

## Case Report

# Indigenous digital intraoral Gothic arch tracer

Ashish Bhagat, Aparna S. Barabde<sup>1</sup>, Amar Thakare<sup>2</sup>, Mansi M. Oswal

Department of Prosthetic Dentistry, D Y Patil Dental School, Pune, <sup>1</sup>Department of Prosthetic Dentistry, VYWS Dental College and Hospital, Amravati, <sup>2</sup>Department of Prosthetic Dentistry, YCDC, Ahmednagar, Maharashtra, India

**Abstract** This paper describes indigenously developed digital Gothic arch tracer for the acquisition of centric jaw relation in patient. The developed tracer eliminates disadvantages of intra-oral tracing and makes it more suitable for recording centric relation in patients. The system also makes real-time monitoring of tracing possible in intraoral tracing. This also opens various avenues for research in removable prosthodontics.

**Keywords:** Digital tracer, Gothic arch tracer, intraoral tracing

**Address for correspondence:** Dr. Ashish Bhagat, Department of Prosthetic Dentistry, D Y Patil Dental School, Charholi (BK), Pune - 412 105, Maharashtra, India.

E-mail: [ashish3534@gmail.com](mailto:ashish3534@gmail.com)

**Received:** 08<sup>th</sup> May, 2018, **Accepted:** 23<sup>rd</sup> December, 2018

## INTRODUCTION

Centric relation is defined as maxillomandibular relationship, independent of tooth contact, in which the condyles articulate in the anterior superior position against the posterior slopes of the articular eminences; in this position, the mandible is restricted to a purely rotary movement; from this unstrained, physiologic, maxillomandibular relationship, the patient can make vertical, lateral, or protrusive movements; it is a clinically useful, repeatable reference position.<sup>[1]</sup>

It is the most important and critical relationship among all the intermaxillary relations because failure in its correct acquisition will cause disharmony in occlusion.

Gothic arch tracing is established verified method for the acquisition of centric jaw relation. It is divided into two types namely intraoral and extraoral depending on the location of stylus and tracing board intraorally and

extraorally, respectively. Although extraoral Gothic arch tracing is most commonly used in prosthodontics, intraoral tracing has several advantages over it.<sup>[2-4]</sup>

1. It is more accurate since it is located nearer to condylar rotational axis
2. The oral musculature remains passive during recording.

Intraoral tracing is small and cannot be monitored during recording, this disadvantage of this tracing has led to popularity of extraoral method.

## CASE REPORT

In the present case report (Ref/dchamt/ethical/2011-2), authors have attempted to reduce this disadvantage by employing an intraoral digital tracer board connected to extraoral computer monitor, because of this, the intraoral tracing can be seen in real time on the computer screen and can be monitored.

Access this article online	
Quick Response Code:	Website: <a href="http://www.j-ips.org">www.j-ips.org</a>
	DOI: 10.4103/jips.jips_157_18

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

**For reprints contact:** [reprints@medknow.com](mailto:reprints@medknow.com)

**How to cite this article:** Bhagat A, Barabde AS, Thakare A, Oswal MM. Indigenous digital intraoral Gothic arch tracer. J Indian Prosthodont Soc 2019;19:180-3.

The system in principal consisted of three parts namely intraoral sensor pad, extraoral digitizer circuit MAX 232 and a computer display having an analysis software MATLAB® programme (MATLAB 7.11 R2010b). The sensor portion of digitizer works from oral cavity and functions as tracing board. The sensor portion is connected to digitizer control circuit located extraorally.

A touchpad (2.5 cm × 3.5 cm in dimension; 8.9 g in weight) was selected for case having number of resistors in the form of X and Y dimension. It was connected to analog screen of the microcontroller [Figure 1]. When stylus [Figure 2] travels the pad, analog to digital converter input of the microcontroller is sent to PC along with X and Y dimension. Microcontroller was not directly connected to computer or laptop. It causes voltage levels for which MAX 232 circuit [Figure 3] is used for level shifting. Computer/laptops port reads X and Y dimension and MATLAB®, a computing analysis software [Figure 4] shows the exact location of stylus pin. The tracer used in the study was made by modifying Height tracer (AVCO enterprises, Mumbai, Maharashtra, India) to intraoral use by reducing the dimension of stylus pin and by installing it with the central bearing device.

Changes in Y coordinates represented movement in anteroposterior direction while changes in X co-ordinates

were associated with lateral movement over tracing board.

### Jaw relation procedure

A tentative vertical jaw relation at rest was determined by combination of Niswonger<sup>[5]</sup> method and by phonetics method. After confirming vertical dimension at rest, vertical dimension at occlusion (VDO) was calculated considering free-way space of 2–4 mm [Figure 5].

After vertical jaw relation maxillary central bearing device in the form of spring-loaded stylus was attached to occlusal rims and subsequently secured rigidly in modeling wax by green stick compound. The adjustment of central bearing device is done in such a way that stylus is fully compressed, and it is just slightly above the occlusal rim plane when both jaws are closed.

Now, the tracing board in the form of touchpad was fixed permanently to the conventional mandibular central bearing device with adhesive resin. The lower central bearing device with tracing board in the form of touchpad is now placed

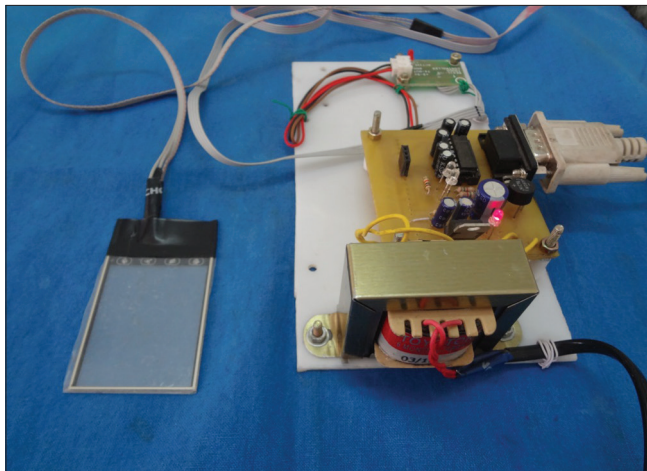


Figure 1: Intraoral tracing board attached to the digitizer

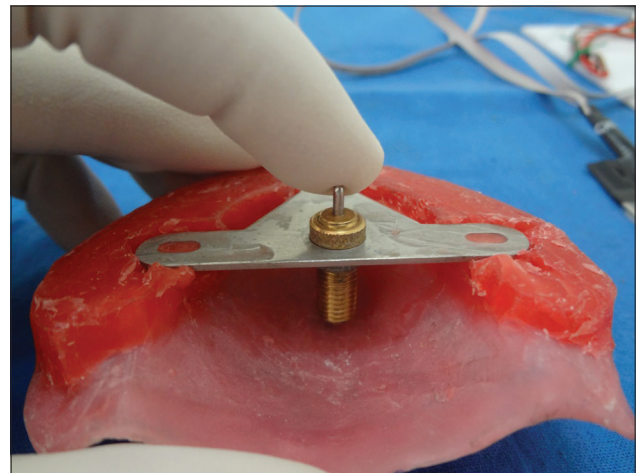


Figure 2: Central bearing device attached to maxillary occlusal rim

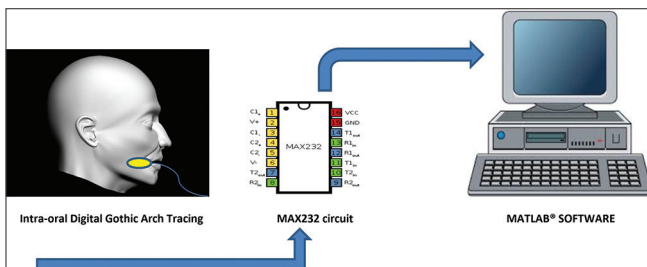


Figure 3: Illustration of digital Gothic arch system

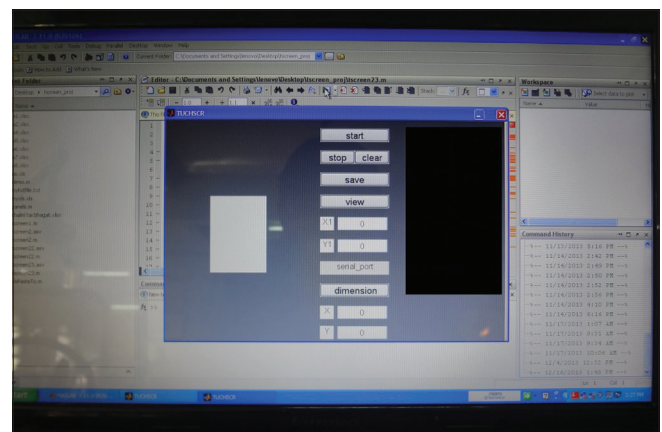


Figure 4: MATLAB® software analysis for X and Y coordinates (before the procedure)

over the wax occlusal rim in such a way that previously determined VDO is not disturbed. The height of mandibular occlusal rim is reduced to meet this requirement. After this, both the occlusal rims with their respective central bearing devices were placed in patient's mouth [Figures 6 and 7],

and observations were made for VDO. After this, it was ensured that spring loaded stylus is completely compressed to maintain VDO when patient closes both jaw while some space is observed between the occlusal rims to ensure free movement of stylus over tracing pad without any obstruction or contact between opposing occlusal rims.



Figure 5: Vertical jaw relation



Figure 6: Maxillary occlusal rim with the central bearing device (intra-oral view)



Figure 7: Mandibular occlusal rim with mounted tracer board on central bearing device (intra-oral view)

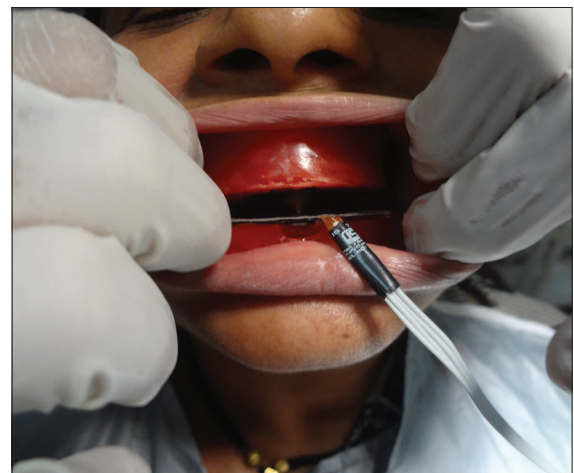


Figure 8: Gothic arch tracing

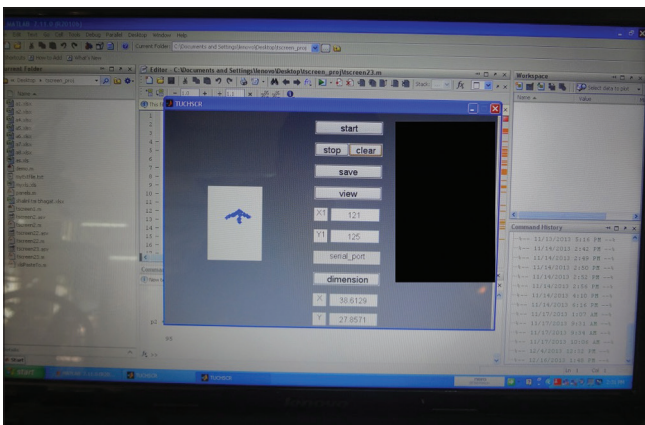


Figure 9: MATLAB® software showing Gothic arch tracing and coordinates of Gothic arch apex

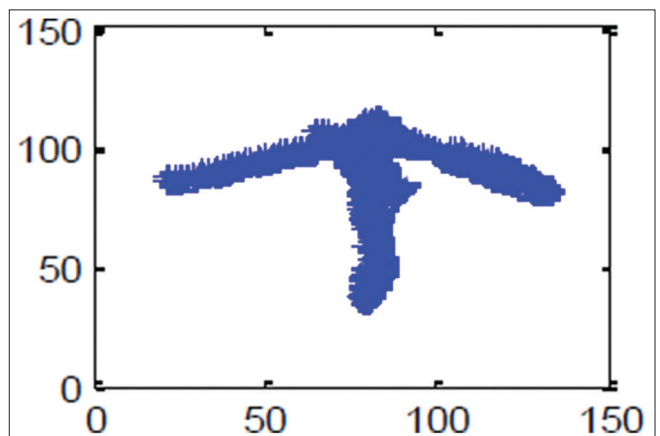


Figure 10: Gothic arch tracing saved by software

The patient was then instructed to move the mandible forward and back in the median line which gave the path of a straight protrusion. After this, the patient was instructed to retrace the mandible to its fullest extent and slide it one side and back again [Figure 8]. The form of tracing in the shape of arrowhead tracing was noted, and its X and Y coordinates were noted [Figures 9 and 10].

Interocclusal check records were taken with bite registration silicone (Virtual<sup>®</sup> CAD bite), and teeth arrangement was completed. The verification of centric jaw relation was done at the step of try in.

## DISCUSSION

The use of a digital screen for tracer board was first attempted by Watanabe<sup>[6]</sup> in 1999 with an immovable stylus however we believe that better recording can be achieved using spring-loaded stylus as both the occlusal rims separate during protrusive movement due to the Christensen phenomenon.<sup>[7]</sup>

The intraoral sensor was made up of touchpad working on resistive technology.

Its clinical applicability including specific indications is as follows:

- a. Acquisition of centric jaw relation
- b. Acquisition of protrusive bite records (after using updated software)<sup>[8]</sup>
- c. To study the pattern of mandibular movements in the horizontal plane
- d. Comparison of different centric jaw relation methods for their reproducibility with each other, for example, Chin Point guidance method against Gothic arch tracing, etc.
- e. The comparison of different centric jaw relation methods for their maximum retrusion with each other.

## Limitations of system

Use is contraindicated in patient with macroglossia, excessively resorbed ridges as it will compromise the

stability of the central bearing device. Use is also contraindicated in patients with excessive biting forces and with poor neuromuscular control.

Intraoral tracing is now more operator friendly and can now be monitored in real time.

## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

## REFERENCES

1. The glossary of prosthodontic terms: Ninth edition. J Prosthet Dent 2017;117:e1-105.
2. Rubel B, Hill EE. Intraoral gothic arch tracing. N Y State Dent J 2011;77:40-3.
3. Bansal S, Palaskar J. Critical evaluation of various methods of recording centric jaw relation. J Indian Prosthodont Soc 2008;8:185-91.
4. Shetty S, Kunta M, Shenoy K. A clinico-radiographic study to compare and co-relate sagittal condylar guidance determined by intraoral gothic arch tracing method and panoramic radiograph in completely edentulous patients. J Indian Prosthodont Soc 2018;18:19-23.
5. Niswonger JE. The rest position of the mandible and the centric relation. J Am Dent Assoc 1934;21:1572-82.
6. Watanabe Y. Use of personal computers for gothic arch tracing: Analysis and evaluation of horizontal mandibular positions with edentulous prosthesis. J Prosthet Dent 1999;82:562-72.
7. Zarb GA, Bolender CL. Prosthodontic Treatment for Edentulous Patients. 12<sup>th</sup> ed. St Louis: Elsevier; 2005. p. 284.
8. Gupta M. A comparative clinic-radiographic analysis of horizontal condylar guidance determined by height tracer, novel indigenous intraoral digi tracer and check bite in complete denture prosthesis. Int J Curr Res 2017;9:49940-6.