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Worn is born: The role of the maxillo-mandibular relation in management of worn dentition

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ABSTRACT

Worn dentition, often accompanied by occlusion changes such as reduced vertical dimension, poses a big challenge to both diagnosis and treatment. Current established causes fail to explain the observed tooth wearing patterns, and the treatments based on the documented pathogeneses are often unpredictable and require frequent maintenance. From the perspective of stomatognathic system, we postulate that the role of maxillo-mandibular relation is a crucial part in the tooth wear progression patterns, and should be well addressed in treatment planning. Incompatible occlusion with the inherent tendency of maxillo-mandibular relation has a profound effect on either wearing of natural teeth or failures of restorations. With the aid of cephalometrics and analysis of occlusion it is now possible to reduce this fallacy and achieve a harmony by re-designing the occlusion. According to our treated worn dentition cases, the restoring treatment guided by the tendency of maxillo-mandibular relation showed very promising results.

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Background

Worn dentition is a result of non-carious tooth wearing with substantial dental tissues loss involving a group of teeth or the full arch. It is often accompanied by profound occlusal changes, including but not limited to reduced vertical dimension, shortened maxillary anterior teeth, changed occlusal plane, and mesial shift of posterior teeth [1–3]. These changes lead to compromised aesthetics, masticatory malfunctions, or even muscle tenderness and joint pain [1,4]. Patients suffering from worn dentition were estimated to be around 3% in the population; and the rate demonstrated an increasing trend at a younger age in recent years [4–6].

The only viable treatment for worn dentitions in adults is full-arch occlusal rehabilitation, either by adhesive restorations or by conventional full-crowns [7–9]. However, it seems that the restored dentitions are facing the same wearing challenge just as the natural ones they meant to replace. Fractures, debonding, and porcelain chipping become major concerns during the first few years of use; protective splints and frequent maintenance are prescribed owing to the unpredictability of the treatment [7,8]. The lost dental substances seemed to be the only target of these proposed treatment options, and little regard was given to a comprehensive consideration of the stomatognathic system. In several systematic reviews on worn dentition (or so-called severe tooth wear), mandible position was ignored when planning oral rehabilitation, and one occlusion design was chosen for all types of patients [8,10–12].

Current established pathogeneses for worn dentition fall into two categories: mechanical and chemical [13]. Several terms have been adopted by dental community to describe them: attrition (physical wearing away by tooth-to-tooth contact), erosion (chemical destruction of tooth structures by acidic substrates), and abrasion (physical wear of tooth surfaces involving a foreign body) [1]. For each term, specific causes are identified, like nocturnal bruxism accounts for dental attrition, internal regurgitation and copious consumption of acidic drinks account for dental erosion [1,4,14]. One author attributed the current increase trend of tooth wear to the increasing consuming of acidic drinks worldwide [4]. Indeed, the worn dentition is usually a result of combination of mechanical and chemical processes [1]. Anthropological findings have revealed that tooth wear existed early on in human evolution, and dentitions in ancient skulls were evenly worn down to edge-to-edge relation at a younger age. Mechanical wearing by coarse food is

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taken as the main cause [15,16]. Considering the accepted causes for modern worn dentition, an evenly wearing down in a similar way should also be expected. However, the clinical findings are just contradicted to this assumption, suggesting that important factors might be overlooked.

The worn dentition often shows, with a higher occurrence, regional wearing patterns other than being even. In some cases, the mandibular anterior teeth were shortened to gingival level while the occlusal surfaces of posterior teeth were only slightly flattened. In other cases, anatomical features of posterior teeth were rotten away whereas the anterior teeth seemed to be intact. One author tried to explain the difference with well accepted causes [17]. According to his reasoning anterior teeth would undergo severe attrition with inadequate or unstable posterior support, which is against the clinical observations [18]. And his argument that evenly erosion of posterior teeth was due to chewing the pulp of citrus fruit is no more than a personal speculation with a poor logic [17]. Therefore, direct causes that lead to dental substances loss are inadequate to explain the different tooth wear progressions between regions within one dentition, and an unknown pathogenesis may underlie these clinical phenomena.

Hypothesis

We postulate that the role of maxillo-mandibular relation is a crucial part in the tooth wear progressions. A total of 95 worn dentition patients (28–55 years old, averaged at 41.5) visited our department during 2013–2016, all of which were in good healthy condition without untreated systematic diseases. A correlation of interest was observed: patients with a neutral maxillo-mandibular relation (skeletal class I) showed a uniform wearing down from anterior teeth to posterior ones; patients with the mandible distal to the maxilla (skeletal class II) usually had greater wearing on posterior teeth than on anterior ones; patients with the mandible mesial to the maxilla (skeletal class III) usually had greater wearing on anterior teeth than on posterior ones (Fig. 1). Another observation of interest was also noted: after deprogramming masticatory muscles most patients had a different mandible position. Here, the maxillo-mandibular relation seems to show an inherent developmental tendency, which is independent of the occlusion established. The discrepancy between the new relation and the previous one (as determined by occlusion) indicates the incompatibility of occlusion with the tendency of maxillo-mandibular relation in worn dentition patients. Importantly, this incompatibility may result in an unbalanced stress distribution on the teeth, which could finally produce the uneven regional tooth wearing. The worn dentition may be more like a congenitally compromised and ontogenetically compensated result of the stomatognathic system, in which the maxillo-mandibular relation tends to follow its own tendency so as to eliminate the imbalance.

The occlusion design in rehabilitation of worn dentition should then comply with the tendency of maxillo-mandibular relation. In our clinical department, we adopted the condyle center's distance to plane of occlusion (DPO) measured in cephalometrics to facilitate the design. A short DPO, usually accompanied by a distal relation tendency of mandible to maxilla (class II), indicates a steep inclination of occlusal plane and a higher possibility of posterior premature contact. In this situation, group function, instead of canine guidance should be fit for these patients (Fig. 1A and B). On the contrary, a long DPO with a mesial relation tendency of mandible to maxilla (class III) means a gentle inclination of occlusal plane and a higher possibility of anterior premature contact, for which canine guidance is a more appropriate design (Fig. 1C and D). As for patients with a normal DPO and neutral relation tendency of mandible to maxilla (class I), canine guidance with sequential separation should be chosen (Fig. 1E and F).

Evaluation of hypothesis

The most suitable subjects for evaluation of the hypothesis are the patients with dentitions that are severely and unevenly worn, and free of orthodontic history. As stated, these patients often have an incompatible occlusion with maxillo-mandibular relation tendency. To address this discrepancy, comprehensive occlusion anal-

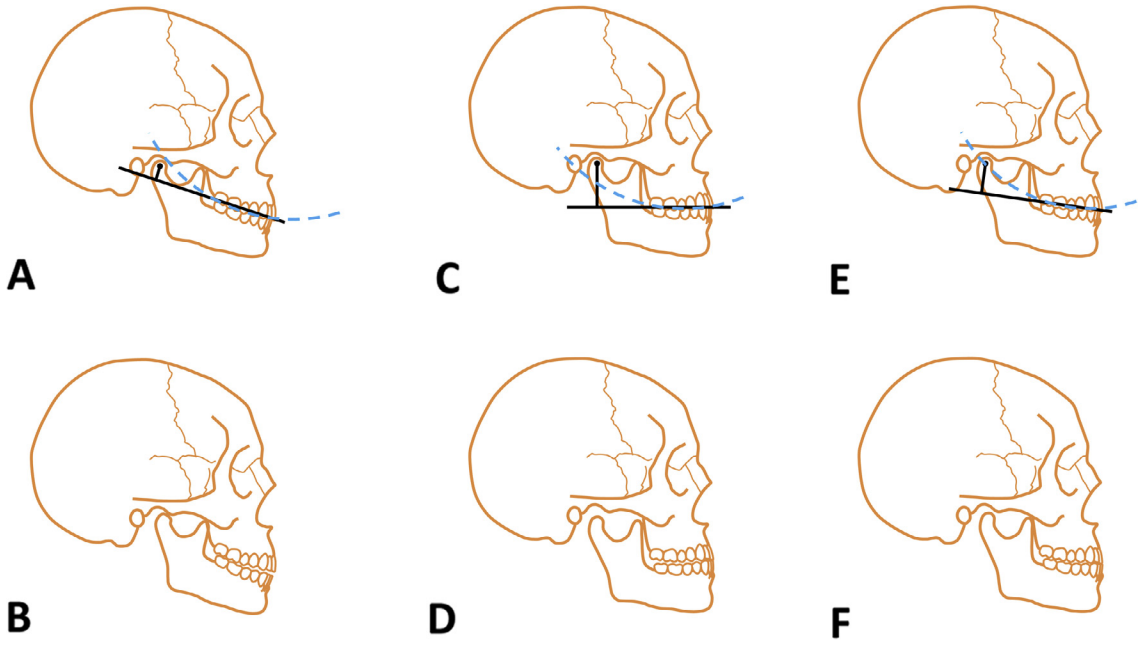

Fig. 1. Different tooth wear progression patterns. The occlusal plane, Spee curve, and condyle center's distance to plane of occlusion (DPO) are presented in panel A, C, and E. The contacts in panel B, D, and F indicate the location where tooth wear mainly progresses.

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