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Integration of Craniofacial Biology to Find Creative Solutions in Clinical Cases: Is the 'Biology' Ready for Translation?

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Dentoalveolar area harbors various dental stem cells including periodontal ligament stem cells (PDLSCs), dental follicle precursor cells (DFPCs) and stem cells from apical papilla (SCAP)[1]. The suture and periosteum are also considered as sources for highly potent mesenchymal cells[2]. Mechanical stimulus facilitates the proliferation and differentiation of those immature cells, leading to formation of bone, tooth and pulps[3,4]. In spite of the extensive research on the fundamental biology, its clinical application has been scarce particularly in orthodontic field, due to the bioethical reasons etc[5,6]. The discontinuity between the 'bench' and the 'clinic' may make clinicians believe that the research in biology remains impractical, and thus a radical question may arise: has the craniofacial biology ever been translated into clinical practice? Nonetheless, it has to be remembered that any therapeutics in dentistry, including the orthodontic treatment, is a procedure where numerous stems cells are manipulated with or without the knowledge of the operator. It is conceivable that the understanding on the biology would provide creative solutions in clinical practice. In this editorial, some clinical examples indicating the power of understanding on the biology will be demonstrated particularly in the orthodontic field.

Orthodontic tooth movement and tooth eruption are commonly mediated by the fibrous tissue intervening the tooth and the alveolar bone[7]. Additionally, eruptive tooth movement is facilitated by active root formation by potent apical papillary stem cell groups[1]. In particular, in cases of complicated impactions exhibiting complex three-dimensional relationship among the tooth germs, such as transposition and horizontal impaction, conventional surgical opening may not be applicable due to the limited access and treatment timing may be an issue. Considering the possible time- and stage- specific host regulation of the apical stem cells and periodontal ligament cells[8,9], simple delay may not resolve the situation and may even worsen the pathology such as resorption of adjacent teeth[10,11]. Instead, an early

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relocation of the impacted tooth may be justifiable for the facilitation of root development. Case 1 (Fig. 1) is an 8-year-old boy with transposed impaction of the upper left canine and 1st premolar. Direct access to the canine was impossible and the 1st premolar root development was minimal. Since an adverse effect of canine follicle on the root apex of the 1t premolar was anticipated, an early surgical intervention was conducted for forced eruption of the impacted tooth. After 9 months, the 1st premolar was relocated and the eruption path for the canine was secured (Fig. 1D).

Differentiation of suture and/or periosteal cells is crucial for 'beyond-the-alveolar-bone' tooth movement, such as lateral displacement of posterior segment for the correction of narrow maxillary arch. Is it known that remarkable proportion of adult patients possess transverse problems which demands surgically-assisted maxillary expansion, due to the conventional perception that the midpalatal suture is fused at around 15 years of age[12,13]. In contrast, recent researches revealed that the facial sutures, unlike the calvarial sutures, tend to remain patent throughout the adulthood[14,15]. The osteogenic activity of the suture cells has also been extensively investigated[16]. Accordingly, a miniscrew-assisted palatal expander was devised to facilitate transverse correction in adults[17]. The clinical outcome and stability have also been reported as reliable[18]. Related to the basic and clinical studies, Case 2 (Fig. 2) demonstrates a non-surgical expansion in a 42-year-old female who had generalized open bite and relatively narrow maxilla. Semirapid expansion protocol of 1 turn a day was observed. Separation of midplalatal suture

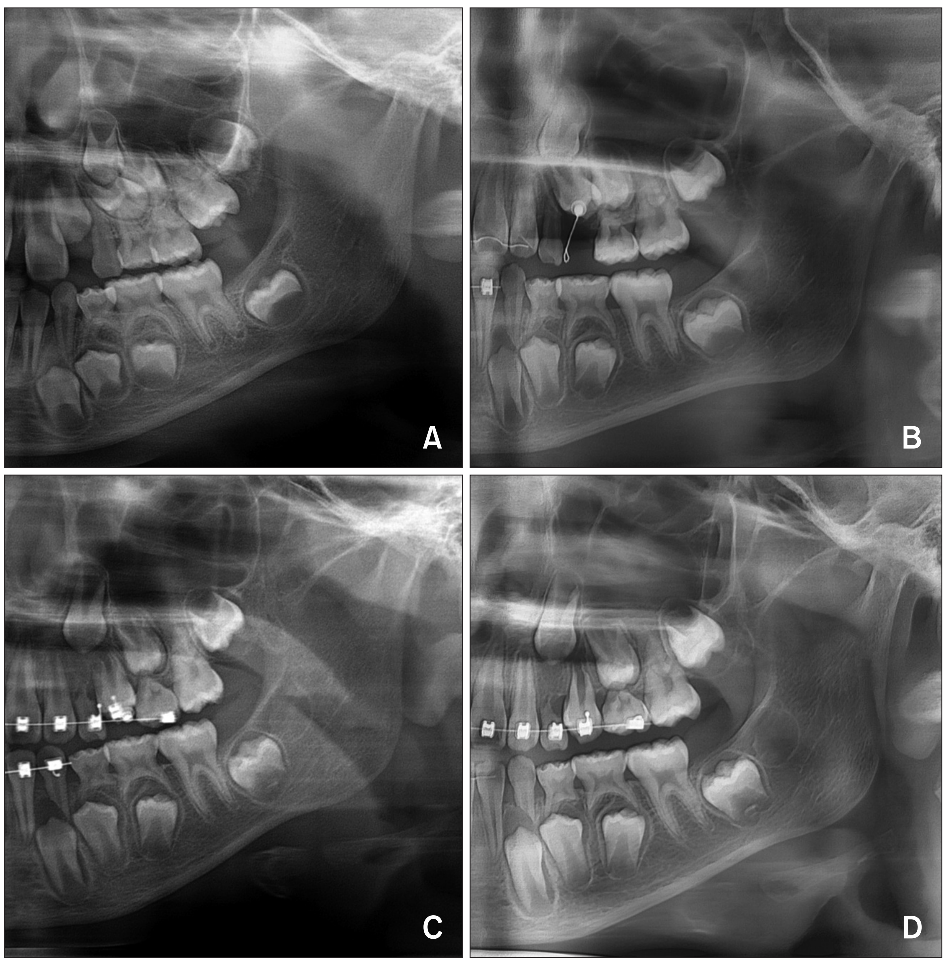

Fig. 1. An 8-year-old boy with complicated transposed impaction of canine and 1st premolar. (A) Initial panoramic view. (B) Forced eruption of 1st premolar with immature root. (C) During forced eruption. (D) Relocated 1st premolar showing root development.

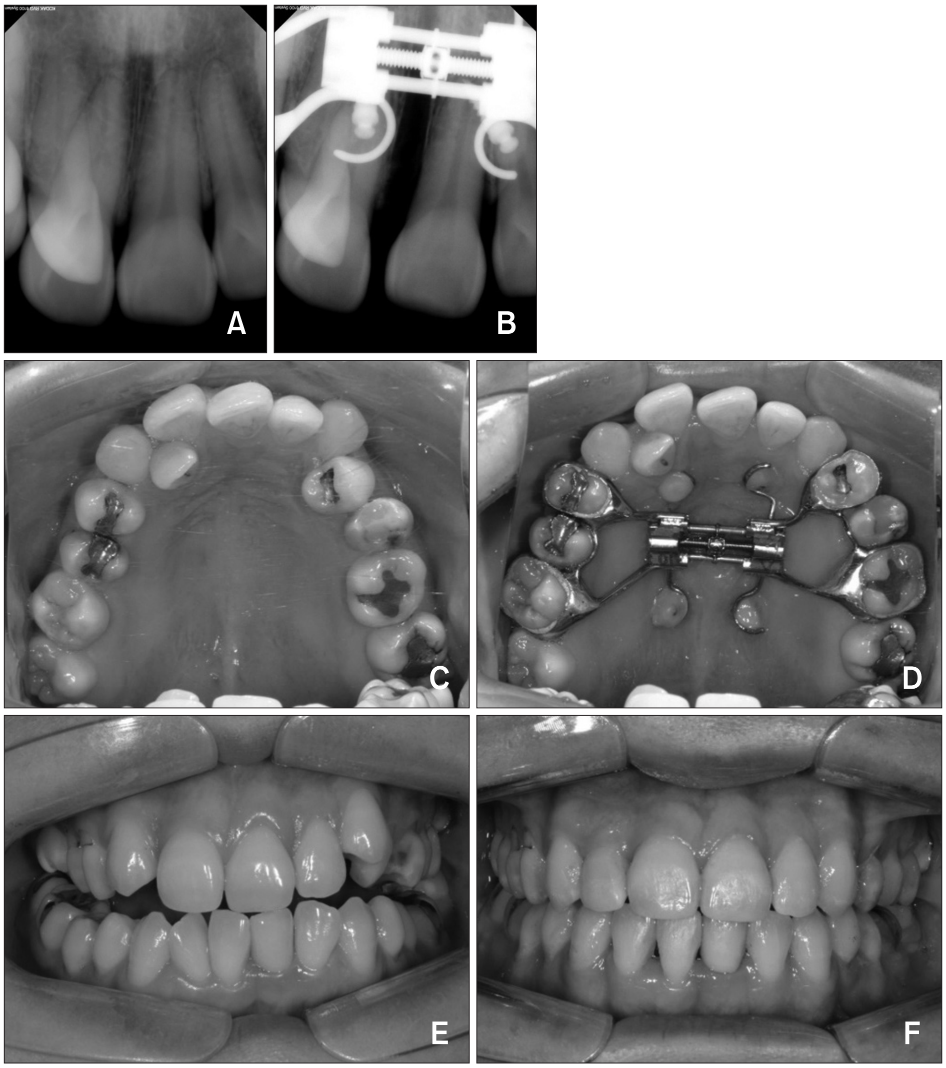

Fig. 2. A 42-year-old female patient with maxillary constriction and generalized lateral open bite. (A) Initial periapical view. (B) Periapical view after nonsurgical maxillary expansion. (C) Initial occlusal view. (D) Occlusal view after maxillary expansion. (E) Initial intraoral view. (F) Final intraoral view.

was confirmed from the periapical view before and after expansion (Fig. 2A~D). Subsequent orthodontic alignment and orthodontic settling followed (Fig. 2E, F). Latest clinical research also revealed clinically acceptable stability of the expansion in adults.

Above clinical examples indicate that the information on craniofacial biology can be translated to clinical cases, based on sound understanding on the research outcomes. Since research works in the biomedical area would eventually aim to benefit the human patients, close collaboration between the researchers and clinicians are utmost important.

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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