

# A Clinical Comparative Study of Cadiax Compact II and Intraoral Records Using Wax and Addition Silicone

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Evaluation of mandibular movements is necessary to form the occlusal anatomical contour, analyze the temporomandibular joint status, and evaluate the patient's occlusion. This clinical study was conducted to compare the mandibular recording device Cadiax Compact II with routine intraoral records for measuring condylar inclinations. The results showed that the differences between Cadiax and intraoral records were statistically significant for all measurements. Cadiax measurements had a stronger correlation with silicone records. The quantities of recorded Bennett angles were lower and the values of sagittal condylar inclination were higher with Cadiax than with routine intraoral records. *Int J Prosthodont* 2014;27:541–543. doi: 10.11607/ijp.3852

Several reports in the dental literature underscore the importance of accurate and reproducible interocclusal records for oral rehabilitation protocols.<sup>1–6</sup> There also has been an insistence in some professional groups, although not underpinned by robust scientific evidence, that recording condylar movements is crucial. The accuracy of electronic pantographs has been evaluated in several studies.<sup>1–4</sup> This preliminary study compared the Cadiax Compact II system, a computerized recorder of condylar inclination (GAMMA Dental), with intraorally determined records that used silicone or wax recording materials.

## Materials and Methods

The study was authorized to use human subjects by the university human research ethics committee. A convenience sample of 22 nonpatient participants (14 men and 8 women with Angle Class I occlusal relationships), with an average age of 25 years, were selected

and trained to minimize errors imposed by movement inaccuracy. Applying a fully adjustable articulator (Reference SL, GAMMA Dental), three methods were used to record and compare sagittal condylar inclination (SCI) and Bennett angle (BA) in all participants.

1. **Cadiax recordings.** The participant was brought into the reference position (centric relation [CR]) with unforced chin point guidance. Next, all movements (protrusion, right/left excursion, and open/close) were conducted three times. Cadiax was calibrated before each movement (Fig 1).
2. **Intraoral recording with silicone.** Maxillary and mandibular impressions were obtained using condensation silicone (Zetaplus, Zhermack), poured by dental stone type III (elite model, Zhermack), and mounted with mounting plaster (elite arti, Zhermack) using Cadiax facebow and CR records. Interocclusal records were established with silicone registration material (Futar D, Kettenbach). The mandible was manipulated to the lateral or protrusive path up to 5 mm from the guided CR. Three interocclusal records were obtained.
3. **Intraoral recording with wax.** Maxillary and mandibular impressions were obtained using condensation silicone (Zhermack), poured by dental stone type III (elite model, Zhermack), and mounted with mounting plaster (elite arti, Zhermack) using Cadiax facebow and CR records. Interocclusal records were established with wax wafer (Karl Berg) and zinc oxide–eugenol. The mandible was manipulated to the lateral or protrusive path up to 5 mm from the guided CR. Three interocclusal records were obtained.

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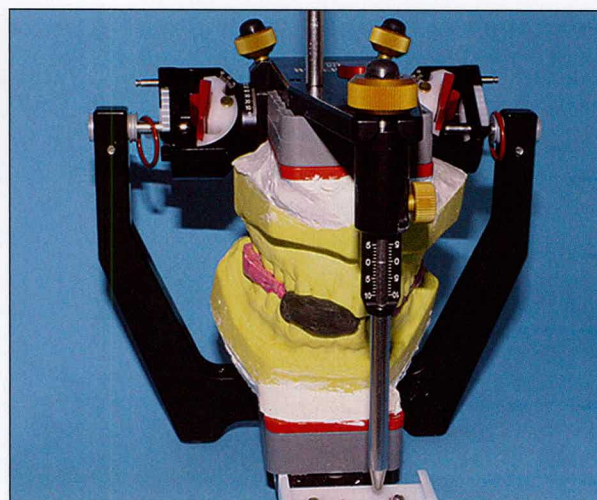
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**Fig 1** Cadiax has been mounted on the participant's face.



**Fig 2** Condylar setting has been adjusted using an intraoral silicone excursive record. The protrusive record was used for adjusting the SCI (left and right), and the lateral interocclusal records were used for adjusting the BA on the opposite side.

**Table 1** Results of Cadiax and Intraoral Records

	Material	N	Mean	SD	SEM
Right SCI	Wax	22	39.5000	3.83902	0.81848
	Cadiax	22	42.1818	5.35089	1.14081
	Silicone	22	40.6818	4.30267	0.91733
Left SCI	Wax	22	38.5909	3.50046	0.74630
	Cadiax	22	41.0909	5.74795	1.22547
	Silicone	22	39.8636	4.48591	0.95640
Right BA	Wax	22	15.6364	3.49892	0.74597
	Cadiax	22	10.2273	3.49056	0.74419
	Silicone	22	15.9091	1.97386	0.42083
Left BA	Wax	22	16.3636	3.07905	0.65645
	Cadiax	22	11.0455	5.11280	1.09005
	Silicone	22	15.7727	3.19124	0.68037

SCI = sagittal condylar inclination; BA = transversal condylar inclination (Bennett angle).

Before applying the occlusion registration material, a jig that was thick enough to cause a 2-mm separation of the posterior teeth was constructed by modeling compound for each movement.

The wax and silicone records were transferred to the articulator. Condylar guidance measurements were recorded (Fig 2) and compared using a paired *t* test (level of significance:  $P < .05$ ) and intraclass correlation coefficient (ICC, valued between 0 and 1).

## Results

As Tables 1 and 2 summarize, statistical differences between the Cadiax and the intraoral records were

more significant for BA than for SCI (Table 1). ICC confirmed more consistency between silicone registration material and Cadiax records. The highest correlation was seen in SCI (Table 2).

## Discussion

Progress in treatment quality calls for evaluation and improvement of the accuracy of materials and instruments. The success of restorative efforts is related to avoiding the creation of new occlusal interferences. This study was conducted to compare the efficacy of different jaw-recording methods for clinical diagnostic and research-based practices.

Cadiax records showed statistically significant differences in all variants with intraoral records ( $P < .05$ ). Generally, Cadiax measurements correlated weakly with wax records, which were not accurate and reliable despite the sensitivity to details. Posselt and Franzen showed that wax is not reproducible, as well.<sup>5</sup>

The differences between the intraoral and Cadiax records were more statistically significant for BAs than SCIs. BA mean values were lower for Cadiax records (10.6 degrees) than intraoral measurements (15.9 degrees), while SCI mean values for Cadiax records (41.6 degrees) were higher than intraoral records (39.6 degrees).

The interocclusal records neither provide visual graphics and verify the problems of the border movements nor help dentists diagnose functional problems of the temporomandibular joints. These records represent only the last point of the condylar path, and SCI depends on the degree of protrusion.<sup>5</sup>



**Table 2** Results of Cadiax Records Compared with the Intraoral Records (Wax and Silicone)

	Comparison pairs	N	Mean	SD	SEM	ICC	P value
Right SCI	Cadiax and wax	22	-2.68182	4.25817	0.90785	0.582	.008
	Cadiax and silicone	22	1.50000	2.50238	0.53351	0.867	.010
Left SCI	Cadiax and wax	22	-2.50000	5.11534	1.09059	0.422	.032
	Cadiax and silicone	22	1.22727	2.67140	0.56954	0.866	.043
Right BA	Cadiax and wax	22	5.40909	3.51404	0.74920	0.494	.000
	Cadiax and silicone	22	-5.68182	3.04547	0.64930	0.423	.000
Left BA	Cadiax and wax	22	5.31818	4.78476	1.02011	0.375	.000
	Cadiax and silicone	22	-4.72727	3.61454	0.77062	0.640	.000

ICC = intraclass correlation coefficient; SCI = sagittal condylar inclination; BA = transversal condylar inclination (Bennett angle).

Regarding the natural curvature of the condylar path depicted on Cadiax tracings, it can be concluded that a 3-mm mandibular protrusive displacement captured only the steepest portion of the eminence, which triggers the conflicting readings of condylar path inclination. For more accurate condylar guidance recordings, at least 5-mm excursive movements are recommended. Although the results of this study are statistically significant, further studies are warranted before the system can be clinically approved.

### Conclusions

1. Comparison of Cadiax and intraoral records showed statistically significant differences in measuring SCI and BA.
2. Cadiax measurements had a stronger correlation with silicone records.
3. BA and SCI values recorded by Cadiax were respectively lower and slightly higher than those of interocclusal records.
4. A 3-mm protrusive displacement is insufficient and at least 5-mm excursive movements are proposed for more accurate condylar guidance analysis.

### Acknowledgments

The authors would like to thank the vice-chancellery of Shiraz University of Medical Sciences for supporting the research (grant no. 1426). Also, the authors thank Dr N. Shokrpour and Mr O. Hoseini for help with the English in the manuscript. The authors reported no conflicts of interest related to this study.

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