EDITOR's OPINION

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Practical utility of the three-dimensional approach in orthognathic surgery

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During recent decades, the three-dimensional (3D) approach in orthognathic surgery were introduced and adopted in clinical practice, providing practical advantages to orthognathic surgeons. Even when the 3D approach is assessed based on the current state of technological development, it has advantages in orthognathic surgery and has become an essential method. It is not sure what to come next in the development of the 3D approaches, It is clear that the 3D approach represents a milestone in the development of orthognathic surgery.

Key words: Orthognathic surgery, Three-dimensional approach, 3D-printed wafer, Practical utility

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Knowledge of the history of orthognathic surgery is key to understanding the practical utility of the three-dimensional (3D) approach because this surgery has changed much over a relatively short time period. The history of orthognathic surgery can be divided into development, popularization, digital, and 3D phases. Orthognathic surgery was introduced by Trauner and Obwegeser[1] in 1957, and has since been modified by many surgeons such as Dal Pont[2] and Hunsuck[3] to produce the current standardized surgical procedures. However, orthognathic surgery was not performed actively until the 1980s, which marked the end of the developmental period. The popularization phase started in the 1980s, when orthognathic surgery became popular worldwide, and surgeons planned treatment based on film analysis and paper surgery. Facial photographs, cephalometric X-ray images, face-bow, and bite registrations were used to analyze each case. The surgical wafers were made through a conventional laboratory process. Just after the turn of the millennium, X-ray images were digitized, and film analysis was conducted using software. The digitized period involved intensive research. During recent decades, 3D simulation, 3D-printed surgical wafers, 3D-printed metal plates, and sawing guides were introduced and adopted in clinical practice, providing practical advantages to orthognathic surgeons.

First, this approach saves time, as it shortens the time for preoperative preparation, analysis, planning, and wafer fabrication. Park et al.[4] reported that the mean preoperative preparation time showed a 54.2% reduction with the 3D approach compared to the conventional approach. Wafer fabrication showed a 76.7% reduction in time for the 3D approach compared to the conventional approach. Ultimately, the total time required for the 3D approach was 62.8% less than that of the conventional approach. The authors reported that costs were similar for the conventional and 3D approaches. Thus, this study shows that the 3D approach is advantageous in terms of time at similar cost, and this advantage is almost certain to become more pronounced given further technologic developments.

Second, the 3D approach enables precise planning of symmetry, especially in asymmetric patients, and simplifies set up of the midline of upper incisors, chin midline, amount of yaw correction, and symmetric body contour. In asymmetric patients, the etiology of the asymmetry and the diagnosis must be made accordingly to obtain satisfactory surgical results. Even with accurate diagnosis, the conventional approach limits its precise confirmation of asymmetric measures. However,

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3D analysis precisely measured each cephalometric point, such as maxillary yaw and mandibular body asymmetry, to allow better surgical planning.

Third, the 3D approach allows prediction of the amount of bony interference between proximal and distal segments, which can occur after mandible sagittal splitting. Furthermore, this can make surgery easier and more predictable and eventually prevent early skeletal relapse and temporomandibular joint disorders. In addition, the location of the inferior alveolar nerve, which is the most common iatrogenic cause of paresthesia after orthognathic surgery, can be identified accurately and preserved during surgery.

Fourth, the 3D approach can be used to determine the causes of postoperative complications. For example, in patients with large skeletal relapse after orthognathic surgery, the direct cause can be identified by postoperative 3D analysis. In addition, it can be determined whether the problem is caused by condylar positioning, segmental fixation, or occlusal set-up.

The 3D approach can reduce differences between the surgical results achieved by experienced and non-experienced surgeons. Non-experienced surgeons not only require longer operating times, but also tend to less accurately adhere to surgical plans. However, these differences are almost eliminated when using a sawing guide and a 3D-printed metal plate[5].

Accordingly, even when the 3D approach is assessed based on the current state of technological development, it has advantages in orthognathic surgery and has become an essential method.

It is not sure what to come next in the development of the 3D approaches, It is clear that the 3D approach represents a milestone in the development of orthognathic surgery, and artificial intelligence (AI) is set to play important roles. Although still in the research process, 3D programs based on AI are being developed for 3D analysis and surgical planning, and patients soon will be provided more accurate and faster diagnosis[6].

Conflict of Interest

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

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