Chapter 11
Orthodontic T–Scan Applications

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ABSTRACT

This chapter reviews T-Scan use in Orthodontics, defines normal T-Scan recordings for orthodontically treated subjects versus untreated subjects, and explains T-Scan use in the case-finishing process. After orthodontic appliance removal changes in the occlusion result from “settling,” because teeth can move freely within the periodontium. Despite a post treatment, visually “perfect” Angle’s Class I relationship, ideal occlusal contacts often do not result solely from tooth movement. Creating simultaneous and equal contacts following fixed appliance removal can be accomplished using T-Scan data to optimize the end-result occlusal contact pattern. The software’s force distribution and timing indicators (the 2 and 3-Dimensional ForceViews, force percentage per tooth and arch half, the Center of Force, and the Occlusion and Disclusion Times) aid in obtaining an ideal occlusal force distribution during case-finishing. Several case reports highlight combining lingual orthodontic treatment with Orthognathic surgery, where each presented case utilized T-Scan data during active treatment and retention.

INTRODUCTION

The dental occlusion develops progressively, under the guidance of functional and genetic influences throughout the differing stages of dental arch morphogenesis, and then subsequently through a variety of adaptations made notably to the Temporomandibular joint and the masticatory muscles.

When dealing with complex malocclusions, Orthodontists modify all dental contacts to achieve a new position of occlusal equilibrium, and take responsibility for its functional integration. Fully aware of these implications, they devote special attention to the quality of the final occlusion of their treated cases, whatever the therapeutic occlusal philosophy is that they ascribe to follow.

It is uniformly understood and agreed upon, that at the completion of orthodontic treatment the occlusal contacts of all teeth should demonstrate simultaneous contact timing and be of equal force intensity, thereby creating a uniform and symmetrical distribution of masticatory force. It has been recommended that the anterior teeth be...
slightly less loaded than the posterior teeth (Roth, 1970; Dawson, 2006).

In Orthodontics, and other dental medicine disciplines as well, such as Prosthodontics and Periodontics, the assessment of occlusal quality has relied mostly on the visual inspection of occlusal contacts, by using:

- The intercuspation of stone dental casts.
- Subjectively Interpreting articulating paper marks.
- Listening to oral patient “feel” feedback.

Alternative, but more time-consuming occlusal indicator techniques have been described, that are often employed within research studies. These alternative occlusal indicator methods are:

- Observing imprints in high fluidity impression materials.
- Analyzing force distribution statically within pressure sensitive wax - Dental Prescale 50H (Fuji Photo Film Corporation, Tokyo, Japan) and its analyzing apparatus (Occluzer™ FPD703, Fuji Photo Film Corporation, Tokyo, Japan).

After the patient imprints the above static dental material indicators, the indicators require digital scanning, followed later by computer processing to retrieve and analyze their force data. Unfortunately, their effectiveness in generating force distribution representations is offset by the significant chair time used to complete data retrieval. Furthermore, neither of these techniques gives the clinician information about the “timing” of the contacts. They offer no indication as to the location of the first contact, the sequence of contacts from 1st contact through until maximum intercuspation, nor the distribution of contacts within the maximum intercuspated position. Therefore with these methods, the clinician does not have the required tools to properly evaluate the ‘simultaneity’ or ‘timing’ of the post orthodontic occlusal contact result.

**Orthodontic End-Result Occlusal Function**

Several questions have arisen about orthodontic treatment completion and the established end-result occlusal function:

- Should Orthodontists assume that achieving ideal positional tooth-to-tooth relationships is enough to obtain a measurably balanced occlusion?
- Do the occlusal contacts spontaneously improve the overall occlusal force balance resultant from settling, after appliance removal?
- Is post treatment occlusal force distribution of the teeth symmetrically obtained when a pre treatment dental asymmetry has been corrected, orthodontically?

The T-Scan III (T-Scan III Version 7, Tekscan Inc. S. Boston, MA, USA) is an occlusal analysis system available to Orthodontists, that records in real-time, the contact force distribution as it changes functionally throughout the progression of occlusal contacts from 1st contact through until maximum intercuspation during closure, and quantifies the time durations of any frictional occlusal surface engagements that posterior teeth make in protrusive or lateral excursions. This very detailed occlusal analysis can be played back in increments of 0.01 seconds, or when in the much faster Turbo-mode, 0.003 second-long increments.

This chapter will initially review the literature describing orthodontic norms and post-orthodontic functional occlusion. Then, the clinical use of the T-Scan III system in Orthodontics will be explained by highlighting the force distribution indicators for closure contacts leading to maximum intercuspation (the 2-Dimensional and 3-Dimensional ForceViews; the percentage of force per