

## Chapter 14

# Centric Relation Records and T-Scan Occlusal Analysis of Centric Relation Prematurities

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### ABSTRACT

*Occlusal analysis is the examination and diagnosis of the forces generated by the contacting surfaces of teeth. The clinician can use both mounted diagnostic casts and the T-Scan Occlusal Analysis system to understand the role of adverse forces in a patient's dentition. These casts should be mounted in Centric Relation so that they replicate the patient's hinge axis maxillomandibular relationship, absent of tooth contact. Diagnostic casts can demonstrate the mandibular slide into maximum intercuspation, as well as illustrate the excursive contacts. The T-Scan not only records the location of tooth contacts present in Centric Relation, maximum intercuspation, and lateral excursions, but also detects the timing and relative force of all contacts. The rapid display of recorded tooth contact data in the 2- and 3-Dimensional ForceViews makes it practical for intraoral operative use. These modalities can be used separately or in concert depending on the clinical situation. This chapter discusses the clinical technique, advantages, and rationale for identifying Centric Relation prematurities with mounted diagnostic casts and the T-Scan.*

### INTRODUCTION

Centric Relation (CR) is defined as “the relationship of the mandible to the maxilla when the properly aligned condyle-disc assemblies, are in the most superior position against the eminentia, regardless of tooth position or vertical dimension. (Dawson, 1983).

The clinical significance of CR is that this is the position that the mandibular condyle assumes when fully seated in the glenoid fossa during normal elevator muscle contraction. When the condyle and disc are braced in the most superior anterior and medial position possible, there is a bone-to-disc-to-bone relationship, that is stable, and capable of tolerating high muscle contraction loads. In CR, the elevator muscles can contract

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while the inferior belly of the lateral pterygoid muscle remains relaxed. Additionally when in CR, the mandibular hinge axis rotates in a precise arc, allowing for a predictable diagnosis of the dental occlusion, and predictable treatment planning of any proposed occlusal changes.

An arc of closure interference within the dental occlusion, or an internal derangement present within the Temporomandibular Joint (TMJ)-Articular Disc complex, can affect the physiologic seating of the condyle. An arc of closure interference places all the occlusal forces on a single tooth, which stimulates a protective response via the mechanoreceptors of the periodontal ligament (PDL), triggering the protrusive muscles to reorient the mandible into maximum intercuspation (MIP), where more teeth contact exists to better distribute the occlusal forces (Roth, 1973).

Since  $\text{Pressure} = \text{Force}/\text{Area}$ , 100% closing force on a single tooth is traumatic compared to dispersing that same force over 14 teeth.

The condyle when positioned in MIP usually has a protruded position on the slippery incline of the articular eminence (Utt, Meyers, Wierzbica, & Hondrum, 1995). It has been suggested that constant protrusive muscle hyperactivity is required to hold this position, such that during elevator muscle contraction, uncoordinated muscle function is created. As such, these muscle groups should function in a reciprocal fashion, and not concurrently (Mahan, Wilkinson, Gibbs, Mauderli, & Brannon, 1983).

Many arc of closure interferences can also be interferences in lateral or protrusive excursions. Posterior tooth excursive contact creates prolonged excursive contact durations, and resultant prolonged PDL compressions, with a common outcome of masticatory muscle hyperactivity, pain, and dysfunction (Kerstein, Chapman, & Klein, 1997; Kerstein & Radke, 2012).

Internal derangements of the TMJ articular disc can displace the condyle, dependent on the direction of the disc displacement, and prevent

optimal condylar positioning (Weinberg, 1985; McNeill, 1985). Muscle hyperactivity due to an arc of closure interference, or from a displaced disc, cannot be considered optimal muscle function or as being advantageous to the patient.

Mounted diagnostic casts and T-Scan occlusal analysis (Tekscan, Inc., S. Boston, MA, USA) can be used to identify any arc of closure interferences when the mandible is placed in CR. There are multiple clinical applications for mounted diagnostic casts verified in CR. However, fabricating these casts involves time, cost, and they are not repeatable intra-operatively. The T-Scan is an accurate, practical way to diagnose and document occlusal contacts present within the arc of closure. It quickly displays the timing, location, and relative force of the arc of closure interference. Recording Cr to verify the arc of closure interference is consistent, can be easily repeated at any stage of any dental procedure. These modalities for CR diagnosis can be used separately or in concert, dependent upon the clinical situation.

## **TECHNIQUES OF LOCATING CENTRIC RELATION**

The need to record the mandibular transverse axis of rotation for making an accurate diagnosis of the existing interarch occlusal relationships, and for the fabrication of prosthetic restorations that are in harmony with the patient's orofacial anatomy, has been previously recognized (Preston, 1979). Historically, a predictably repeatable maxillo-mandibular relationship has been assumed to be a useful relationship. Without repeatability there would be no value in recording this relationship. It is important to recognize that CR is considered to be the optimal anatomic relationship of the fully seated condyle, rotating on its braced medial pole, which provides stability and repeatability (Dawson, 1983).

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