Space management in adults using CAD/CAM aligners—Three case reports

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Using CAD/CAM technology to produce a series of clear plastic overlays is an aesthetically agreeable solution for space management. Initially, the use of aligners was restricted to treating minor orthodontic cases only, but the improvement in aligner manufacturing in the last five years has allowed us to use aligners in a variety of malocclusion situations today.

Recently, successful outcomes have been reported with aligner treatment for more complex malocclusion. In the following article, I present three such cases from my private practice.

Case I: Space adjustment after extraction for implant placement

Diagnosis

This case was referred to me by a colleague. The main requirement of my colleague and his patient was space adjustment.

Clinical examination revealed a space of 3 mm between the lower right lateral incisor and the lower right canine; a suspended bridge consisting of an abutment over the lower right second molar; a pontic for the lower first right molar, which was very small in size; and an occlusal rest on the second lower right premolar (Fig. 1).

Treatment objectives

Our objective was to close the spaces in the lower arch except the space of the missing lower right first molar, which would be increased. In planning the treatment, CAD/CAM technology was utilised (Fig. 2).

Treatment plan

The treatment plan was to remove the old bridge and move the lower right canine, first pre-
molar and second premolar mesially to close the anterior space. This would open up enough space to replace the missing lower right molar with an implant.

Treatment progress

The patient used 19 aligners for two weeks each. The entire treatment time was nine months and two weeks. The movements achieved are shown in Table I.

Results

Upon final treatment, the anterior spaces had been completely closed and space had been created to replace the missing lower right first molar with an implant (Fig. 3).

Case II: Space management for a congenitally missing tooth

Diagnosis

A 32-year-old male patient reported to my clinic with spaces between his upper teeth and forwardly placed incisors.

The patient was diagnosed with a Class I malocclusion with a missing upper right lateral incisor, spacing in the upper arch, proclined upper and lower incisors, a midline shift owing to deviation of the upper midline 1 mm to the right side, and higher upper labial frenum attachment (Fig. 4).

Treatment objectives

The treatment objectives were:
1. maintenance of the Class I molar and canine relationship;
2. creation of adequate space for the missing upper right lateral incisor;
3. closure of any other spaces in the upper arch;
4. midline correction; and
5. retroclination of the upper and lower incisors.

Table II: Teeth movement records for case 2.
We decided to use aligners for both upper and lower arches to manage the upper arch spaces and to retrocline both upper and lower incisors. The treatment plan was accomplished using CAD/CAM technology (Fig. 5).

Treatment progress
The treatment progress was recorded every month as shown in Figure 6. During the first month, the upper right central incisor was moved mesially. In the second, third and fourth months, more mesial movement of the upper right central incisor occurred, as well as retraction of both upper and lower incisors. In the fifth month, correction of the midline shift was achieved and a frenectomy was performed. Finishing and final detailing was achieved in the last month. After finishing the treatment, upper and lower clear retainers were prepared and a pontic of composite was added at the space of the missing lateral incisor.

Overall treatment time with aligners lasted for six months and two weeks for the upper arch and four months and two weeks for the lower arch. The movements achieved with each aligner are shown in Table II.

Results
Facial and intra-oral photographs (Figs. 7a–h) show midline correction, closed upper spaces (except the space of the missing upper right lateral) and decreased upper and lower proclination.

Case III: Generalised spacing and protrusion
Diagnosis
A 44-year-old female patient presented with complaints about protrusion and spaces between her upper teeth. She had no complaints with regard to her lower arch. All upper incisors were covered with crowns.

She was diagnosed with a Class I malocclusion with proclined and spaced upper incisors, lower arch crowding and 1 mm overjet (Figs. 8a–e).

Treatment objectives
The treatment objectives were to close the upper spaces and retract the upper incisors. Therefore, the lower teeth had to be moved back to allow upper teeth movement.
Treatment plan

All upper incisors were covered with crowns. The patient was satisfied with these crowns with regard to their shade, size and shape. In such cases, three treatment options are available:

1. new crowns for the upper anterior teeth;
2. conventional braces, which would lead to two problems: risk of frequent bracket bonding failure and scratching of the labial crown surfaces; and
3. aligners.

By using aligners, neither did the crowns need to be changed nor did we face problems generally associated with brackets. Using CAD/CAM technology, Figure 9 shows the initial situation and the expected outcome.

Treatment progress

As shown in Table III, the first phase of treatment focused on levelling and aligning the teeth in both upper and lower arches. Thereafter, intrusive and extrusive forces were applied to level the lower incisors followed by the retraction of the teeth by lingual tipping. The entire treatment time lasted less than five months using only nine aligners.

Results

As shown in Figures 10a–e, all the spaces were closed in the upper arch, the lower arch crowding was relieved, and both upper and lower incisors were retracted.

Discussion

Although space management in adults can be done using prosthetic appliances alone, cooperation with an orthodontist in such situations can lead to better aesthetic results, especially when teeth are moved using aligners, an almost invisible treatment option. Patient cooperation is the critical factor in achieving a successful aligner treatment. Aligners should be worn for at least 20 hours per day, seven days a week.

The overall hygiene maintenance and the level of clinical finish achieved are of satisfactory quality. The acceptance of this treatment modality is far higher compared with conventional orthodontics.

Conclusion

Space management in the dental arch in adult patients, which can be caused by different factors such as extracted teeth, congenitally missing teeth or generalised spacing, should be approached with a team including an orthodontist. Aligners have the advantage of being an invisible appliance, offering better oral hygiene and patient acceptance as compared with fixed orthodontics.

Editorial note: A complete list of references is available from the publisher.

Table III. Teeth movement records for case 3.

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