

## Chapter 65

# The Limitations of Traditional Non-Digital Occlusal Indicators When Compared to the T-Scan Computerized Occlusal Analysis Technology

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### **ABSTRACT**

*The traditional occlusal indicators used in dental practice are articulation papers, shim-stock foils, elastomeric impression materials, and occlusal wax strips. These static dental materials have been widely believed to have occlusal force descriptive capability. However, modern material studies are challenging the widespread belief that occlusal indicator materials can measure differing occlusal force levels. This chapter evaluates the force reporting limitations of these static occlusal indicators and discusses how clinicians subjectively interpret their appearance characteristics to determine differing occlusal force levels. This chapter then compares these non-digital occlusal indicators to computerized occlusal analysis technology that records and displays precise, quantifiable, relative occlusal force variances and occlusal contact timing sequences. This digital data aids the clinician in making a more accurate occlusal analysis and can guide the clinician in the correction of occlusal contact force and timing abnormalities, thereby eliminating the subjectivity that is inherent in traditional occlusal indicator use.*

### **INTRODUCTION**

Occlusal indicators are used in prosthetic dentistry to determine occlusal contact locations, and for the recording and transferring of patient's interocclusal relationship onto an articulator for the fabrication of dental prostheses. The conventional or traditional methods used in clinical practice for occlusal contact selection during occlusal adjustment procedures are non-digital. Static dental materials are placed between

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opposing teeth to imprint, or mark with color, the occlusal contacts. Commonly employed non-digital occlusal indicators are often combined with the patient's subjective occlusal "*feel*" verbal feedback, to help guide the clinician in occlusal contact forcefulness detection.

These static materials display a wide range of physical properties (viscosity, elasticity, volumetric shrinkage, distortion, and crumpling), which contribute to their clinical use inaccuracies.

In clinical practice when making occlusal adjustments, the most commonly used non-digital occlusal indicators are:

- **Articulation Paper Strips:** That leave ink marks on the teeth where occlusal contacts exist.
- **Shim-Stock Foils:** Which are tugged and pulled from between the teeth, to detect withdrawal resistance that supposedly indicates the presence of forceful tooth contacts.
- **Elastomeric Impression Materials:** Which, when injected between opposing teeth to locate occlusal contacts, are displaced completely where there is tooth contact.
- **Occlusal Wax Sheets:** Which are softened and then imprinted by opposing teeth. Wax perforations or apparent wax thinness indicate occlusal contact, or near contact.

The properties of an 'ideal' interocclusal recording material are (Malone & Koth, 1989):

- Limited initial resistance during closure, to avoid displacement of both mobile teeth and the mandible, itself;
- Excellent dimensional stability after setting;
- High resistance to compression after polymerization;
- Ease of manipulation;
- The absence of any adverse effects on the tissues involved in the recording procedures;
- Accurately records the incisal or occlusal surfaces of teeth; and
- Ease of record verification.

There is no ideal occlusal recording material available to clinicians that possess all of these properties (Malone & Koth, 1989). The static materials listed above all demonstrate varying degrees of limitation, when a clinician is choosing which contact(s) appear to be forceful during an occlusal adjustment procedure.

Occlusal adjustments are routinely accomplished by using the appearance characteristics of these non-digital occlusal indicators to select the contacts for treatment. This method is widespread in Dental Medicine, despite there being a lack of scientific evidence correlating wax or impression material imprints, the depth of the color of a paper mark, or a paper mark's size, to measured amounts of applied occlusal force. Studies indicate that none of these static dental materials have demonstrated the capability to quantify occlusal forces, to detect occlusal contact time simultaneity, or determine the sequence of tooth contacts that occur during a mandibular closure into maximum intercuspation (Koos et al., 2010; Kerstein, 2008). These static dental materials are indicators of contact location only and are incapable of quantifying functional occlusal force and timing information. Specifically, published studies about articulation paper and Shim-stock foil are analyses of their physical properties themselves (thickness, composition, ink substrate and plastic deformity (Schelb & Kaiser, 1985; Carey, Craig, Kerstein & Radke, 2007) and offer no evidence to suggest that variable articulation paper mark size, or Shim-stock "*hold*" can accurately describe varying occlusal contact loads (Harper & Setchell, 2002).

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