Chapter 5
Adding Technology to Diagnostic Methods

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ABSTRACT

Adding modern technology to clinical diagnostic methods instead of replacing them, represents an improvement in patient care, because objective bio-physiologic measurements enhance the information obtained from the patient report of symptoms and the clinical observations made during a patient examination. Combining multiple tests has universally been acknowledged to enhance diagnostic sensitivity and specificity. The increased objectivity of bio-physiologic measurements that represent quantifiable data for diagnostic purposes also adds value to treatment monitoring and/or outcome assessments. The most recent evidence suggests that the emotional aspects of temporomandibular disorders (TMD), are more the result of pain and dysfunction than the cause. This chapter discusses several dental technologies that are now available that provide objective bio-physiologic measurements of masticatory functions. Bio-physiologic measurements have the capacity to provide detailed, objective analysis. Each diagnostic technology is illustrated with an example of its output data, recorded from both an asymptomatic subject, as well as a patient with masticatory dysfunction. Of significance when considering employing these instruments is that a dentist can use these technologies to improve the initial diagnostic accuracy, and also to verify the degree of success after rendered treatment. Finally, recommendations are provided that dental medicine should accept the use of modern digital technology as an indispensable part of modern clinical practice, and that resistance to its implementation should no longer inhibit its widespread clinical use.

INTRODUCTION

There are three types of data collection methods used in healthcare to gather information for research, for diagnostic purposes, or to monitor treatment outcomes. They are given in Table 1.

Of the above three methods, Biophysiologic Measurement is the most quantifiable (e.g. blood pressure, heart rate, range of motion), since it incorporates modern measurement equipment, and currently takes

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Table 1.

Healthcare Data Collection	Type of Data
• Self-Report (Patient History)	Subjective
• Observation (Clinical Examination)	Subjective/Objective
• Bio-Physiologic Measurement (BPM)	Objective/Subjective (Interpretation)

full advantage of the latest advances in computer technology. Despite the advantages of incorporating digital technology in dental practice, resistance within the dental community discounts the application of technology to dental diagnosis and treatment monitoring (Reid and Greene, 2013; Greene, Klasser & Epstein, 2010; Greene, 2010a; Greene, 2010b). In the 21st century, this resistance is surprising, especially considering that there exists a myriad of evidence-based information, published studies, and extensive dental literature, that demonstrates the efficacy of various technologies for specific dental applications.

However, at closer inspection, some published literature that appeared in1969 proposed a psychosocial and stress-related theoretical epidemiology of what was termed "Myofascial Pain Dysfunction Syndrome" (MPDS), that to date, has long fueled the debate as to the need, or lack thereof, to employ measurement technology when diagnosing Temporomandibular Disorders (TMD) (Laskin, 1969; Greene, Lerman, Sutcher & Laskin, 1969; Laskin,1970). The promulgated biopsychosocial etiology minimizes the role that a breakdown of the masticatory structures plays in the appearance of Temporomandibular Disorder symptoms, thereby eliminating the need to measure physical and structural function. This stress-related epidemiologic theory was further perpetuated into the early 1990s, when the so-called "Research Diagnostic Criteria" was first postulated as a valid method to diagnose TMD (Dworkin and LeResche, 1992). The ongoing belief within the dental profession that TMD is caused by emotional stress, explains why some clinicians and authors still resist using any bio-physiological measurements in clinical diagnosis. The "biopsychosocial" theorists' rejection of virtually all physical diagnostic measurement is based in their (incorrect) assumption that TMD has no causative physical structural basis.

It is interesting to note that resistance to technology-aided TMD diagnosis is maintained philosophically, despite there being a complete lack of reproducible physical data to support these biopsychosocial theories. Alternatively, the dental literature does contain many studies that detail the benefits that technology offers to patients who present with Temporomandibular Disorders, some of which will be described within this chapter. While scientific honesty requires acknowledging conflicting or competing theories, that can be very difficult for some people to do.

Biophysiologic Measurements (BPM)

In some cases, BPM does require some interpretation (e.g. MRI images), which adds a degree of subjectivity. However, *Observation* is far less quantifiable. For example, there is no quantification obtained when stating, "you look sad and appear to have a rash", or asking "are you just too warm?" (Carr, 1994; Pollack & Panacek, 2000) While some observations can be objective (a visible missing tooth), much of what is observed is highly subjective (such as with muscle and joint palpation). Thus, BPM is the most objective and *Observation* is the least objective, but BPM can also potentially be physically intrusive (like when a patient is subjected to ionizing radiation). Self-report falls somewhere in between, being less quantifiable, less objective, but also somewhat less intrusive than BPM. The analysis of a patient's