Chapter 13
Comparison of Masticatory Function of Symptomatic Patients and Control Subjects

John Radke
Chairman, Bioresearch Associates Inc., USA

Ben A. Sutter
https://orcid.org/0000-0001-7869-4776
The Smile Institute Center for Aesthetic Dentistry, Eugene, USA

ABSTRACT

Mastication (chewing) is a frequently ignored aspect of occlusal function. Cosmetic factors have traditionally outweighed function because appearance is what patients are most aware of, and often request smile improvements. Although damaged teeth are routinely restored with crowns or replaced with implants, much less emphasis is placed upon evaluating a patient's functional improvements from any rendered occlusal therapy. The complexity of masticatory system has been confounding, defeating most efforts to sort out what is good mastication from poor mastication. Most chewing performance evaluations measured particle size changes from chewing, which are somewhat interesting but do not provide clinically relevant assessments of chewing muscular performance or chewing motion mechanics. Whereas the implementation of the biometrically derived normal average chewing pattern (ACP) and the normal average chewing cycle (ACC) establishes a clinically applicable baseline for evaluating masticatory function. The ACP reveals the average shape, timing, variability, and smoothness of an individual's chewing movements, while the ACC reveals the muscular hierarchy, any muscular variability, the presence within the chewing stroke of problematic occlusal contacts that induce muscular silent periods (SP), and the masseter and temporalis muscles' timing during the bolus crush. These measurements can then categorize chewing as Type I (normal movements with normal muscle activity), Type II (normal movements with dysfunctional or adapted muscle activity), and Type III (abnormal movements and dysfunctional or adapted muscle activity). Rarely is a Type IV mastication encountered (abnormal movements with normal muscle function), but it can also be observed. Therefore, the Specific Aims of this chapter are to describe the ACP and the ACC in detail, to illustrate examples of healthy Type I patients, well-adapted Type II patients, and compromised Type III patients, and to illustrate that measured mastication improvements can be an excellent outcome parameter following dental therapeutic interventions.

DOI: 10.4018/978-1-6684-9313-7.ch013

INTRODUCTION

To achieve optimal masticatory function, four components of the masticatory system must all be compatible, and be structurally and functionally sound.

1) The Temporomandibular Joints (TMJ),
2) The Muscles of Mastication
3) A Normal Dental Occlusion
4) A Normal Skeletal Maxillo-mandibular relationship (not necessarily Class I).

If the vertical dimension of the Maximum Intercuspal Position (MIP) is over-closed or distalized, and if during the closure-into MIP there is mandibular yaw, pitch, or roll the masticatory muscles can react negatively with pain and dysfunction. This is consistently true whenever the size of the vertical discrepancy or the aberrant maxillo-mandibular relation exceeds the adaptive range of the individual patient.

The dental profession does not hold function in high value. Part of that shortfall is the responsibility of dental school curriculums, with the remainderr falling prey to market demands. Patients face a myriad of advertisements for straighter and whiter teeth, but never for better chewing function. Medicine uses many different technologies to evaluate function such as blood panels, EEGs, EKGs, and rapid assay tests, among others, which all have normal values that can guide patient care. And, although Dental Medicine has different technologies that evaluate TMJ sounds, muscle physiology with surface EMGs, the Range of Motion kinematics, occlusal contact forces and timing, and many mastication parameters, presently these technologies are not mainstream (Pandey, Sattur, Kerstein, Radke, & Burde, 2021).

SECTION ONE: MEASURING MASTICATORY FUNCTION

Lepley et al., evaluated Masticatory performance using median chewed-up particle size as the primary indicator (Lepley, Throckmorton, Parker, & Buschang, 2010; Lepley, Throckmorton, Ceen & Buschang, 2011). In addition to chewing that created larger particle sizes, the authors noted poorer performers chewed significantly slower, with more variation thereby making a different chewing pattern shape than subjects who's chewing created smaller particle sizes. The authors subsequently concluded that considering all the factors present, occlusal factors were most closely related to masticatory performance.

Although particle size is a relevant parameter, it is messy calculating average particle size and impractical for clinically evaluating masticatory function. Various other methods used in the past include EMG activity (Rodrigues, Melchior, Magri & Mazzetto, 2015), the number of cycles required for mixing colored gum together (Hama, Kanazawa, Minakuchi, Uchida & Sasaki, 2014), the cycle time, and the Average Chewing Pattern shape (Kuwahara, Miyauchi & Maruyama, 1992).

In this last decade, the Nordic Orofacial Test has been recommended to assess masticatory function, and the effects that treatments may have had or not had on mastication (Bergendal, Bakke, McAllister, Sjögreen & Åsten, 2014). Using the Nordic Test, Rodrigues et al., found significant differences in every chewing parameter comparing normal and symptomatic subjects, but concluded that impaired mastication was not present within their symptomatic subjects (Rodrigues, Melchior, Magri, Mestriner & Mazzetto, 2015). It is difficult to imagine how the authors arrived at their conclusion of "no impairment in masticatory function," when every measured chewing parameter in the symptomatic group was negatively