

Table 2 Cephalometric landmarks [18]

Landmark	Abbreviation	Definition
Sella	S	Center of sella turcica
Nasion	N	Anterior point on the frontonasal suture
Condylion	Co	Point tangential to the most superior aspect of the condyle using a perpendicular to the ramal plane

Mandibular superimpositions were performed to evaluate the growth of the cephalometric landmark condylion (Co), defined as the point tangential to the most superior aspect of the condyle using a perpendicular to the ramal plane. The control and pre-surgical tracings were superimposed on the following: (1) inner contour of the cortical plate at the lower border of the symphysis, (2) distinct trabecular structures in the symphysis, and (3) contour of the mandibular canal [20]. The post-surgical superimpositions of the treated cases were performed using the same structures, as well as distinct rigid fixation hardware in the proximal segment of the mandible (Fig. 1).

Calculations

To quantify the horizontal and vertical changes in Co, reference axes were established on the pre-surgical tracing. The horizontal axis was defined as sella-nasion minus 7°, and a perpendicular to the x -axis, registered on sella, defined the y -axis. The reference axes made it possible to quantify the horizontal, vertical, and total changes in condylar position. Negative values indicate that Co moved in a posterior or inferior direction. The

total change included both the horizontal and vertical (i.e., the hypotenuse) growth changes.

Measurement reliability

To reduce measurement errors, all cephalograms were digitized and traced by one investigator (TPB). Based on 12 replicates, Cronbach's alpha (0.941) indicated reliable landmark identification.

Statistical analysis

Skewness and kurtosis statistics showed that the data were normally distributed. Means and standard deviations (SD) were used to describe the age distributions and condylar growth changes. The growth changes were annualized by dividing each individual's growth changes by the age changes that occurred. The pre-surgical changes in Co were compared to the post-surgical changes using paired t tests. Independent sample t tests were performed to determine group differences. All calculations were performed using SPSS Statistics software (version 17.0, SPSS, Chicago, IL) with the significance level set at 0.05.

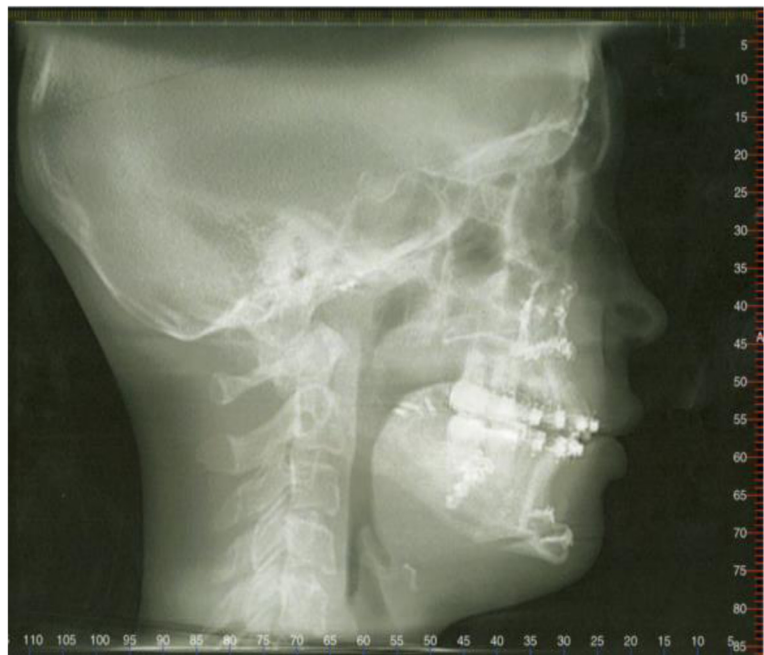


Fig. 1 Post-surgical cephalometric radiograph demonstrating the rigid fixation devices in the proximal segment of the mandible used for superimposition