

AWARENESS OF JAW TRACKING DEVICES FOR ASSESSMENT OF MANDIBULAR MOVEMENT AMONG DENTAL PRACTITIONERS.

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ABSTRACT

INTRODUCTION: The main functions of the stomatognathic system is chewing or mastication. An integrated neurologic controlling system, called the central pattern generator, regulates and coordinates all structural components involved in the process of mastication. The use of devices for quantitatively measuring mandibular movements has recently become more common in clinical practise.

AIM: The main aim of this study was to assess the awareness of various jaw tracking devices among dental practitioners and postgraduates.

MATERIALS AND METHODS: The sample population of this study includes dental practitioners and post graduates. A generalized questionnaire based on awareness of jaw tracking devices was prepared and uploaded in an online platform (survey planet) which was circulated among the sample population using various social media platforms. Data collected was assessed and tabulated using Microsoft excel. The collected data was then subjected to statistical analysis using Statistical Package for Social Science (SPSS).

RESULTS: About 41.5% of the respondents had 1-5 years of experience, about 20.9% had 6-10 years and 37.4% had more than 10 years of experience. About 68.9% of the total population were aware about cadiax compact. 78.2% of the total population were aware about computer monitored radionuclide tracking. 68.9% of the total population were aware of motion tracking systems. 78.2% of the total population were aware about electromagnetic articulography.

CONCLUSION: Several methods have been employed to measure mandibular movements. Measurement techniques include simple measurement devices, such as a millimeter ruler, to sophisticated electronic devices to record movements of the mandible using magnets or photodiode sensors.

Within the limits of this study, we observe that the majority of dental practitioners were aware of various jaw tracking devices for recording mandibular movements.

KEYWORDS: Awareness, dental, jaw tracker, movements, innovation

INTRODUCTION

The main functions of the stomatognathic system is chewing or mastication. An integrated neurologic controlling system, called the central pattern generator, regulates and coordinates all structural components involved in the process of mastication. The use of devices for quantitatively measuring mandibular movements has recently become more common in clinical practise. Often, the goal of these devices has been to provide an objective basis for diagnosing musculoskeletal disorders of the jaws or to facilitate the progress of active treatment methods. The extent to which jaw tracking of the mandible provides a useful research tool, a diagnostic aid, or in therapy clearly depends on what is being measured, how the process is carried out, and why the information is important (1). Management of craniomandibular disorders is still largely based on clinical assessment and experience, and diagnosis is often not made with confidence, diagnostic appliances (occlusal splints) are often fitted in the hope that they may help the problem. It is important for clinicians to confidently diagnose psychogenic, muscular or articular craniomandibular disorders in order for management strategies and provide better treatment(2,3). Objective assessments or special tests, such as specialized imaging, analysis of study casts etc, in conjunction with history and clinical examination are known to assist diagnosis. Jaw tracking devices also may be valuable to assess jaw muscle and jaw joint function (4).

The form of the bilateral temporomandibular joints and their function facilitate the mandible in making a variety of movements mainly which is carried out in three different planes, namely, the frontal, the sagittal and the horizontal planes. Mainly, these movements produce translational (sliding) and rotational (turning) motions.(5) The hinge-like or rotary movement occurs between the condyle and the articular disc. Basically, there are a couple of movements of the mandible:

- The functional movements which are the characteristic naturally occurring mandibular movements such as those occurring during mastication, speaking, and yawning.
- The parafunctional movements which are non characteristic movements such as clenching, bruxism and tapping.

Over the years, several methods have been employed to quantitatively measure mandibular movements. Measurement techniques include simple measurement devices, such as a millimeter ruler or scale, to sophisticated electronic devices to record movements of the mandible using photodiode sensors or magnets. Jaw tracking devices are based on the use of recording instruments that usually employ sensors fixed on the mandible, such as accelerometers, ultrasound, electromagnetic fields, videofluoroscopy, and optoelectronic devices.(6) Other methods include graphic tracings, imaging (lateral radiographs), or electromagnetic transducers cemented on anterior teeth. Our team has extensive knowledge and research experience that has translate into high quality publications(7–14), (15–29). There is a lack of literature studies about Jaw tracking devices and its awareness among dental practitioners, especially pertaining to the South Indian population. Hence the main aim of this study was to assess the awareness of various jaw tracking devices among dental practitioners and postgraduates.

MATERIALS AND METHODS

Study Setting:

The sample population of this study includes clinicians and postgraduate students. A generalized questionnaire based on awareness of various jaw tracking devices was prepared and uploaded in an online

platform (survey planet) which was circulated among the sample population using various social media platforms.

Sampling:

The total population of this study was 99 dental practitioners. In this research simple random sampling was done in order to minimize sampling bias. Internal validity was the pretested questionnaire. External validity was homogenisation and cross verification with existing studies.

Data Collection:

The questionnaire contained 12 questions. The participants were asked to answer all questions to access them. Independent variables such as demographic details were recorded. Questions were based on the awareness of various jaw tracking devices such as cadiax compact, computer monitored radionuclide tracking, optoelectronic devices. The collected data was tabulated in Microsoft Excel 2010.

Data Analytics:

The acquired data was subjected to statistical analysis. Microsoft Excel 2010 data spreadsheet was exposed to Statistical Package for Social Science (SPSS) for windows. Descriptive statistics was applied for the variables, chi-square tests were applied at a level of significance of 5% ($P < 0.05$)

RESULTS

This survey was conducted amongst dental practitioners and postgraduate students. About 41.5% of the respondents had 1-5 years of experience, about 20.9% had 6-10 years and 37.4% had more than 10 years of experience. About 68.9% of the total population were aware about cadiax compact. 78.2% of the total population were aware about computer monitored radionuclide tracking. 68.9% of the total population were aware of motion tracking systems. 78.2% of the total population were aware about electromagnetic articulography. About 77.9% of the total population were aware about pantronic. 51.6% of the total population were not aware about mandibular kinesiograph. 52.1% of the total population did not know about JAWS 3D. It was observed that clinicians with more than 10 years of experience were more aware of JAWS 3D than clinicians with a low experience (Figure 1-10).

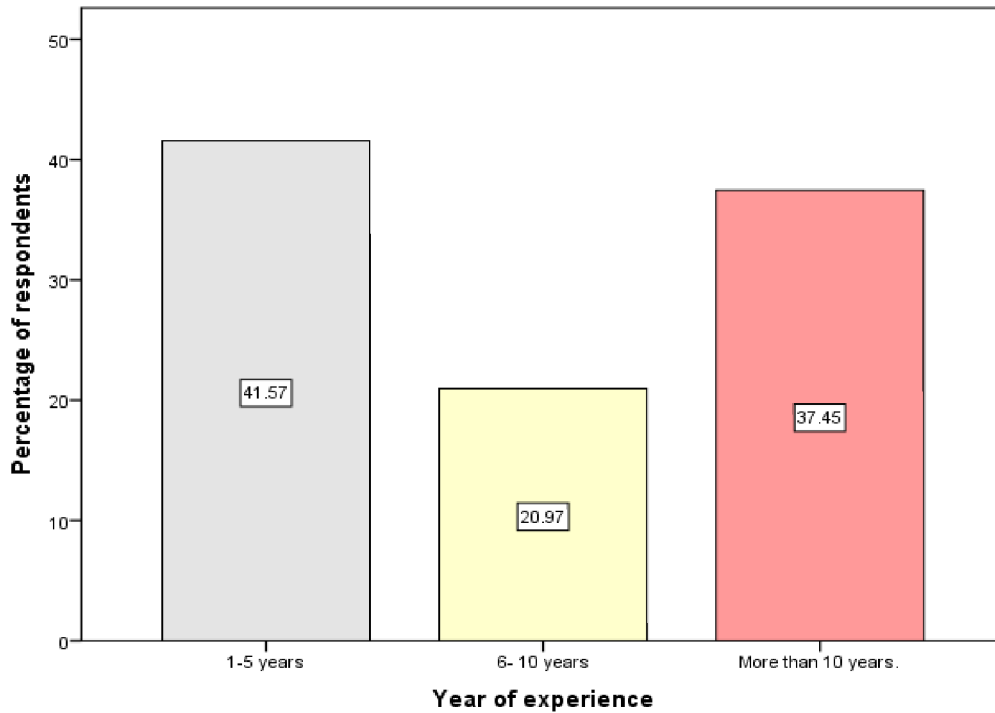
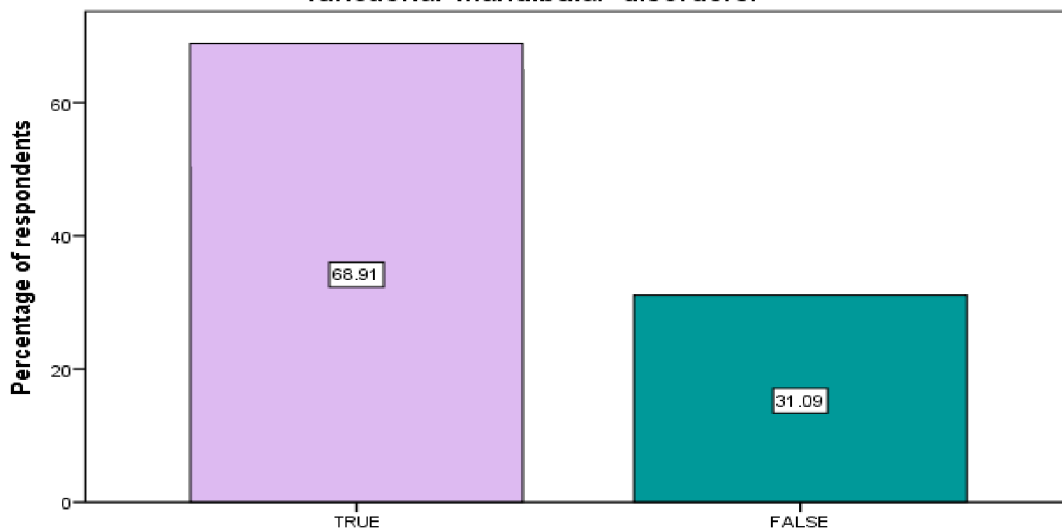


Figure 1: This bar graph depicts the year of experience of the clinicians who participated in this survey. Grey colour denotes 1-5 years, yellow colour denotes 6-10 years and pink denotes more than 10 years. About 41.5% of the respondents had 1-5 years of experience, about 20.9% had 6-10 years and 37.4% had more than 10 years of experience.

The Cadiax compact axiographic device was designed to produce a fast joint analysis for articulator programming and also to aid in diagnosing the functional mandibular disorders.



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Figure 2: This bar graph depicts the awareness of cadiax compact axiographic device among clinicians. Purple colour denotes the response true, green colour denotes false. About 68.9% of the total population were aware about cadiax compact.

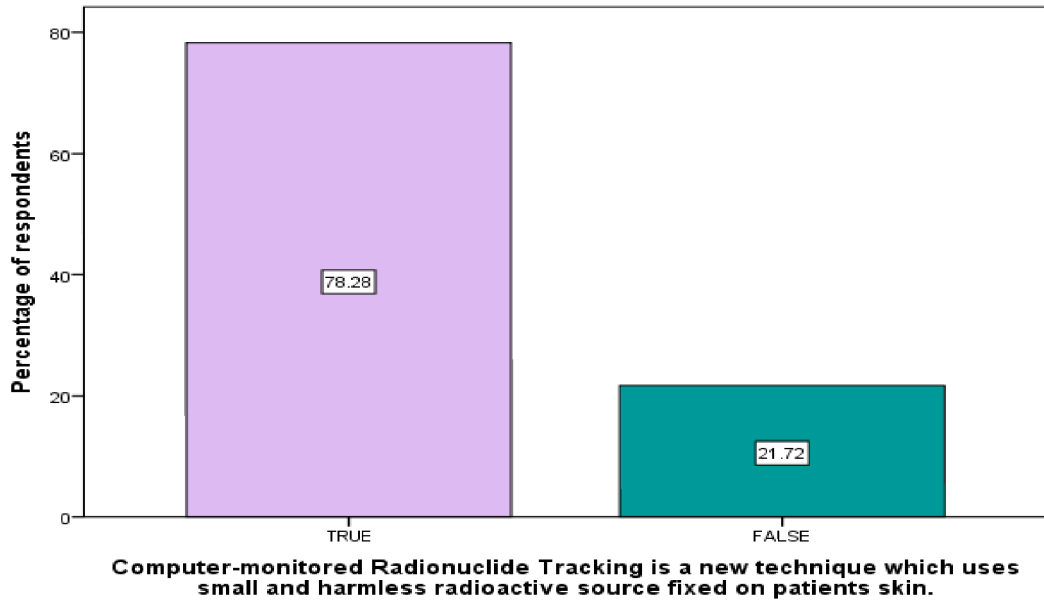


Figure 3: This bar graph depicts the awareness of computer monitored radionuclide tracing device among clinicians. Purple colour denotes the response true, green colour denotes false. About 78.2% of the total population were aware about computer monitored radionuclide tracking.

Motion tracking systems based on optoelectronic technology has become the preferred method to study jaw movements because of their operational and accuracy advantages over the other methods.

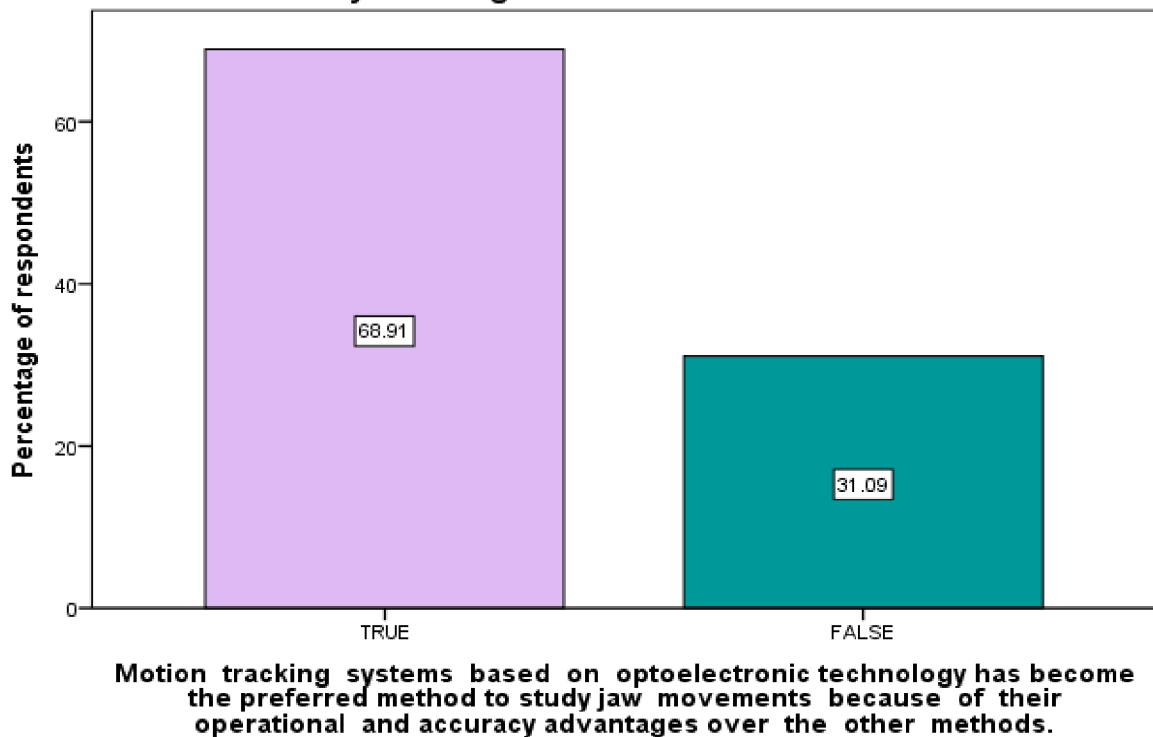


Figure 4: This bar graph depicts the awareness of motion tracking systems among clinicians. Purple colour denotes the response true, green colour denotes false. About 68.9% of the total population were aware of motion tracking systems.

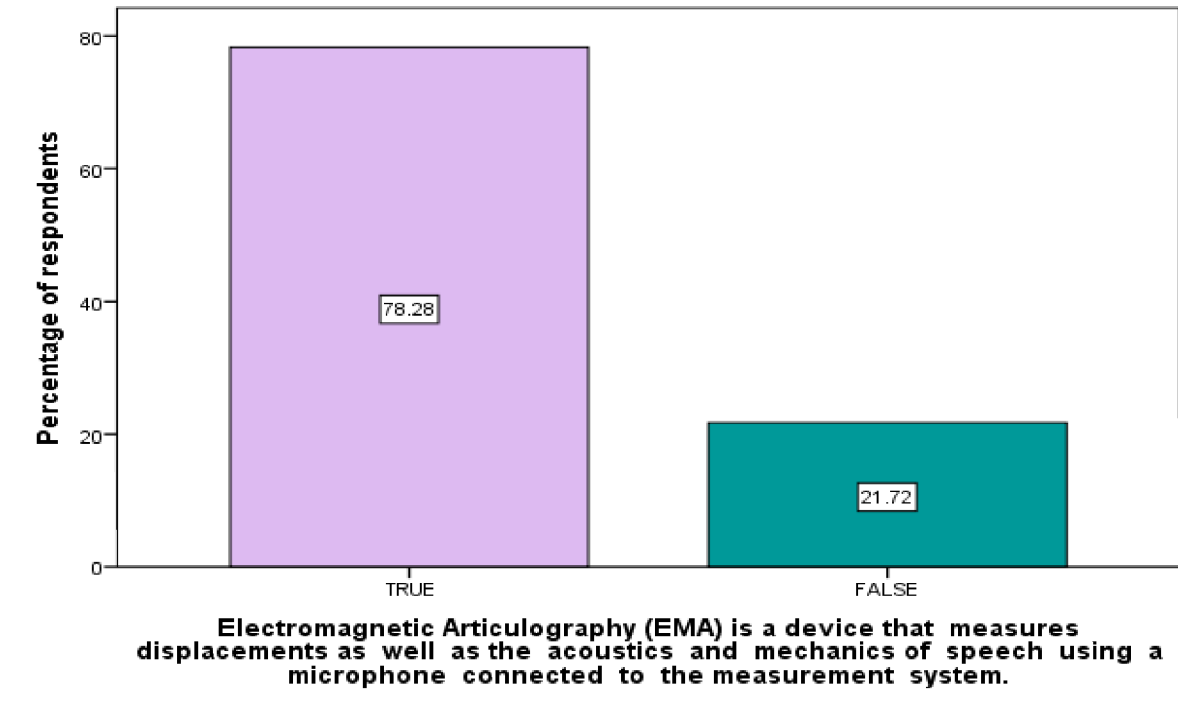


Figure 5: This bar graph depicts the awareness of electromagnetic articulography among clinicians. Purple colour denotes the response true, green colour denotes false. About 78.2% of the total population were aware about electromagnetic articulography.

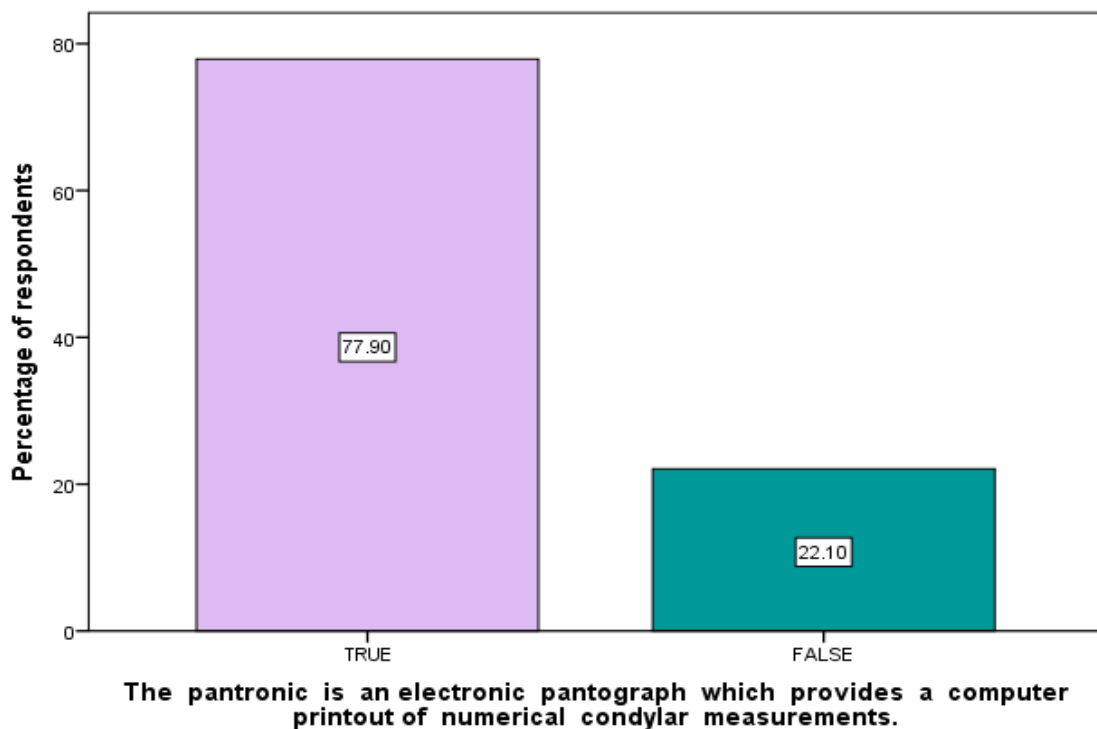


Figure 6: This bar graph depicts the awareness of pantronic device among clinicians. Purple colour denotes the response true, green colour denotes false. About 77.9% of the total population were aware about pantronic.

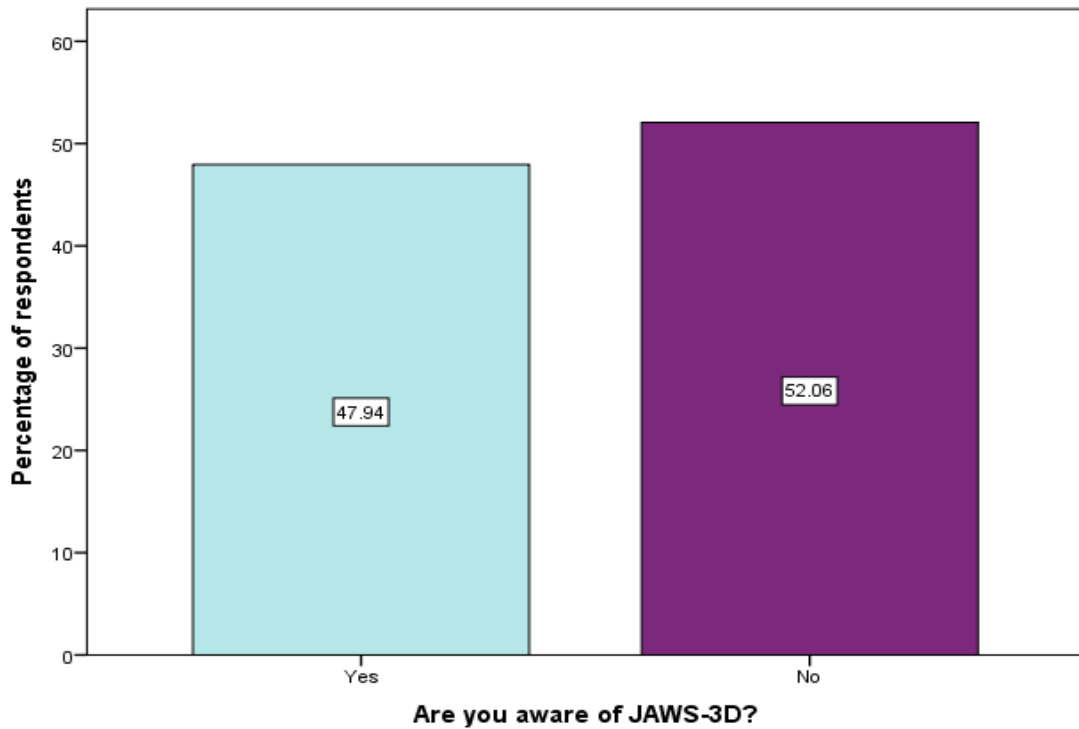


Figure 7: This bar graph depicts the awareness of JAWS 3D among clinicians. Blue colour denotes the response yes, purple colour denotes no. About 52.1% of the total population did not know about JAWS 3D.

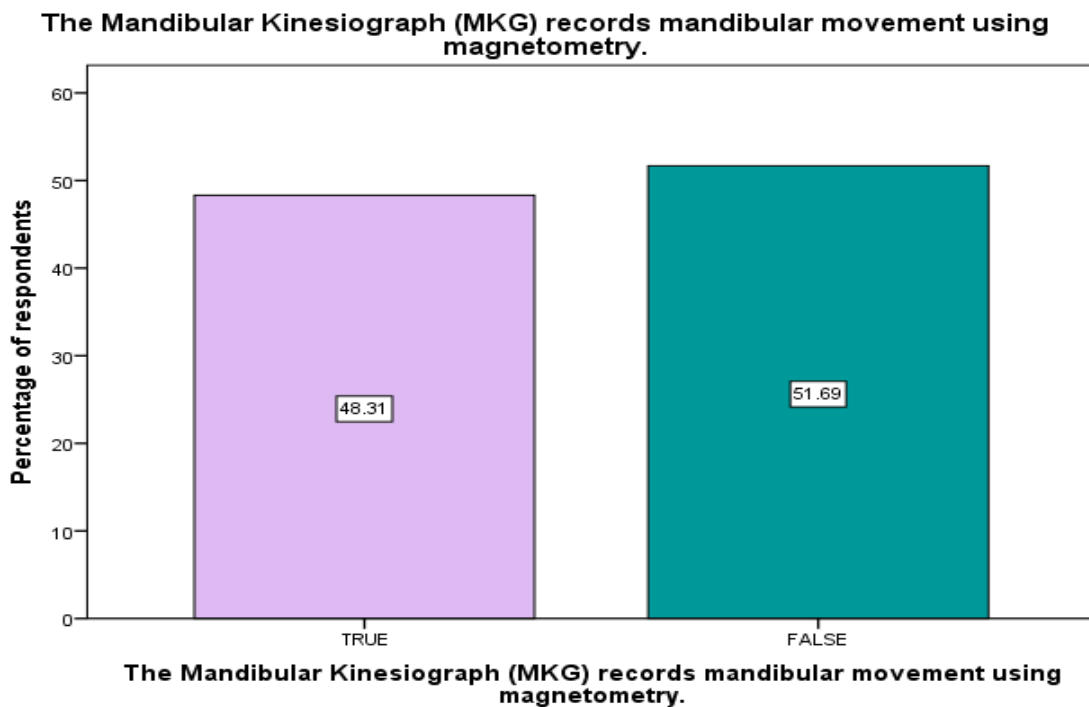


Figure 8: This bar graph depicts the awareness of mandibular kinesiograph among clinicians. Purple colour denotes the response true, green colour denotes false. About 51.6% of the total population were not aware about mandibular kinesiograph.

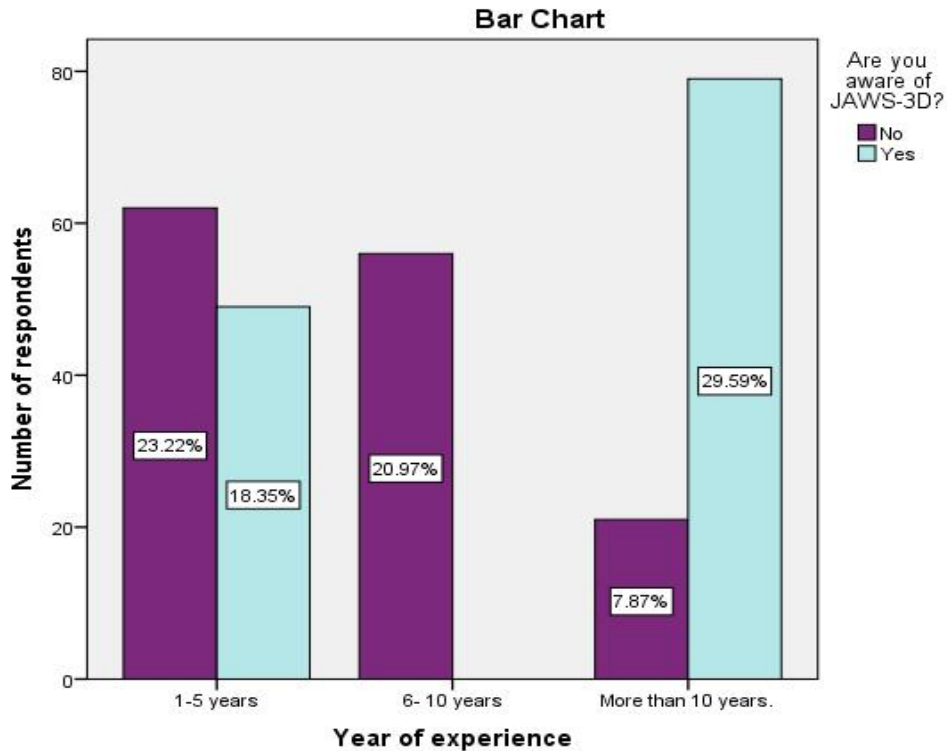


Figure 10: This bar graph depicts the association between years of experience and awareness of Jaws 3D. X- axis denotes the year of experience of the participants with the response of the question “Are you aware of JAWS 3D?” in the X-cluster and the Y axis denotes the frequency distribution of the responses. Blue colour denotes the response yes and purple colour denotes no. It was observed that clinicians with more than 10 years of experience were more aware of JAWS 3D than clinicians with a low experience. This was found to be statistically significant when the chi-square test was used with a p value of 0.04.

DISCUSSION

For prosthetic replacement of teeth and restoring its function, it is important to have a thorough knowledge of the mandibular movements as it aids in selection and programming of articulators, fabricating dental restorations, understanding occlusion, and arranging artificial teeth.

The Cadiax compact axiographic device was designed to produce a fast joint analysis for articulator programming and also to aid in diagnosing the functional mandibular disorders. It allows computerized recording of the opening, protrusion, and mediotrusion tracings, and it calculates the sagittal and transverse condylar inclination angles for the adjustment of articulators. About 68.9% of the total population were aware about cadiax compact.

Recent technique for the three-dimensional recording of mandibular movements uses a small and harmless radioactive source that is fixed on the patient’s skin at the point of interest or sealed in a tooth cavity. Using proper collimation, motion of the point source is recorded through a gamma camera and a minicomputer. Long-term storage on a magnetic device offers playback, slow-motion facilities, and data analysis. This method; computer-monitored radionuclide tracking offers a powerful tool for the tracking of dynamic events in many fields such as TMJ dysfunction, craniomandibular disorders and prosthetic restorative techniques. It was observed from this study that about 78.2% of the total population were aware about computer monitored radionuclide tracking.(30)

Electromagnetic articulography measures displacements of the mandible in real time as well as acoustics and mechanics of speech using a microphone connected to the measurement system. It has transmitter coils that determine magnetic fields to collect information about movements from sensors located on various structures such as the tongue, palate, mouth, incisors, skin, etc. After measurement, the information is passed on to a computer and read to analyze the recording of the mandibular movements registered by electromagnetic axiography. (31) About 78.2% of the total population were aware about electromagnetic articulography.

The pantronic is an electronic pantograph which provides a computer printout of numerical condylar measurements. There are three appliances available for tracings - one designed by Stuart, one by Granger, and the third by Guichet. (32) About 77.9% of the total population were aware about pantronic.

A system for recording mandibular movements using magnetometry - The MKG was introduced by Jankelson. It is an instrument designed for research and diagnosis of mandibular function or dysfunction. It electronically records mandibular incisor-point movements in all three dimensions. Measurement of vertical velocity is also provided by differentiating the vertical position signal. (33) About 51.6% of the total population were not aware about mandibular kinesiograph.

JAWS-3D an optoelectronic system was designed for monitoring the functional movements of any mandibular point by Mesqui and Palla.(34) The system consisted of three charge coupled device cameras that recorded the position of six LEDs mounted on two triangular target frames attached to the upper and lower dental arches by means of custom-made metal splints. The upper target frame compensated for head movements. About 52.1% of the total population did not know about JAWS 3D. It was observed that clinicians with more than 10 years of experience were more aware of JAWS 3D than clinicians with a low experience.

CONCLUSION

Several methods have been employed to measure mandibular movements. Measurement techniques include simple measurement devices, such as a millimeter ruler, to sophisticated electronic devices to record movements of the mandible using magnets or photodiode sensors.

Within the limits of this study, we observe that the majority of dental practitioners were aware of various jaw tracking devices for recording mandibular movements.

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