


Chapter 20

T-Scan Digital Occlusal Analysis Applications in Orthodontics: A Guide to Measuring the Dynamic Occlusion While Moving Teeth

Svitlana Koval

 <https://orcid.org/0000-0002-2325-4316>

Private Practice in Orthodontics, USA & Private Practice in Orthodontics, Odessa, Ukraine

ABSTRACT

Orthodontic outcomes have been extensively graded to ensure optimal aesthetic and functional results. Several grading systems are used worldwide, with the most being the American Board of Orthodontics objective grading system (ABO-OGS) and the peer assessment rating (PAR). The ABO-OGS has been shown in recent orthodontic studies to highly correlate with T-Scan digital occlusion analysis parameters, where post-orthodontic patients demonstrated worse excursive movement parameters compared to non-orthodontically treated patients. Additionally, one static occlusion T-Scan parameter (the Anterior/Posterior % ratio) was correlated to the presence of significant anterior overbites and the presence of a Class II Angle Classification. As such, the Specific Aims of this chapter are to describe the T-Scan parameters of orthodontic patients treated with different techniques (fixed appliances on the buccal or lingual, and clear aligner treatment), and compare those results against the differing orthodontic grading systems. Moreover, this chapter will describe in detail how fixed appliance orthodontic therapy when combined with T-Scan digital occlusal analysis improves orthodontic treatment outcomes prior to debanding. Additionally, this chapter will illustrate how T-Scan, when used during clear aligner treatment planning, and in the refinement stages when additional aligners are often required, can markedly improve clear aligner outcomes, as well.

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INTRODUCTION

The Universal Measures of Assessing Orthodontic Outcomes

In most orthodontic clinical settings professional, subjective, and experience-based clinician's judgment are used to assess the treatment outcome, which has been a gold standard for many years (Hong et al., 2014). However, one of the largest international studies has highlighted that there often significant inter-practitioner variations when differing clinicians subjectively assess orthodontic treatment outcomes (Richmond et al., 2011).

Orthodontic treatment outcome assessment has evolved with the use outcome indexes:

- **The American Board of Orthodontics Objective Grading System (ABO-OGS)** (Casko et al., 1998)
- **The Peer Assessment Rating (PAR)** (Richmond et al., 1992)
- **The Occlusal Index** (Summers, 1971)

While the Occlusal Index was deemed tedious to perform, and was intended to evaluate pre-treatment records more than post-treatment outcomes, the PAR index has shown good validity and reliability. However, PAR has been deemed imprecise when determining minor inadequacies in tooth position.

The main difference between the PAR and ABO-OGS indices, is that PAR assesses pre- and post-treatment records by calculating an "Improvement Score", while the ABO-OGS evaluates only the post-treatment records. Further, the PAR index evaluates the dental arches in quadrants, while the ABO-OGS evaluates the orthodontic outcome on a tooth-by-tooth basis by assessing the final casts and post treatment panoramic radiographs (Ardani et al., 2021).

The morphological characteristics of the initial malocclusion as described by the ABO-OGS and PAR index criterion, are evaluated for orthodontic treatment planning (PAR index) and/or to determine the degree of occlusal improvements at the end of tooth movement (ABO-OGS) (Casko et al., 1998; Deguchi et al., 2005).

The American Board of Orthodontics Objective Grading System (ABO-OGS) Index

The Objective Grading system has specific criteria that are believed to depict the most accurate representation of the final occlusal outcome. The eight criteria of the ABO-OGS include (Figures 1a, b and c):

- Alignment
- Marginal ridges
- Buccolingual inclination
- Occlusal relationships
- Occlusal contacts
- Overjet
- Interproximal contacts
- Root angulation.

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