The Concept of a Shortened Dental Arch

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The principles of clinical decision-making are hardly ever exclusively based on scientific considerations. Traditional concepts and ways of thinking, never examined for logic and conclusiveness, also play a role. Therefore, clinicians tend to replace all lost occlusal units, including those in the molar region. This type of treatment planning is supported by the 1969 publication "Optimal occlusion," where Henry Beyron defined the determinants of a healthy dentition.[1] They included a "maximum number of bilateral centric stops"—a requirement that dominated dental treatment planning protocols for many decades.

This traditional type of treatment planning was challenged by Käyser's[2] classic paper "Shortened dental arches and oral function," which was published in 1981. His observations on 118 patients led to his proposing "that there is sufficient adaptive capacity to maintain oral function in shortened dental arches when at least four occlusal units are left" (Fig 1). The Käyser study was followed by many scientific studies dealing with the clinical characteristics of the shortened dental arch (SDA). The problem was investigated in epidemiologic as well as clinical and experimental trials. The most important examination parameters of these studies are presented and their significance described in greater detail using a few publications as examples.

Fig 1 An illustrative example of a shortened maxillary dental arch. This particular patient presented with stable occlusal conditions 25 years after the extraction of the molars.

Shortened Dental Arch—Definition

In the scientific literature, the definition of an SDA is not the same in all cases. The studies lay down different morphologic baseline conditions as criteria for inclusion in the respective trials. These differences must be carefully considered in the interpretation of the results. However, the definition used in the review by Armellini and von Fraunhofer[3] applies to most of the studies: "SDA may be defined as having an intact anterior region but a reduced number of occluding pairs of posterior teeth."

Chewing Ability

A shortened dental arch is not necessarily combined with reduced chewing ability. Most patients seem to complain about difficulties in mastication when no or only two pairs of occluding premolars are present. However, the situation changes completely when the premolar region is intact and the patient has at least one pair of occluding molars. In this case, complaints about impaired chewing ability are the exception.[4]

Occlusal Stability

In order to describe the occlusal stability of SDA cases, the following parameters were analyzed: interdental spacing, occlusal contacts of anterior teeth, overbite, occlusal tooth wear, and alveolar bone support. The cases studied showed more interdental spacing in the premolar region, more anterior teeth in occlusal contact, and less alveolar bone support. However, as these conditions remained constant during the period of observation, the conclusion drawn was that SDA can provide long-term stability.[5]

Temporomandibular Disorder Problems

Extensive epidemiologic studies did not detect any evidence indicating that SDAs provoke signs and symptoms associated with temporomandibular disorder. However, the risk of joint pain and sounds increases if the complete posterior support has been lost unilaterally or bilaterally.[6]

Prosthodontic Interventions

Studies on the efficiency of prosthetic therapy challenge treatment concepts aimed at replacing posterior teeth. One study that compared interview data of patients with and without dental restorations concluded that "there appears to be little sociofunctional need to replace lost posterior teeth with a removable partial

denture until the person has fewer than three posterior functional units."[7] It must, however, also be emphasized that esthetic concerns play a role in seeking treatment and resisting the functional implications of an SDA. The subjective role played in patients' motivation to seek treatment remains complex and often misunderstood. Numerous health care disciplines, including prosthodontics, are confronted with patients' needs to feel good about their appearance, with a visible display of missing molars regarded as unacceptable.

Consequences

The scientific findings made in SDA patients have led to the concept of a shortened dental arch. This concept includes both a diagnostic and a therapeutic challenge. Since the requirements of a functional dentition can also be met with a shortened dental arch, the reasons for treating SDA patients have to be provided in each individual case. Priority should be given to maintaining and replacing the strategically important parts of the dental arch—the anterior and premolar regions. However, since the functional requirements may vary considerably from one patient to the next, the therapy in each case should be adjusted to the individual conditions of the patient and to the patient's needs and ability to adapt. Moreover, a patient's esthetic concerns regarding dental appearance may play a significant role in determining the merits of an SDA mind-set in finalizing a treatment plan.

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Osteoarthrosis/Osteoathritis in the Temporomandibular Joints

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Temporomandibular disorders (TMDs) can be categorized into three groups: muscle disorders, internal derangements, and degenerative diseases. Historically, the latter have been overlooked as a structural basis for TMD.

Table 1 Prevalence of OA in TMJs

Method of evaluation	Prevalence (%)
Clinical	8–18
Radiologic	14–44
Macro/Microscopic (from autopsy)	22–84

Osteoarthrosis is a noninflammatory disease characterized by a pattern of reaction of the joints to injury. Deterioration and abrasion of articular cartilage and soft tissue surfaces, thickening and remodeling of the underlying bone, and formation of marginal spurs and subarticular cysts can be observed. These changes are very common in elderly patients, but are often asymptomatic.

Patients may become symptomatic and severely disabled when osteoarthrosis is associated with synovitis. Secondary inflammatory changes resulting from tissue damage in the joint may play a role in producing pain. The term osteoarthritis best describes this secondary inflammatory arthropathy.

Prevalence

Osteoarthrosis/osteoarthritis (OA) is the most common degenerative disease of temporomandibular joints (TMJs); however, the prevalence is difficult to establish since there is a lack of concordance between structural changes and pain. The method of examination is a significant factor in determining the prevalence of OA (Table 1 and Fig 1). OA is strongly correlated with age, and occurs more often and is more generalized in women than in men.