

T SCAN- A DIGITAL OCCLUSAL ANALYZER

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Abstract

Dental occlusion is the main concern in dentistry. In old days there are few tools like articulating paper, occlusal waxes, shim stock foil and impression material etc. which provide occlusal detail to the clinician. Instead of this information they didn't provide details regarding amount, timing and distribution of force. T SCAN overcome all these demerits and help the clinician to provide better outcome to the patient by digital occlusal analysis of bite force. Along with the occlusal detail the T SCAN also able to provide information related to masticatory muscle and TMJ during different jaw movement due to its compatibility with Surface Electromyograph (SEMG) and Joint vibration analyzer (JVA). The aim of this Short Communication is to provide an insight to T-SCAN.

Key words: Dental occlusion, T SCAN, Digital Occlusal analysis, JVA.

Introduction

Occlusion is "the static relationship between the incising or occlusal surfaces of the maxillary or mandibular teeth or toothanalogue. The occlusion should be balanced and as stress free as possible".¹

The concept of occlusion is not restricted to morphological contact interactions between teeth. It embraces the dynamic morphofunctional interactions amongst all constituents of the masticatory system, including teeth, periodontal tissues, the neuromuscular system, the temporo-mandibular joint and the craniofacial bones.²⁻⁴

One of the most innovative systems for quantitative occlusal analysis was developed by Maness. He developed the T-Scan system, which is considered as a computerized device capable to interpret occlusal contact information quantitatively.⁵ T-Scan I was invented 25 years ago, and since then, the entire system has undergone hardware and software revisions such that today T-Scan III system (version 7) is vastly improved over the earliest T-Scan I system.⁶

T-Scan technology is a bite analysis system that measures the efficiency of how teeth come together and separate to protect natural teeth, restored teeth, implants, and muscles. T-SCAN III also having the compatibility with SEMG & JVA and provide a high quality result which make this device a very useful diagnostic tool.

Parts of T SCAN

- Sensor and Support-Two sizes available
a) Large b) Small
- Handle assembly
- Computer software
- Printer

Computerized T SCAN wizard

T-Scan III analyzes the order of the occlusal contacts while simultaneously measuring the force percentage changes of those same contacts, from the moment the teeth first begin making occlusal contact, all the way through to maximum intercuspation. Therefore, it can assess the initial occlusal contact, the order that all the occlusal contacts occur in, and the amount of relative

occlusal force loading each contact. It enables us to assess the force changes, all during the process of contact evolution. Computer-guided occlusal adjustments can then be employed to alter a poorly contacting tooth sequence into a contact sequence where multiple equal-intensity contacts are occurring simultaneously throughout the arches bilaterally.

In the left top corner analysis window (Figure 1), the amount of relative occlusal force is displayed in 3-dimensional colored bar graphs. The color and height of each bar indicates the intensity of force per contact. The top right corner analysis window is a 2-dimensional dental arch, in which the occlusal contact forces are surrounded by a yellow outline that locates the contacts, while illustrating in the same colors (as the 3-dimensional bar graph window) the differing of occlusal force levels.

A dentist adjusts a problematic occlusal contact by finding its location in the 2-dimensional dental arch window. In the 2-dimensional window, the right and left arch halves are outlined in green (left) and in red (right), and their respective arch half-force percentages are calculated and displayed for analysis at the bottom. The anterior and posterior regions can also be displayed by

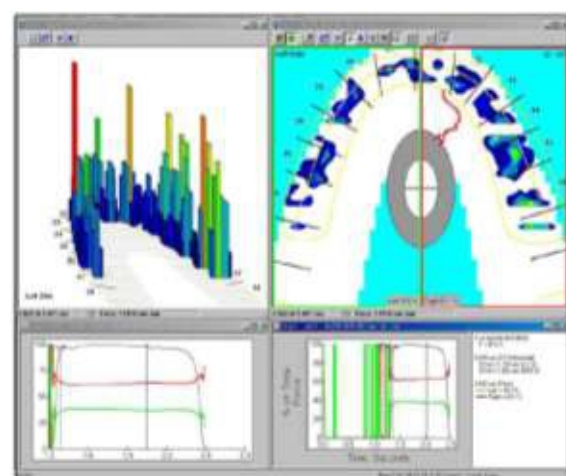


Figure 1: Computerized T-Scan III wizard

dividing the 2-dimensional window into 4 quadrants (pink and aqua colors are added). vs. Time graph indicates elapsed time, while the vertical axis indicates the changing percentage of occlusal forces in both sides of the arch. The total force of the combined left and right arch halves is described in the Force vs. Time Graph by the non-vertical black line.⁶

Applications

- Fixed & Removable Prosthetics
- Implant Prosthetics
- TMD Appliances
- Occlusal Equilibration
- Disclusion Time Reduction
- Abfraction Management
- Periodontal Management
- Differential Diagnosis
- Orthodontics
- Locating Painful Teeth
- Dental Case Finishing

Merits

- Determine Premature Contacts
- Instant Documentation
- Enhanced Patient Comfort
- Reliability
- Reproducibility
- Easy to reference
- Accurate
- Portable
- User friendly
- Improved outcome

Limitations

- Thinner occlusal registration materials provide more consistent records of the contact points. To fulfill the technological demands, the T-Scan sensors are made as thin as possible (0.1mm) which is still thicker than articulating silk.
- If forces are concentrated over a small area sensors may be damaged, such as, a sharp tooth cusp. This may also lead to inaccurate recording of the occlusal contact and/or artifacts in the produced images.
- Less than 0.6mm occlusal interferences can not be reproduced by the T-Scan system.
- The two different modes of the system (force and time analysis modes) may reproduce different occlusal contact data. Time mode has been shown to register the maximum number of contacts, while the force mode has been shown to present the least variability. However, these differences are small.

Discussion

Reliability and reproducibility of occlusal analysis is an important dimension of planning evidence-based clinical decisions, in clinical dental treatments and research.⁷ The conventional static occlusal indicators such as articulating paper and waxes only reveal the contact size and location, whereas the T-Scan has an additional ability of quantifying occlusal contact timings and forces.⁸ Kerstein reduced the posterior disclusion time to less than 0.5 seconds per excursion and the patients returned to normal muscle function within 1 month of treatment, without the use of any splints. The occlusal adjustments included removal of all posterior interferences (lateral and protrusive) by enameloplasty to develop a complete anterior guidance.⁹

Although the role of occlusal disturbances as one of the etiological factors in the multifactorial TMDs is controversial, correction of the occlusal disturbance in various cases has been shown to reverse the condition and provide relief to the myalgia. It has been shown that lower surface electromyographic (SEMG) activity is associated with higher number of contacts and the maximum level of bite force during centric maximal voluntary clenching.¹⁰

Compatibility with JVA makes T SCAN a valuable tool which help to diagnose TMJ disorder occurs due to the premature contacts of teeth or restorations. T Scan makes post orthodontic result more stable by detecting any high point contact and any overly active muscle of mastication which could be responsible for relapse. The T-Scan system presents a superior alternative to conventional occlusal registration methods due to its ability to record dynamic tooth contact relationships.

Conclusion

Compared to conventional occlusal indicators, the T-Scan system clearly has more clinical utility in diagnosing and treating cases of temporomandibular disorders when caused due to occlusal disturbances. Computerized occlusal analysis with the T-Scan II can be applied to analyze the relative time of initial occlusal contact of natural teeth and dental implant prostheses, so that it is possible to separate them as they come under occlusal loading. T-Scan system demonstrates sufficient sensitivity and specificity as a diagnostic tool and presents higher reliability in intra-oral conditions with presence of saliva. This technology reduces the subjective interpretation of occlusal analysis data and also provides registration of dynamic occlusal information. Therefore it is recommended that the use of T-Scan system should be supported in clinical practices for the diagnosis and occlusal optimization in cases of occlusal disturbance related temporomandibular disorder, due to its capability of measuring occlusal force and contact timing.

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