Chapter IV

An Objective Registration Method for Mandible Alignment

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ABSTRACT

This chapter introduces a computer-controlled method for mandible alignment. The exact positioning of the mandible in relation to the maxilla is still one of the great daily challenges in restorative dentistry. Between 1980 and 1991 long-term animal experimentation series about the performance of jaw muscles as well as temporomandibular joints were made at the University of Leipzig, Germany. Until today other studies of similar scale or approach can not be found in international literature. Miniature pigs were exposed to stress under unilateral disturbance of occlusion. Based on that morphological, histochemical and biochemical processings and some other functions were then analyzed. The studies proved that masticatory muscles play a vital role in the positioning of the mandible. Combining these findings with knowledge about support pin registration and the influence of masticatory force on the results of this method a computer-controlled registration method was developed. With the DIR® System exists a final method of measurement which gives objective, reproducible and documentable results.

INTRODUCTION

The exact positioning of mandible is still one of the common challenges in restorative dentistry. There are many methods that are being taught when it comes to bite registration, and is frequently mentioned in international literature. Looking closer one discovers that truly objective guidelines for a reproducible methodology are missing. It is solely up to the manual and the individual varying skills of the dentist to determine the so called centric position. This situation reflects the fact that until now multiple definitions of the centric position can be found across different international publications. Sources in the past decades note the alignment of the temporomandibular joints (con-
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dyles) was referred on the correlation to the teeth row. Commendable works over the last years give a detailed overview over the manifold literature. The following brief compilation of attempts at a definition over the last hundred years are mainly based on the research of Von Schilcher (2004; referencing 409 international publications). The compilation covers all key stages of dentistry and within these stages illustrates the level of knowledge at a certain point in time. It does not lay to claim to be a source of completeness.

THE HISTORY

Early methods include Gysi (around 1900) referring to the “Gothic arch” and McCollumn (1921) adducting the hinge axis to determine the jaw relations. After this early period different definitions and ideas follow in ever accelerated successions. Jacobson, Sheppard et al. (1959) favor an intermediate (non-retral) position in which temporomandibular joints, teeth and muscles are in balance. Meanwhile Lauritzen et al. (1964) reclaims the terminal hinge axis. This continues 1966/67 (Mühlmann et al.), 1978 (Bauer et al.; Stuart), and 1986 (Gerber). In all cases all structural elements involved are being evaluated differently and the focus keeps shifting between temporomandibular joint and occlusion. In 1992 the Arbeitsgemeinschaft für Funktionsdiagnostik (AFG) (i.e. Working pool for function diagnostics) of the Deutsche Gesellschaft für Zahn-, Mund- und Kieferheilkunde (DGZMK) defines the condyles in centric position as “cranio-ventral, non-sideways shifted position of both condyles in physiological head-disc-positions as well as physiological load of the participating tissue”. In 2006 Türp took on a critical review of over 80 works across the international literature, resulting in a comprehensive article about bite registration. He explicitly considers the horizontal and vertical jaw relationships separately and concludes that today’s centric position is the desirable one. At the same time he realizes that “the problem within centric positioning of the condyles is not knowing in which exact position the condyle-head disc-complex is in relation to the temporal joint structures.” All together he states that there is not a commonly accepted method for the registration of the position of the jaws. The overwriting commonality in all these attempts of pinpointing a definition is the reoccurrence of the sagittal and transverse alignment of the mandible as a central focus. Much less insight is given about the objective facts of the third plane, the vertical axis. The bottom line being that under exact scientific aspects, the role of the musculature as well as the neural control are underrated.

BASIC RESEARCH OF THE OROFACIAL SYSTEM

In the early 1980’s Dr. med. Andreas Vogel initiated an investigation by a work group at the Poliklinik für Prothetische Stomatologie at the University of Leipzig (in cooperation with the Anatomic Institutes of the Universities of Leipzig und Rostock, especially noting Gert Horst Schumacher as well as the Institut für Sportmedizin of the Deutsche Hochschule für Körperkultur —DHfK -, also Leipzig, all Germany). To gain deeper insight into these complex processes the group focused on the behavior of certain masticatory muscles and tempromandibular joints structures in relation to the occlusal system. The results of these investigations, which lasted over ten years, were conducted under varying statements of task and can be summarized as following:

- Highest priority needs to be awarded to the neuromuscular component within the orofacial system.
- The efficiency (chewing) as well as the matters of sensitiveness (tactile perception and...