A digital method of teaching artificial teeth arrangement

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NYU College of Dentistry suspended all clinical and pre-clinical activity on March 13, 2020 due to the COVID-19 pandemic. This closure necessitated continuation of teaching remotely.

1 | PROBLEM

In the absence of a dental laboratory, artificial teeth arrangement for a complete denture course in the second year of dental school needed to be taught in an alternative manner, while considering students in different time zones.

2 | SOLUTION

DENTCA CAD/CAM Denture Company (Torrance, CA) offers 2 Web-based platforms: (1) Dentca Academy, which has a selection of exercises for students to practice complete denture teeth arrangement, and (2) Dentca Design, which is an automated teeth arrangement software program using uploaded patient digital information for fabrication of complete dentures.

To establish a progressive digital learning module on teeth arrangement, 5 exercises were designed specifically by NYU faculty, varying in complexity and ultimately reaching the same goals and objectives of traditional wax teeth arrangement (Table 1). The first digital exercise teaches basic skills of digital manipulation (Figure 1). Starting with a half-completed maxillary arch, the student places the denture teeth to mirror the opposite side. Exercises increase in complexity and skill ending with a full maxillary and mandibular artificial teeth arrangement.

To create these exercises, the actual articulated stone models (simulated patient) were scanned with markers for digital orientation and then uploaded into Dentca Design (Figure 2). Modifications for each exercise were made before transferring the exercise into the Dentca Academy platform, which does not require any software installation or purchase by students. This platform allows students to work independently and have unlimited practice of artificial teeth arrangements, while accommodating students in different time zones. A student’s work is automatically graded by comparing to the established ideal arrangement. This automated grading provides a standardized and efficient measure, which is of special importance in a large class size, and during remote instruction. A 1-hour orientation lecture was given to both students and faculty prior to their use of Dentca Academy.

3 | RESULTS

Digital teeth arrangement is a viable alternative to teach students key parameters in artificial teeth arrangement in complete dentures. With many students living in geographical isolation in different time zones, the lessons can be done at the students’ convenience, asynchronously.

Another valuable aspect of Dentca Academy is that since grading on position and rotation is automatic, the subjective nature of the human element in grading is eliminated.

The creation and availability of this customized digital teeth arrangement also helps with faculty standardization, as well as with the ability to simultaneously teach traditional teeth arrangement and digital teeth arrangement upon return to live teaching. If the social distancing and group-size limitations continue upon return, 1 group of students can be taught the skills digitally, while another group can experience the traditional teeth arrangement with wax; subsequently, the groups can switch, observing the group-size limitations.
TABLE 1  Five digital exercises are designed to increase in complexity and enhance progressive learning from least complex (1) to the most complex (5)

| NYU exercise | Description | Goals and objectives of the exercise is to learn and practice |
|--------------|-------------|------------------------------------------------------------|
| 1            | Students set maxillary right side (#2-8) teeth. 1/2 maxillary arch exercise | Basic skills of digital manipulation  
Duplicating details of symmetry  
Anterior teeth alignment and limited posterior occlusion |
| 2            | Maxillary anterior teeth only (#6-11) | Establishment of a midline  
Axial inclination of maxillary anterior teeth  
Appropriate anterior-posterior relationship of these teeth relative to key anatomical landmarks (incisive papilla)  
Maxillary anterior complete denture occlusion |
| 3            | Maxillary and mandibular anterior teeth (#6-11 and #22-27) | Establishment of a mid-line  
Axial inclination of maxillary and mandibular anterior teeth  
Appropriate anterior-posterior relationship of these teeth relative to key anatomical landmarks (incisive papilla and mandibular anterior ridge)  
Maxillary anterior teeth complete denture occlusion  
Appropriate vertical and horizontal overlap of the anterior teeth in complete denture occlusion |
| 4            | Full maxillary arch | Those listed in (2)  
Establishing posterior teeth arrangement for optimal occlusion and relative to a given mandibular plane |
| 5            | Full maxillary and mandibular arches | To establish a viable plane of occlusion  
Understand spatial orientation of arches  
Use knowledge and skills gained in exercises (1) to (4)  
Design a clinically acceptable artificial teeth arrangement for a maxillary and a mandibular edentulous arch using appropriate anatomic parameters for anterior and posterior teeth |

FIGURE 1  First exercise: All teeth are in place except for the maxillary right side. The student places the denture teeth to mirror the opposite side

In order to maintain an outcome driven curriculum, a Pilot assessment of the platform was performed with 9 second-year dental students, who had experienced a traditional wax-up, and 10 faculty volunteers. The level of satisfaction on the “ease of navigation” on a scale of 1 (least satisfactory) to 5 (most satisfactory) was 4.21 (mean). The overall level of satisfaction with the exercises received a mean score of 3.95. These exercises are now publicly available for schools sharing the same curriculum goals.
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