, excursion and open and close are recorded. The records at 3mm and 5mm are clinically relevant and were used for comparison.

Since the data is not normally distributed, Wilcoxon signed-rank test will be utilized to analyze the non-parametric paired data.

RESULTS

Subjects	1	2	3	4	5	6	z value	p value < .05
C_HCI R (3)	33°	48°	35°	33°	40°	40°	-1.5724.	Not significant
M_HCI R (3)	37°	47°	33°	56°	35°	54°		
C_HCI L (3)	38°	43°	36°	33°	31°	44°	-1.2014	Not significant
M_HCI L (3)	45°	46°	46°	62°	31°	56°		
C_HCI R (5)	32°	50°	38°	29°	40°	41°	-1.6773	Not significant
M_HCI R(5)	33°	46°	42°	53°	46°	53°		
C_HCI L(5)	39°	49°	32°	31°	31°	46°	-1.3628	Not significant
M_HCI L(5)	41°	41°	39°	57°	42°	52°		
C_TCI R(3)	7°	15°	14°	30°	5°	7°	-0.3145	Not significant
M_TCI R(3)	21°	12°	18°	12°	9°	14°		
C_TCI L(3)	14°	16°	9°	27°	5°	5°	-1.0483	Not significant
M_TCI L(3)	12°	24°	15°	20°	2°	21°		

Table 1. Comparison of values derived from CADIAX and MODJAW for Right (R) and Left (L) Horizontal condylar inclination (HCI) and Transverse condylar inclination (TCI) at 3mm and 5mm.

CONCLUSION

Since the p value is greater than .05, we conclude that there is no statistical significant difference between parameters and that there is no sufficiently strong evidence to reject the null hypothesis. Hence, the null hypothesis that there is no difference between the values obtained for HCI and TCI from Cadiax and MODJAW is true. This will enable us to use the clinically acceptable data derived from MODJAW in digital workflow directly.

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