Contents

CHAPTER 1

From 3-D Volumetric Computer Tomography to 3-D Cephalometry

Filip Schutyser, Johan Van Cleynenbreugel

1.1 CT Imaging of the Head **2**
1.1.1 CT Scanner **2**
1.1.2 Characteristics of a CT Dataset **3**
1.1.3 Radiation Dose **5**
1.1.4 3-D Image Volume **7**

1.2 3-D Scene Approach **8**

1.3 Virtual Cephalograms **10**
1.3.1 Conventional 2-D Cephalograms **10**
1.3.2 Generation of the Virtual Cephalogram **10**
1.3.3 Visualization of Virtual Cephalogram and 3-D Data **11**
1.3.4 Benefits of This Environment **11**

CHAPTER 2

Basic Craniofacial Anatomical Outlines

Gwen R. J. Swennen

2.1 3-D CT Anatomy of the Skull **14**

2.2 Multi-planar CT Anatomy of the Skull **37**
2.2.1 Axial CT Slices **37**
2.2.2 Virtual Coronal (Frontal) CT Slice Reconstructions **46**

2.2.3 Virtual Sagittal CT Slice Reconstructions **64**

2.3 Virtual X-Rays of the Skull **76**

CHAPTER 3

3-D Cephalometric Reference System

Gwen R.J. Swennen

3.1 Standardized Virtual Positioning of the Skull **94**

3.2 Computing of Virtual Lateral and Frontal Cephalograms **96**

3.3 Definition of the Nasion and Sella 3-D Cephalometric Landmarks **99**

3.4 Set-up of the Anterior Cranial Base (S-N) Plane **106**

3.5 Set-up of the 3-D Cephalometric Reference System **107**

CHAPTER 4

3-D Cephalometric Hard Tissue Landmarks

Gwen R. J. Swennen

4.1 Definition of 3-D Cephalometric Hard Tissue Landmarks **116**

4.2 Set-up of 3-D Cephalometric Hard Tissue Landmarks **174**

4.3 Additional 3-D Cephalometric Hard Tissue Landmarks **181**

CHAPTER 5

3-D Cephalometric Soft Tissue Landmarks

Gwen R.J. Swennen

5.1 3-D Cephalometric Soft Tissue Landmarks **186**

5.2 Set-up of 3-D Cephalometric Soft Tissue Landmarks **223**

5.3 Additional 3-D Cephalometric Soft Tissue Landmarks **226**

CHAPTER 6

3-D Cephalometric Planes

Gwen R. J. Swennen

6.1 3-D Cephalometric Planes **230**

6.2 Set-up of 3-D Cephalometric Planes **240**

CHAPTER 7

3-D Cephalometric Analysis

Gwen R. J. Swennen

7.1 3-D Cephalometric Hard Tissue Analysis **244**
7.1.1 Linear Hard Tissue Analysis **244**
7.1.2 Angular Hard Tissue Analysis **251**
7.1.3 Orthogonal Arithmetical Hard Tissue Analysis **254**

7.2 3-D Cephalometric Soft Tissue Analysis **257**
7.2.1 Linear Soft Tissue Analysis **257**
7.2.3 Angular Soft Tissue Analysis **274**
7.2.4 Orthogonal Arithmetical Soft Tissue Analysis **283**
7.2.5 Proportional Correlation Soft Tissue Analysis **286**
7.2.6 Additional 3-D Cephalometric Soft Tissue Measurements **287**

CHAPTER 8

3-D Cephalometry and Craniofacial Growth

Gwen R. J. Swennen

8.1 The Basicranium as a Template for Facial Growth **292**

8.2 Superimposition of Serial 3-D Cephalometric Tracings **296**

8.3 Displacement – Remodelling – Relocation **299**

8.4 Developmental Growth Rotations **299**

CHAPTER 9

Clinical Applications

Gwen R. J. Swennen

Case 1 **309**

Case 2 **322**

Case 3 **334**

CHAPTER 10

Future Perspectives of 3-D Cephalometry

Gwen R. J. Swennen, Filip Schutyser

10.1 3-D Cephalometric Reference Data **343**

10.2 Registration of 3-D Cephalometric Data Sets with 3-D Photographs **343**

10.3 Visualization of 3-D Cephalometric Data with Stereoscopic Displays **345**

References **349**

Subject Index **361**