Abstract

Objective: To provide precise measurements that enhance knowledge of mandibular anatomy and to introduce a modified osteotomy for genial advancement surgery in obstructive sleep apnea (OSA) patients.

Study Design: Cone-beam computed tomography (CBCT) analysis.

Methods: CBCT measurements of positions of mental foramina, canines, lateral incisors, central incisors, and genial tubercules in 33 individuals.

Results: Mean horizontal distances from midline to mental foramen and the roots of the canine, lateral incisor, and central incisor were 22.11 ± 1.52 mm, 13.56 ± 3.01 mm, 6.19 ± 1.58 mm, and 2.04 ± 0.87 mm, respectively. Mean vertical distances from the inferior border of the mandible were 15.15 ± 1.77 mm, 17.11 ± 3.28 mm, 20.48 ± 3.10 mm, and 21.81 ± 3.49 mm, respectively. Combined distances from the mandibular midline to MF, C, Li, and CI were 22.11 ± 1.92 mm, 13.56 ± 3.01 mm, 6.19 ± 1.58 mm, and 2.04 ± 0.87 mm, respectively. Individual data points are presented in Table 1. The mean slope from all data points on the right (MF-C-Li-CI) was 0.34 ± 0.17, compared to 0.32 ± 0.15 on the left (p=0.614). This yielded an angle of inclination of 18.14 ± 8.44 degrees on the right, and 17.65 ± 7.60 degrees on the left (p=0.805). The y-intercept of the right MF-C-Li-CI line, representing the midline, was 22.60 ± 3.81 mm, compared to 22.30 ± 3.61 mm on the left (p=.074). Parallel lines placed 2.5, 5, 7.5, and 10 mm below the best fit line of the mean revealed the location of tooth roots, MF, and genial tubercle in relation to each proposed osteotomy (Table 1).

Conclusion: Our proposed osteotomy design achieves a safe, effective, and aesthetically pleasing surgical result for patients with OSA. Preoperative CBCT measurements may aid in the design of an individualized osteotomy that maximizes capture of the mandibular musculature and protection of nearby structures.

Introduction

Surgical advancement of the mandible has proven to decrease the severity of obstructive sleep apnea (OSA).1,2 Several osteotomies, including rectangle,3 circular,4 and mortised5 designs, have been proposed. Most genial advancement procedures target only the genioglossus, which originates from the superior genial tubercle of the mandible. However, advancement of two other anteriorly attached mandibular muscles, the geniohyoid and digastric, may provide additional benefit to OSA patients. We present a modified osteotomy design based on the anatomic structures and relationships of the anterior mandible, which include the genial tubercle, mental foramen, and central incisor, lateral incisor, and canine tooth roots.

Methods and Materials

Cone-beam computed tomography (CBCT) of 33 individuals was used in order to obtain the following bilateral measurements: mental foramen (MF), MF to mandibular midline, canine tooth root (C) to IBM, C to midline, lateral incisor tooth root (LI) to IBM, UI to midline, central incisor tooth root (CI) to IBM, CI to midline, and superior- and inferiormost aspects of the genial tubercle to IBM. These data points were used to determine the slope, which was used to calculate the angle of incline via the inverse tangent. Best fit lines were used to calculate the y-intercept. Parallel lines placed 2.5, 5, 7.5, and 10 mm below the best fit line were created to imitate potential osteotomy placement.

Results

Combined (both left and right) mean distances from IBM to MF, C, Li, and CI were 15.15 ± 1.77 mm, 17.11 ± 3.28 mm, 20.48 ± 3.10 mm, and 21.81 ± 3.49 mm, respectively. Combined distances from the mandibular midline to MF, C, Li, and CI were 22.11 ± 1.92 mm, 13.56 ± 3.01 mm, 6.19 ± 1.58 mm, and 2.04 ± 0.87 mm, respectively. Individual data points are presented in Figure 1. The mean slope from all data points on the right (MF-C-Li-CI) was 0.34 ± 0.17, compared to 0.32 ± 0.15 on the left (p=0.614). This yielded an angle of inclination of 18.14 ± 8.44 degrees on the right, and 17.65 ± 7.60 degrees on the left (p=0.805). The y-intercept of the right MF-C-Li-CI line, representing the midline, was 22.60 ± 3.81 mm, compared to 22.30 ± 3.61 mm on the left (p=.074). Parallel lines placed 2.5, 5, 7.5, and 10 mm below the best fit line of the mean revealed the location of tooth roots, MF, and genial tubercle in relation to each proposed osteotomy (Table 1).

Conclusion: This study provides precise anatomic measurements and introduces an anatomically directed, safe, and effective osteotomy design that achieves the benefits of an aesthetically pleasing monobloc genioglossal advancement and geniohyoid and digastriac muscle suspensions for patients with OSA.