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Occlusal analysis through T-Scan: Case reports

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Abstract
In several dental specialties, occlusal analysis is crucial for analyzing occlusional disharmony. Any issue that results in an unstable bite can lead to pain, tooth or restoration fractures, impaired movement, and TMJ issues. The high points and occlusion pattern in which articulating paper is most frequently used can be evaluated using a variety of techniques. However, articulating paper is not able to precisely measure the occlusal forces' magnitude and ratio. An electronic tool for occlusal force analysis is called T-Scan. In the fields of restorative and prosthetic dentistry, it is crucial. It can identify areas of excessive force, high spots, early encounters, and non-uniform force concentration. When it comes to locating and identifying traumatic occlusal contacts, a T-Scan provides for more information than an occlusal articulating paper. In order to compare the occlusal forces before and after the therapy, this might be done. T-Scan analysis can provide exact guidance for adjustments. Before making a bite modification, occlusal contacts can be assessed through bite testing using T-Scan. When a patient bites on the sensor, the occlusal data is represented as 3D and 2D images with colored columns that go from blue (optimal force) to red (high force). T scan realizes a qualitative study of improvements. T-Scan is employed in this case study as a treatment modifier in addition to a diagnostic tool. Data from before and after surgery were compared and examined.

Keywords: T-Scan, occlusal adjustment, occlusal diagnostic system

Introduction
A balanced distribution of the forces generated in the jaws during mastication is ensured by normal occlusal and articulation relations between them. Any early occlusal contacts and occlusal-articulating blockages result in occlusal traumas, which can lead to tooth or restoration fractures, alter the tissues that support teeth (The mucosa, periodontal tissues, and bone), as well as the temporomandibular joint and masticatory muscles [1].
T-Scan is a digital occlusion study device that uses a thin, flexible, pressure-sensitive bite transducer placed in a dental arch-shaped recorder to record and quantify tooth contact, force, and timing in real-time. The T-Scan occlusal data can be viewed graphically for two- or three-dimensional analysis, or it can be examined step-by-step as a dynamic video. The recorded occlusal data can be used to calculate the occlusal force distribution, occlusal interference, and relative force of each interference [2].
There are two sizes of T-Scan sensors: Large and tiny. A 66 mm wide by 56 mm deep arch can be accommodated by a large size sensor, whereas a 58 mm wide by 51 mm deep arch can be accommodated by a small size sensor. The sensor has a thickness of 0.1 mm^3 [3].
Prematurity, high points, areas of excessive force, and non-uniform force concentration can all be swiftly evaluated with the T-Scan technology. A sensor and support, a handle assembly, the system unit, and computer software are among the parts of the system [4].
The occlusal data is characterized as 3D and 2D images with colored column ranging from blue (Optimum force) to red (High force) when patient bites on sensor. Qualitative analysis of improvements is realized in T-Scan.

Uses of T-Scan includes
- Evaluate and adjust occlusion using accurate and digital data, pinpoint problematic occlusal contact locations.
- Identify interferences

- Ensure canine guidance.
- Document bite force dynamics and track changes over time [5].

It improves the patient care by

- Identify and adjust occlusal imbalances before they become a problem.
- Prevent premature contacts and destructive forces that can cause fractures and breakages.
- Avoid costly remakes by utilizing T-Scan's accurate, digital data.
- Provide outstanding treatment for all your patients [5].

Advantages

- Improves diagnosis (Premature contact and interferences can be identified).
- Decreases the treatment time.
- Increases comfort of dental restoration.
- Reduces risk of restoration failure, trauma to the teeth.
- Helps in legal documentation.

Methods for taking occlusal reading: The process of creating a model of the patient's arch begins with a T-Scan recording. To prevent the impact of head position on the occlusal contact pattern, the individual should be instructed to sit upright in a dental chair with the Frankfurt horizontal (FH) plane horizontal. The same examiner should conduct all recordings in order to eliminate inter-examiner differences. It is recommended that subjects receive prior training to ensure optimal cooperation. Following this instruction, the subject needs to be instructed to execute a variety of bites in an organic, unforced manner. Thus, recordings of the lower arch should be made, and the results should be presented in two dimensions. Measurements should be taken of contacts that form at the meeting point of two teeth. Data about the location and relative force of tooth contact are sent to the operator by the force analysis mode, which can be selected later. Two further modes are available within force analysis: Sequential, which records the intensity of interactions during mandibular movement, and instantaneous, which records mandibular locations [1, 6, 7].

Case Report A

A patient name A run came to Department of Conservative Dentistry and Endodontics complains of sensitivity in upper right back tooth region.

Intraoral examination showed dental caries 16(fig1.a). Diagnosis of symptomatic reversible pulpitis was made Prior to the treatment plan occlusal analysis was done using T-Scan Patient was guided, before taking the actual occlusal analysis to know about proper bite with force.

T-Scan has Handle, Sensor and sensor support

Subject should be asked to sit upright and previously trained to close in maximum intercuspation. Sensor was inserted in the patients mouth placed it centrally corresponding to the midline of the maxillary central incisor. Patient was asked to bite on sensor in maximum intercuspation. The occlusal analysis was shown on the screen.

The 2D image and 3D graph showed low occlusal force near the region of 16[dark blue color graph] (Fig1.b). So direct composite restoration was advised as a treatment plan.

In the same appointment caries removal followed Composite restoration was done (Fig 1.C). After the finishing and polishing high point was checked using articulating paper and corrected, patient was asked about the presence of high point and after obtaining the negative feedback, the post restorative occlusal analysis was done with T-Scan which showed increase in the graph height in 16 region, 3D analysis showed change from dark blue to light blue color in mesial aspect of 16 region which indicate slight increase in the occlusal force in that area (Fig 1.d).

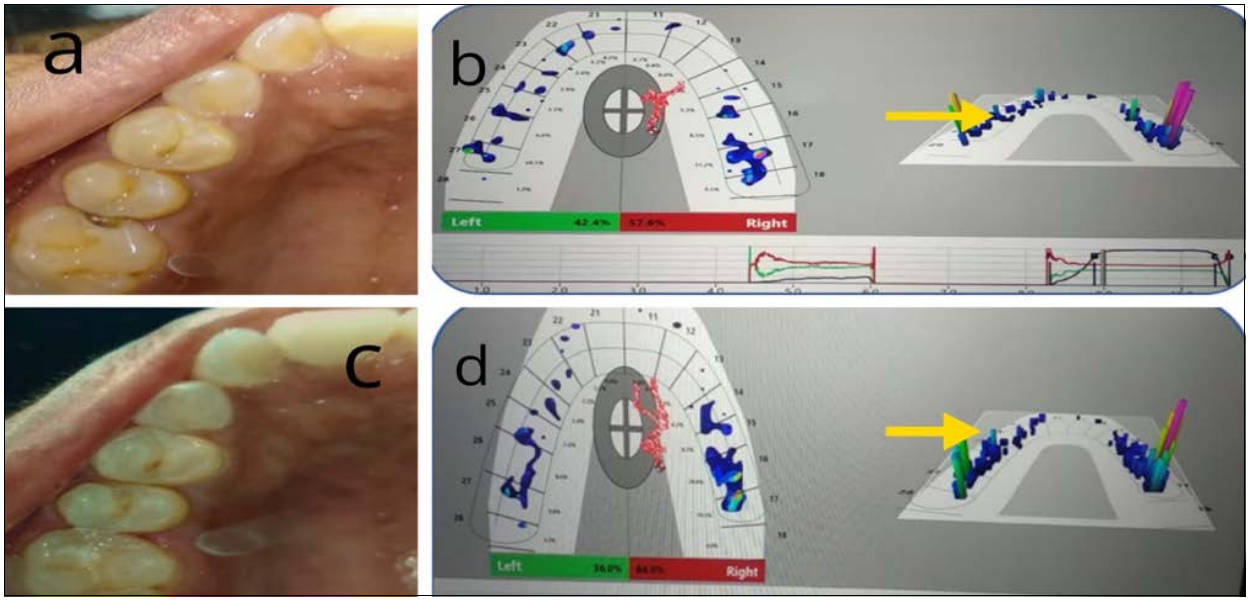

Fig 1: a) Proximal DC-16, b) Pre-operative occlusal analysis in 2D and 3D view which shows less occlusal force in 16 region, c) Direct composite restoration-16, d) - post operative occlusal analysis shows increase in the occlusal forces in 16 region

Case report B

Patient name Lakshmi was reported to Department of Conservative Dentistry and Endodontics with a chief complaint of sensitivity and food lodgment in upper left back tooth region. On examination proximal dental caries -26 was noted (Fig-2.a). Diagnosis of symptomatic reversible pulpits - 26 was made.

Pre-operative T-Scan occlusal analysis was taken which showed green graph which indicates occlusal force is more in the region of 26 (Fig 2.b). Risk of fracture of direct restoration is more due to high occlusal forces in that region. So, indirect restoration was treatment of choice.

Excavation of caries was done and modified the cavity for inlay. Upper and lower jaw impression was made. And metal inlay was fabricated in the lab.

In the 2nd appointment, a try in was made and cementation was done (Fig 2.c). Post cementation occlusal analysis was done for the same. In which change in color of graph from green to blue was noted which indicates the reduction in the forces in 26 region (Fig 2.d).

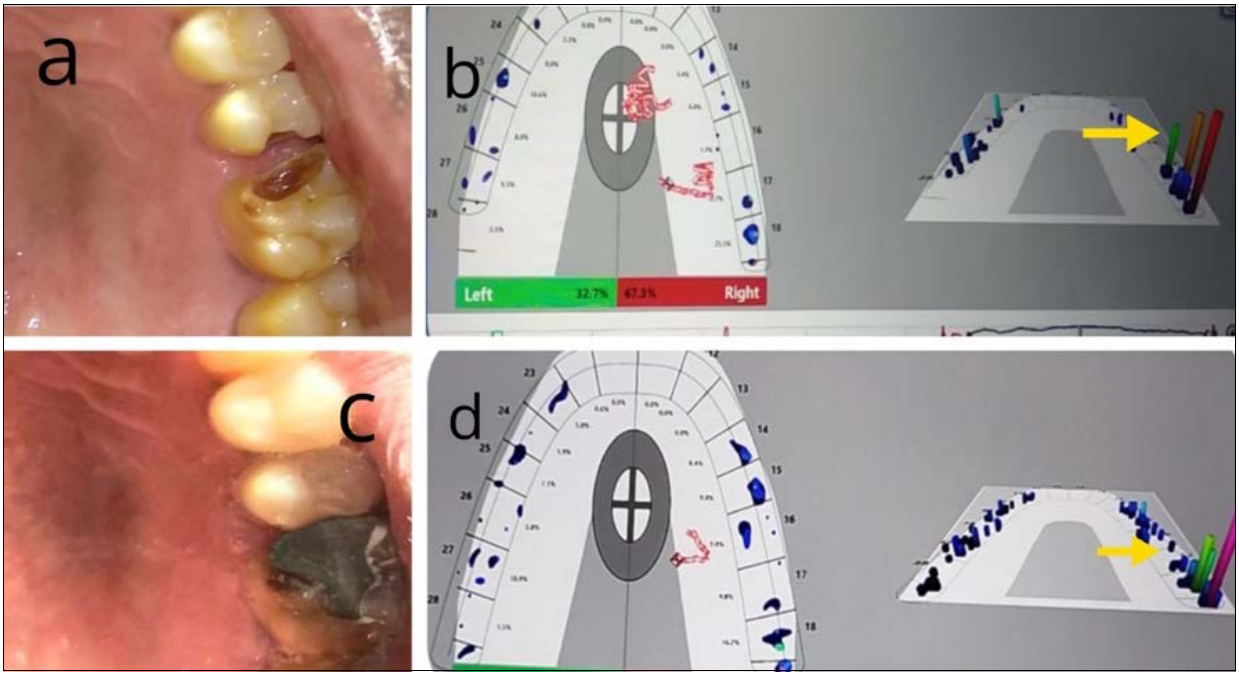

Fig 2: a) Proximal DC - 26, b) Preoperative occlusal analysis showing green colour in 3D graph depict increase in occlusal force in 26 region, c) Metal inlay cementation-26, d) Post-operative occlusal analysis showing blue color 3D graph which indicated less occlusal forces in 26 region.

Discussion

An incorrectly completed restoration can lead to a number of issues, including imbalanced bilateral force application during mastication, headaches, TMD-related issues, and early tooth or restoration fractures. T-Scan has been crucial in ruling out teeth that have been unduly or underlay restored. It has also shortened the time needed to complete restorations and schedule follow-up appointments [3].

As a diagnostic tool, the T-Scan system's sensitivity and specificity are adequate. This allows for the registration of dynamic occlusal information and lessens the need for subjective interpretation of occlusal analysis data. It facilitates evaluating the results of treatment. Despite being quite expensive, this approach is beneficial for clinical examination, recognizing occlusal issues, and providing a useful teaching tool [4].

Through quantitative measurement, the T-Scan system aids in the evaluation of the occlusion and the balance of the occlusal pressures. Compared to alternative techniques for occlusal contact registration, the system's software application offers a more informative representation of dental arches. T-Scan enables quick and precise occlusal-articulation analysis and registration [1].

Does not have to rely on subjective data which can be influenced by duration of the appointment, patient perception instead accurate data can be obtained by T-Scan. Can show patients their occlusion so they can be more confident in your analysis and treatment plan.

Helps to precisely evaluate and adjust the occlusion using accurate digital data. Identifies the interference, pinpoint problematic occlusal contact locations and ensures occlusal harmony of the overall bite. Major drawback is, inability to measure the absolute force value while measuring bite force. Another major drawback of T-Scan system is that it lacks reproducibility of data [3].

In this study T-Scan was helpful to diagnose the occlusal forces in the region to be restored which guided for the treatment option. And post-operative occlusal analysis was correctly obtained instead of depending on subjective opinion of the patient, which can be influenced by on various factors.

Conclusion

When combined with digital technologies, it is possible to create restorations that are more precisely constructed and to visualize each step of the process, from design to dental adaption. It is feasible to attain ideal, harmonic occlusal ratios with the T-Scan. Through the conversion of qualitative data into quantitative characteristics and their digital display, T-Scan offers a reliable method for measuring and analyzing the time sequence and force magnitude of occlusal interactions. The T-Scan can be used to make several adjustments of unbalanced forces for each segment of the dentition. The system is a helpful clinical technique that removes an operator's subjective, biased assessment of the occlusal and articulating interactions. T-Scan integration facilitates chair side occlusal analysis pre/post treatment, decision-making, and treatment modification for a predictable outcome.

Conflict of Interest

Not available

Financial Support

Not available

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