

Assessing The Perspective of Clinical Applications Of T-Scan Technology Amongst Dental Professionals in Marathwada Region: A Cross-Sectional Study

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Abstract:

Occlusion is impacted by nearly every Dental operation. Poor Occlusion reduces one's quality of life. Occlusal contacts must coordinate with the stomatognathic system to operate properly. The notion of occlusion is not just restricted to morphological contact interactions between the teeth but also the dynamic morphofunctional interactions between all the masticatory elements. Unusual occlusal contacts usually lead to occlusal trauma. It has been illustrated that periodontal tissues and even dental implants may deteriorate under higher bite forces and/or excursive overload. Recently the computerized occlusal force analysis tool called T-Scan is used to improve efficiency of the restoration by monitoring the occlusal contacts. Dynamic 2D and 3D graphics with coloured columns are its defining characteristics. The computer-based data assists in making precisely focused modifications. This questionnaire-based study aims to enhance the overall understanding and integration of T-scan technology among dental professionals.

Materials and Methods:

Cross-sectional questionnaire based online survey was undertaken at C.S.M.S.S. Dental College and Hospital, Chhatrapati Sambhajinagar, Maharashtra, India between May 2024 and October 2024 amongst dental postgraduate students and dental practitioners across India. The questionnaire consisted of 18 questions which evaluated their awareness towards maxillofacial prosthetic dentistry. The Chi-square test was used for statistical analysis.

Results:

A total of 100 responses were obtained in the study. Out of which 42% of the study participants were Private practitioner, 39% were Postgraduates and Interns were around 19%. In order to assess occlusal discrepancies, only 8% of participants have used T-scan, 73% utilized articulating paper, and 19% chose interocclusal records. 85% of the replies cited the advantage of giving quantitative data on scanning with T-scan over other traditional occlusal analysis methods. The amount of occlusal load is shown by color-coded bars, with red being the greatest force and blue representing the least. T-scan helps to avoid restoration damage by recognizing and visualizing the distribution of forces produced while biting, as uneven restorations may lead to premature wear, fracture, or even restoration failure.

Conclusion:

The majority of participants were aware of the technology which yields good results but its limitation was the inability to apply it in daily practice. Overall, the current state of knowledge and awareness is praiseworthy. It is evident that improvements in curriculum, training, and resources are required to adequately equip next dental professionals in T-scan technology.

Keywords:

T-scan, Occlusal indicators, Articulating paper.

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I. Introduction:

Occlusion is “the act or process of closure or of being closed or shut off” or “the static relationship between the incising or masticating surfaces of the maxillary or mandibular teeth or tooth analogues”. For proper functioning, occlusal contacts must be in sync with the stomatognathic system. The concept of occlusion encompasses not only morphological contact interactions between teeth, but also dynamic morphofunctional interactions between all components of the masticatory system, including teeth, periodontal tissues, the neuromuscular system, the temporo-mandibular joint, and the craniofacial bones.

The teeth, temporomandibular joint (TMJ), periodontal tissues, and masticatory muscles comprise the masticatory system. Occlusion must be physiologically restored for the masticatory system to operate normally. Each person's dental occlusion is different based on their tooth size, shape, and location; the timing and order of eruption; the size of their dental arch; and the form and pattern of their craniofacial development. Developmental mechanisms affecting the teeth and their associated structures during the time of creation, growth, and post-natal alteration dictate the method of occlusion and the location of the teeth within the jaw.

Uneven pressure distributions on occluding teeth—which frequently do not make contact at the same time—cause occlusal damage. Occlusal trauma is typically caused by abnormal occlusal contacts and an excessively high occlusal height of a restoration. It has been demonstrated that increased biting pressures and/or excursive overload can cause dental, periodontal, and even dental implant tissues to degrade, ultimately resulting in bone loss and failure concerns.

Clinicians examined occlusal contacts using a variety of occlusal markers. In clinical practice, the standard techniques for guiding contact selection during occlusal adjustment include articulation paper, silk strips, impression waxes, impression materials, and shimstock foil. These techniques are frequently paired with the patient's occlusal "feel" input. The most popular technique for identifying excessive force in various occlusal contacts is the articulation paper. However, none of these studies provide evidence that the size or appearance of the marks on articulation papers can adequately reflect the range of occlusal stresses. The T-Scan computerized occlusal force analysis method was developed by dental research to eliminate subjectivity in the interpretation of the articulation paper marks.

T-Scan is a computerized occlusal force analysis device. When the patient bites on the occlusal sensor, the computer screen displays occlusal data. With coloured columns that range from BLUE (optimal force) to RED (high force), it is characterized by dynamic 2D and 3D graphics. The data is saved on a hard drive that may be seen in video format.

The clinician may record the force, timing, balance, and position of interactions in real time with the latest version of Tscan technology. From the first occlusion contact to maximal intercuspation, it evaluates the sequence of the occlusal contacts and calculates the proportion of force changes and occlusion efficiency. It can precisely analyse disclusion time and quickly identify high spots, areas of excessive force, non-uniform force concentration, and prematurity.

This questionnaire-based study aims to enhance the overall understanding and integration of T-scan technology among dental professionals.

The objective of this study is to determine the current level of awareness and understanding among Dental Undergraduates, Postgraduates and Practitioners about T-scan technology in dental practice.

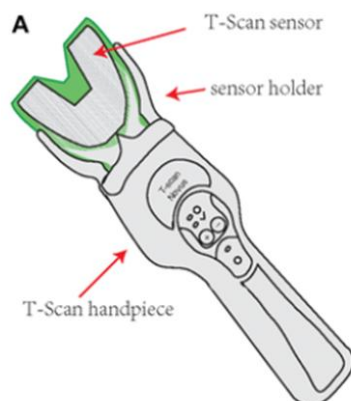


Fig.1. T-Scan Handpiece

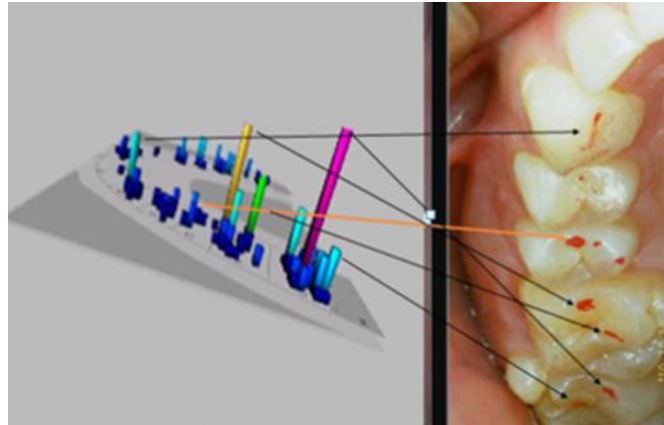


Fig.2. Occlusal contacts shown by colour-coded bars

II. Materials And Method:

A cross-sectional questionnaire based online survey using Google Forms was undertaken at C.S.M.S.S. Dental College and Hospital, Chhatrapati Sambhajinagar, Maharashtra, India between May 2024 and October 2024 amongst dental professionals including Interns, Postgraduates and Private Practitioners across Marathwada region of Maharashtra.

The 18 questions on the questionnaire improved comprehension and integration of Tscan technology's therapeutic application.

Study design: Cross-sectional study

Study Location: C.S.M.S.S. Dental College, Chhatrapati Sambhajinagar

Study Duration: May 2024- October 2024

Sample size: 100

Out of 120 Google forms circulated, a total of 100 responses were recorded.

Inclusion and Exclusion criteria: Dental professionals, including interns, postgraduates from different universities, and private practitioners, were included in the study. Participants' informed consent was acquired using Google Forms in conjunction with the survey. Participants who declined to give their consent were not allowed to take part in the study.

Procedural Methodology:

A well-designed questionnaire was utilized to gather data, and all participants provided written informed permission. After asking respondents about their name, age, years of clinical experience, and address, the questionnaire asked 18 multiple-choice questions about their understanding of and clinical utility for T-Scan technology. The Google form was shared with all research participants through the Telegram and WhatsApp groups.

The study received 100 responses, of which 42% were private practitioners, 39% were postgraduates, and 19% were interns. The use of an online questionnaire made data collection, compilation, and management easier, and the fact that participants could participate whenever it was convenient for them was another benefit. The data collected was immediately available and could be quickly imported into spreadsheets or specialized statistical tools for further analysis. The chi square test was used for statistical analysis to evaluate the responses.

III. Results:

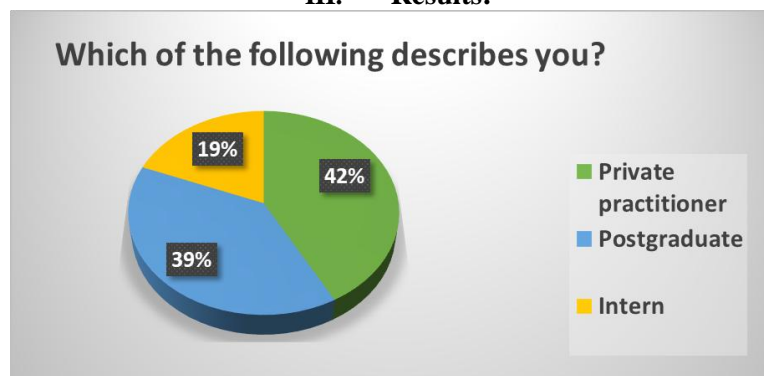


Fig. 3.

42% of the study participants were Private practitioner, 39% were Postgraduates and Interns were around 19%.

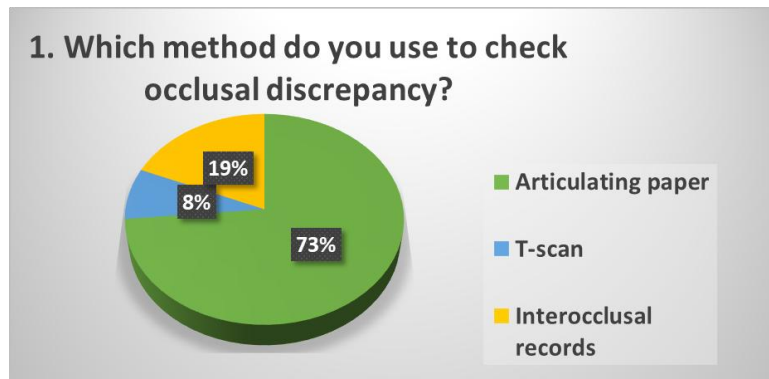


Fig. 4.

In order to assess occlusal discrepancies, only 8% of participants have used T-scan, 73% utilized articulating paper, and 19% chose interocclusal records.

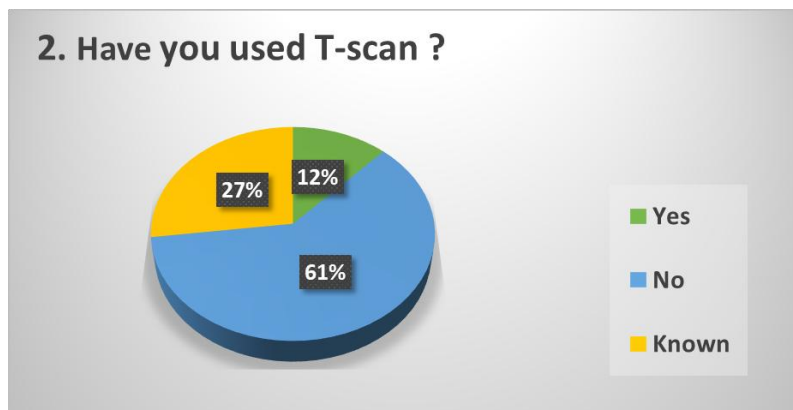


Fig. 5.

Fig.6.

27% of participants were aware of the technology, even though only 12% of them had used a T scan equipment.

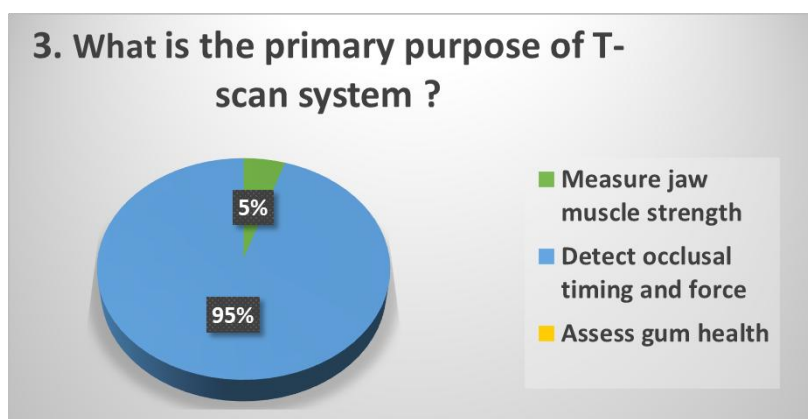


Fig.6.

95% of participants agreed that the main function of T-Scan is to identify the occlusal forces.

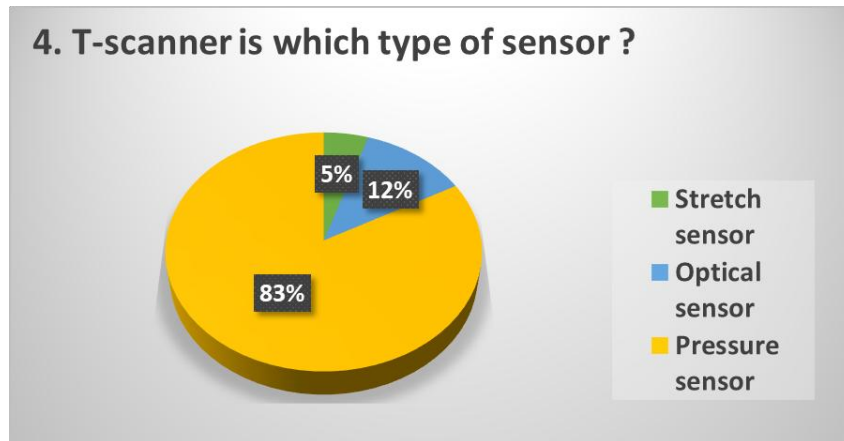


Fig. 7.

The majority of people (83%) believe that the T-scan sensor is a pressure-type sensor that accurately analyzes dental biting forces.

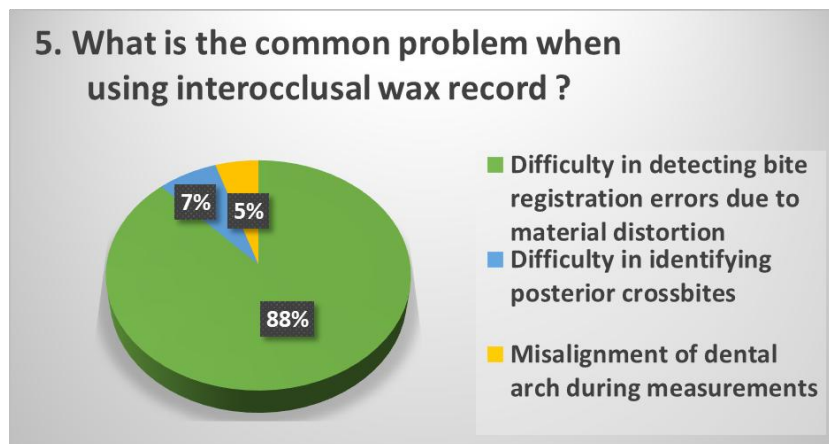


Fig. 8.

Material degradation can be a prevalent issue when utilizing interocclusal recordings to record the bite, out of the three alternatives offered to check for occlusal discrepancies.

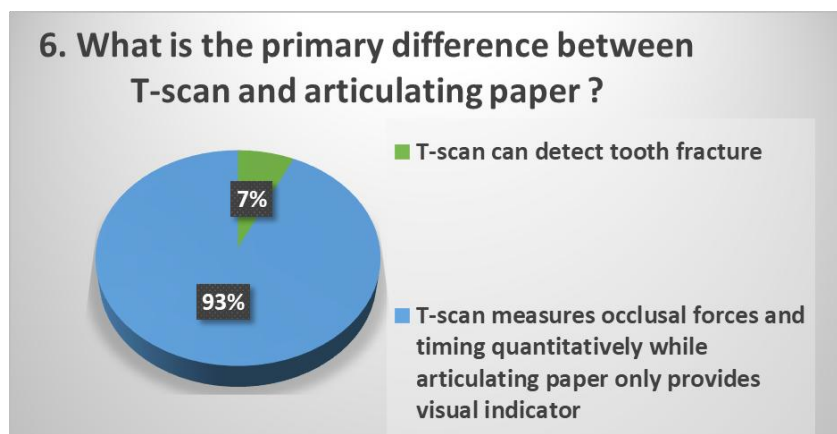


Fig.9.

T-scan quantifies the occlusal pressures and time during bite recording, whereas articulating paper just provides visual indications.

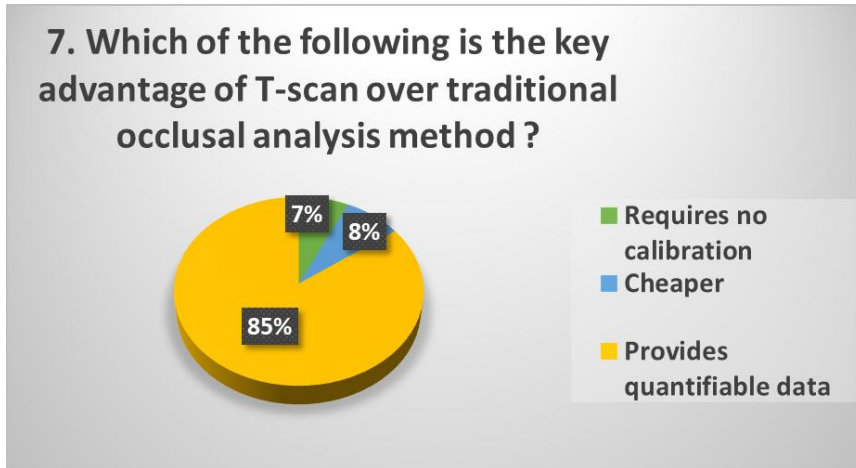


Fig. 10.

85% of the replies cited the advantage of giving quantitative data on scanning with T-scan over other traditional occlusal analysis methods, while 8% said that T-scan was less expensive.

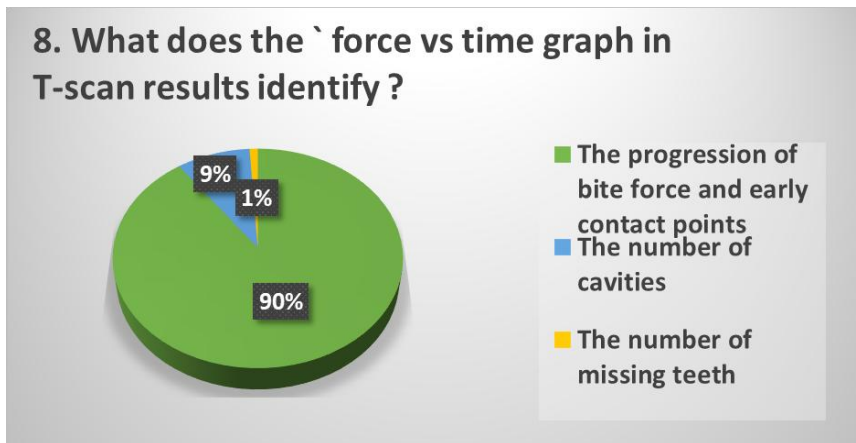


Fig .11.

The force vs. time graph in the data shows the evolution of biting force and any early occlusal contact locations.

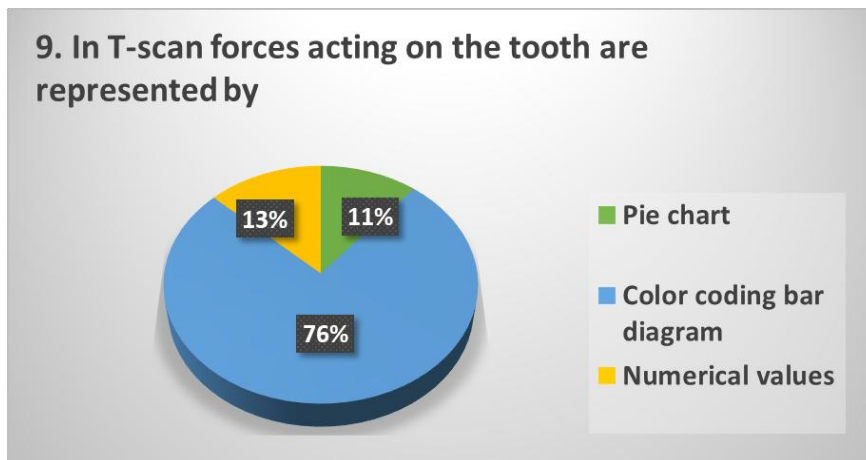


Fig .12.

The amount of occlusal load is shown by color-coded bars, with red being the greatest force and blue representing the least.

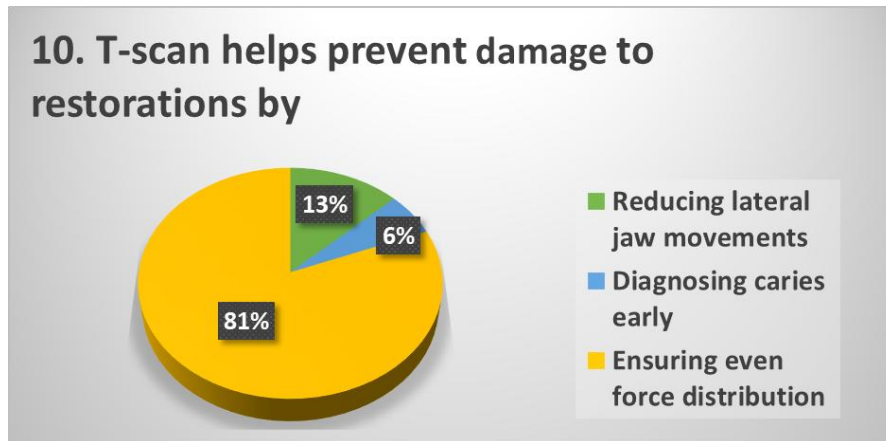


Fig.13.

T-scan helps to avoid restoration damage by recognizing and visualizing the distribution of forces produced while biting, as uneven restorations may lead to premature wear, fracture, or even restoration failure.

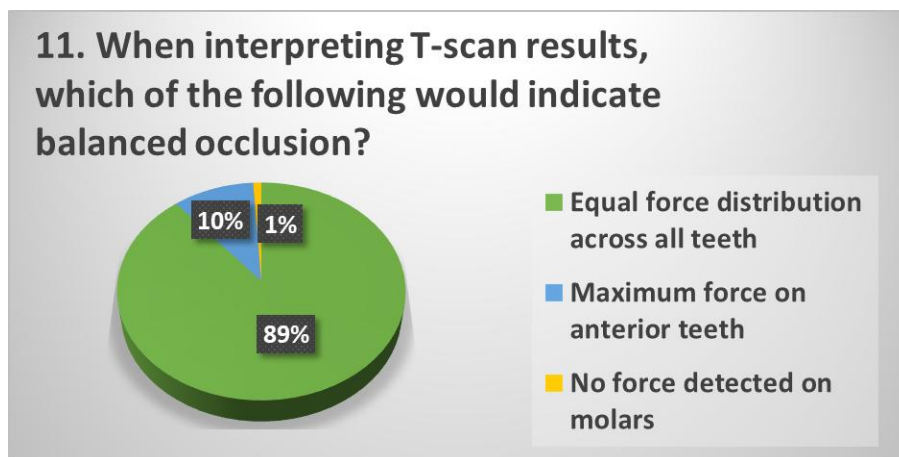


Fig. 14.

89% of the responses suggested harmonious occlusion in circumstances of equal force distribution across all teeth.

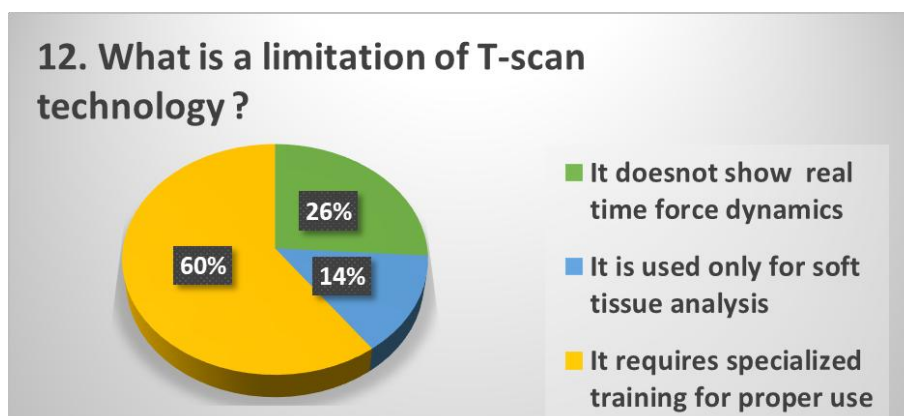


Fig.15.

60% of respondents believed that T-scan handling required specialist training, 26% stated that the T-scan's drawback was that it did not provide real-time force readings.

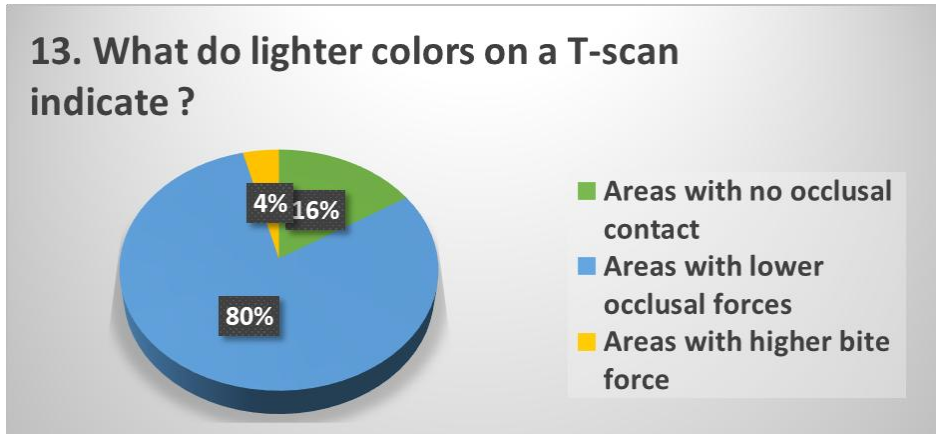


Fig.16.

The amount of occlusal load is shown by color-coded bars, with red being the greatest force and blue representing the least.

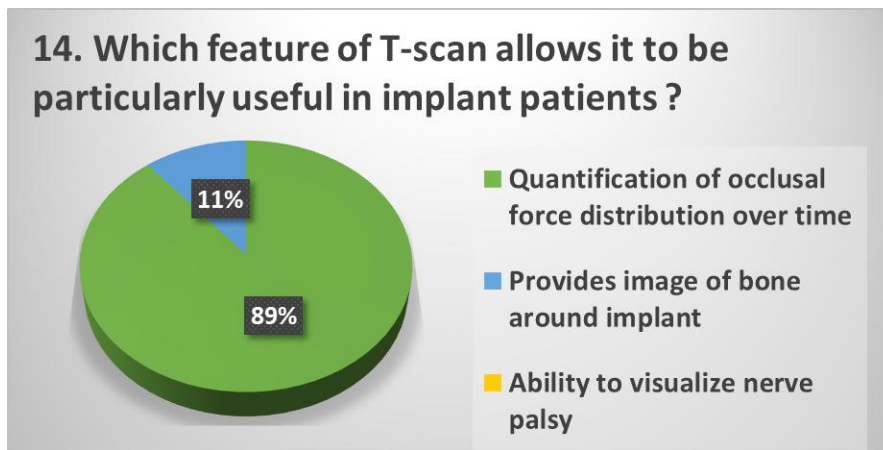


Fig.17.

T-scan helps to avoid implant supported restoration damage by detecting force distribution as it has been illustrated that periodontal tissues and even dental implants may deteriorate under higher bite forces and/or excursive overload.

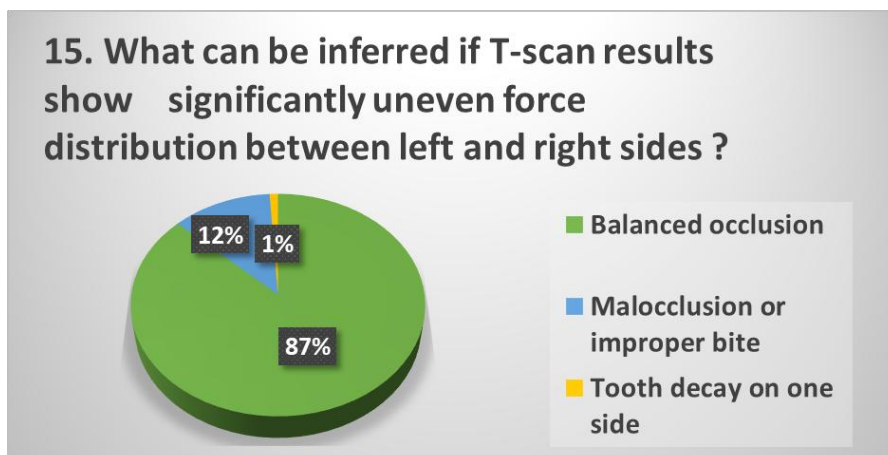


Fig. 18.

Eighty-seven percent of respondents said that an unequal distribution of force between the left and right sides indicated either malocclusion or an incorrect bite.

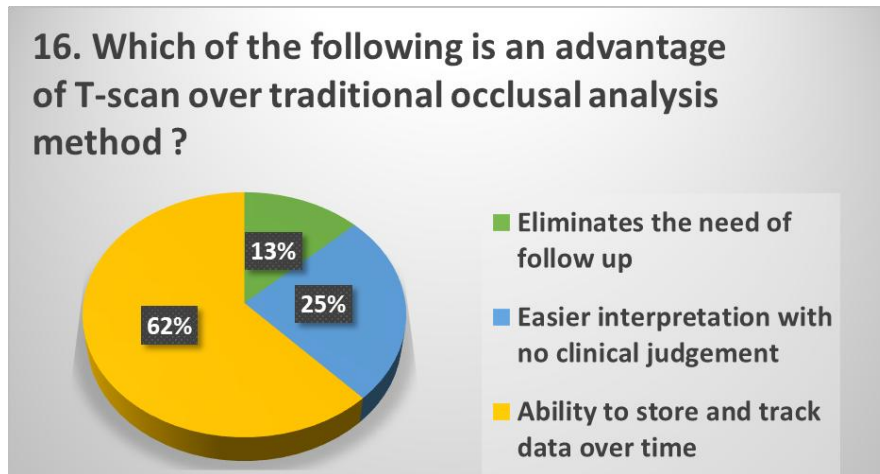


Fig. 19.

62% of respondents say that T-scan has the benefit of being able to save data and track over time, while 25% believe that interpretation is simple and does not require professional judgment.

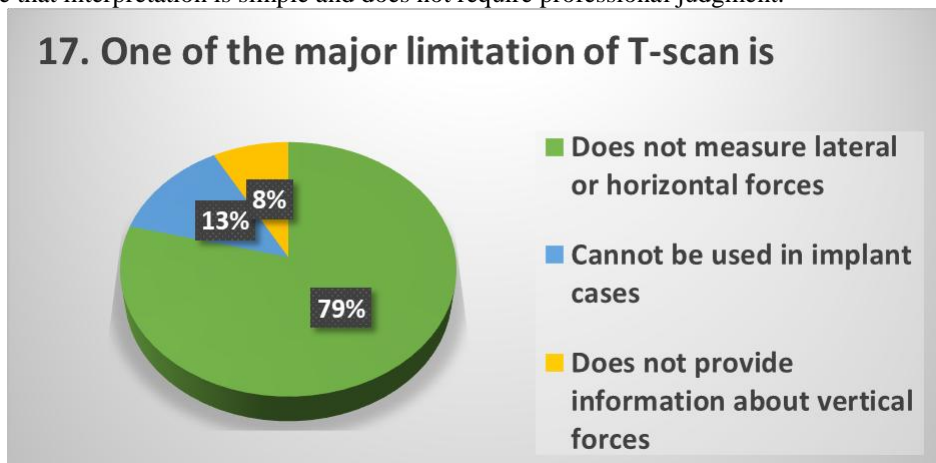


Fig. 20.

Since T-scan's sensor system is primarily intended to record vertical force distribution by turning the force into digital data, 79% of the replies pointed out that this technology's primary shortcoming is that it does not monitor lateral or horizontal forces.

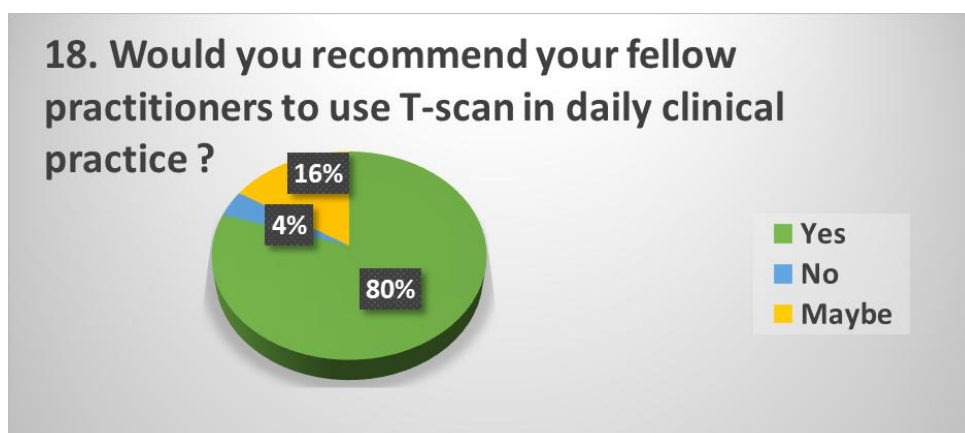


Fig. 21.

Ultimately, 80% of participants think that T-scan should be used in clinical practice.

IV. Discussion:

Clinicians can evaluate therapy results with the use of T-Scan technology, which offers thorough information on a patient's occlusion. Particularly in patients undergoing orthognathic surgery, T-Scan is a valuable technique for evaluating occlusal discrepancies and can be helpful throughout the follow-up phase as well as treatment planning. Additionally, the technique could make it possible to identify relapses early.

As a diagnostic tool, the T-Scan system demonstrated sufficient sensitivity and specificity, as well as greater reliability in intra-oral circumstances with saliva. This method decreases the subjective interpretation of occlusal analysis data and registers changing occlusal information. It assists in determining therapy results. Although costly, this approach is effective for clinical examination and comprehension of occlusal issues.

One may visualize and analyse the sequence of contacts and the forces included inside each labelling by looking at the force and time data and comparing it to the positions (just) of articulating paper markings. With the sequence and force content of a particular (or a set of) marks known, remedial occlusal modifications can then be made to natural teeth, dental prosthesis, and implant prosthesis. Material, implant, or occlusal surface longevity can thus be ensured by quantitatively designing occlusal force control on dental materials, implants, and/or natural teeth.

The study showed the real frequency of use of T-scan technology in clinical practice in Marathwada region. The study highlighted that T-scan is not considered essentially and alternatives are being preferred due to cost, availability and technical complexity. A multi-faceted approach focusing on education, accessibility and demonstrating clinical value would promote the usage of T-scan. Online training modules, workshops, educating via webinars would definitely help in rapidly increasing the knowledge about the T-scan technology.

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