

Orthognathic Surgery

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Principles, Planning and Practice

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Dedication



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father of modern Orthognathic Surgery

Contents

Foreword, xix

Preface, xxi

Acknowledgements, xxiii

Contributors, xxv

1 Introduction: Orthognathic Surgery – A Life’s Work, 1

Hugo L. Obwegeser

Introduction, 1

Historical remarks, 1

How did the sagittal splitting procedure come into being?, 1

Trauner’s inverted L-shaped osteotomy of the ramus, 3

My first successful sagittal splitting of the mandibular ramus, 3

My final technique for many years, 3

International reaction, 4

Transoral chin correction, 4

The mobilization of the maxilla – its history, 5

Operative technique for mobilization of the maxilla, 6

Modifications of the procedures, 6

New procedures, 6

Segmental alveolar osteotomies, 7

Problems of maxillary anomalies in secondary cleft deformity cases, 8

The Le Fort III + I osteotomy, 9

The correction of hypertelorism, 11

Recurrence, 16

Special instruments, 17

Concluding remarks, 20

Acknowledgements, 20

References, 20

Part I: Principles and Planning

2 Historical Evolution of Orthognathic Surgery, 23

Farhad B. Naini

Introduction, 23

Mandibular osteotomies, 24

Mandibular body osteotomies and osteotomies, 24

Surgery to the condyle and condylar neck, 37

Mandibular ramus osteotomies, 41

Osseous genioplasty, 52

Maxillary osteotomies, 54

The Le Fort I-type maxillary osteotomy, 54

Segmental maxillary osteotomies, 58

Blood supply to the osteotomized maxilla, 63

Rigid fixation, 63

Influence of craniofacial surgery, 65

Psychosocial implications of facial deformities, 77

Frances Cooke Macgregor, 77

Katharine Phillips, 79

Conclusion, 79

References, 79

3 Orthognathic Surgery: Preliminary Considerations, 83

Farhad B. Naini and Daljit S. Gill

Definition of orthognathic surgery, 83

Aetiology of dentofacial deformities, 84

Nature vs. nurture, 84

Classification of dentofacial deformities, 85

Morphological–aetiological classification of dentofacial deformities, 85

Terminology for orthognathic surgical procedures, 87

Maxillary surgery (Le Fort I level osteotomy), 87

Mandibular surgery, 87

Mandibular autorotation, 87

Chin surgery (osseous genioplasty), 88

Prevalence of dentofacial deformities, 88

Objectives of orthognathic surgery, 88

1. Aesthetics, 88

2. Function, 88

3. Stability, 89

Effectiveness of orthognathic surgery, 89

Treatment need – who will benefit from orthognathic surgery?, 90

Measurable criteria, 90

Index of Orthodontic Treatment Need (IOTN), 90

Index of Orthognathic Functional Treatment

Need (IOFTN), 91

Facial attractiveness research studies, 91

Scope of orthodontic treatment and growth guidance, 92

Dentofacial orthopaedics/growth guidance, 92

Orthodontic camouflage, 97

A specific problem – the young severe Class III patient, 101

Surgical camouflage, 101

References, 107

4 Orthognathic Surgery: The Patient Pathway, 109*Farhad B. Naini and Daljit S. Gill*

- Introduction, 109
- The orthognathic team, 109
- Orthognathic treatment pathway – the clinician's role, 111
- Sequencing of treatment and coordination of care, 111
 - Initial referral, 112
 - Initial consultation and interview, 113
 - Subsequent consultation and interview, 113
 - Joint 'diagnosis' clinic, 113
 - Preoperative orthodontics, 114
 - Joint 'definitive planning' clinic, 114
 - Surgery, 114
 - Initial postoperative period, 114
 - Postoperative orthodontics, 115
 - Joint 'result check' clinic, 115
 - Joint 'follow up' clinics, 115
- References, 115

5 Patient Evaluation and Clinical Diagnosis, 116*Farhad B. Naini and Daljit S. Gill*

- Introduction, 116
- Patient interview, 116
 - Presenting complaint, 117
 - History of presenting complaint, 118
 - Psychosocial history, 118
 - Medical history, 119
 - Suitability for orthognathic treatment, 120
- Clinical diagnostic records, 120
 - Purpose of clinical records, 120
 - Mandatory records for orthognathic surgery, 120
 - Additional records for orthognathic surgery, 122
- Patient evaluation – the basics, 124
 - Modified subunit principle, 124
 - Planes of space and axes of rotation, 124
 - Evaluation in repose and animation, 126
 - Cephalometric landmarks and definitions, 126
- Systematic clinical evaluation, 129
 - The diagnostic process, 129
 - Clinical facial evaluation, 132
 - Cephalometric analysis, 154
 - Dental-occlusal relationship evaluation, 162
- Concluding remarks, 168
- References, 168

6 Principles of Orthognathic Treatment Planning, 170*Farhad B. Naini and Daljit S. Gill*

- Introduction, 170
- 1. Preoperative diagnosis, 171
 - Evaluation of principle diagnostic parameters, 171
 - Chair side techniques to aid clinical diagnosis, 171
 - Skeletal expansion vs. contraction and effects on the overlying soft tissues, 188
- 2. Vectorial analysis, 189
 - Case example, 190

- Lip–incisor relationship: The foundation stone of treatment planning, 196
 - Case example, 196
 - Sequencing the planning process, 197
- 3. Prediction planning, 199
 - Cephalometric prediction planning, 200
 - Photographic 'montage' prediction planning, 205
 - Photo-cephalometric prediction planning techniques, 205
- 4. Model surgery, 211
- Concluding remarks, 212
- References, 212

7 Smile Aesthetics: Specific Considerations in the Orthognathic Patient, 214*Daljit S. Gill and Farhad B. Naini*

- Introduction, 214
- The alignment of the teeth, 214
- Sagittal position and inclination of the maxillary incisors, 215
- The visibility of the dentition in the vertical dimension, 215
 - The smile line, 215
 - The smile arc, 216
- The visibility of the dentition in the transverse dimension, 218
 - The buccal corridors, 218
- Symmetry, 219
 - Dental midlines, 219
 - Maxillary cants, 219
- Conclusions, 219
- References, 219

8 Orthodontic and Orthognathic Surgery Planning Using CBCT, 221*Lucia H.S. Cevidanes, Vinicius Boen, Beatriz Paniagua, Martin Styner and Tung Nguyen*

- Introduction, 221
- 3D CBCT diagnosis and treatment planning, 222
 - Tooth morphology and relative position within the alveolar bone, 222
 - Temporomandibular joint health and disease, 222
 - Airway assessment, 222
 - Dentofacial deformities and craniofacial anomalies, 223
- Longitudinal assessments using CBCT, 228
 - Radiation from CBCT acquisition, 229
 - Construction of 3D surface models, 229
 - Image registration, 229
 - Quantitative measurements, 230
- Conclusions, 231
- References, 231

9 Psychological Evaluation and Body Dysmorphic Disorder, 235*Katharine A. Phillips and Canice E. Crerand*

- Introduction, 235
- Prevalence of BDD, 235

Definition and clinical features of BDD, 236
 Definition of BDD, 236
 Body areas of concern, 236
 Core BDD symptoms, 236
 Associated features of BDD, 237
 Co-occurring disorders, 237
 Age at onset and course of illness, 237
 A patient with BDD, 237
 Treatment of BDD, 237
 Cosmetic treatment, 237
 Psychiatric treatment, 238
 Assessment of patients with BDD, 239
 Preoperative screening interview, 239
 Screening questionnaires, 241
 How surgeons can approach patients with BDD, 241
 Conclusions, 241
 References, 242

10 Patient Information Provision, 245

Farhad B. Naini, Daljit S. Gill and Umberto Garagiola

Introduction, 245
 Effective communication, 245
 In the clinic and on the ward, 245
 Time management, 246
 Retention of information, 246
 Selective recall, 246
 Dissatisfaction with treatment, 246
 Information-seeking behaviour in patients, 247
 Methods of information provision, 247
 Verbal information, 247
 Written information, 256
 Audiovisual information, 259
 World Wide Web, 261
 Conclusion, 261
 References, 262

11 Consent and Medicolegal Considerations, 263

Robert A.C. Chate

Introduction, 263
 UK perspective, 263
 International perspective, 264
 Informed consent essential requirements, 264
 Informed consent for orthognathic surgery, 265
 Who may legally give consent?, 265
 Adults who lack capacity, 266
 Conclusions, 268
 References, 268

12 Preparatory and Postoperative Orthodontics: Principles, Techniques and Mechanics, 270

Farhad B. Naini and Daljit S. Gill

Introduction, 270
 Preoperative orthodontics, 271
 Types of orthodontic appliance, 271
 Objectives of preoperative orthodontics, 273

Preparation for the preoperative 'joint clinic', 299
 Immediate preoperative appointment, 299
 Intraoperative orthodontic requirements, 301
 Immediate postoperative appointment, 302
 Postoperative orthodontics, 306
 Working archwires, 306
 Kobayashi ligatures, 307
 Intermaxillary working elastics, 307
 Orthodontic 'salvage', 310
 Space closure, 310
 Root 'paralleling', 310
 Orthodontic settling and finishing, 310
 Retention, 310
 Retention protocol, 311
 Types of retainer, 311
 Concluding remarks, 312
 References, 312

13 Model Surgery, 313

Farhad B. Naini, James McInnes, Daljit S. Gill and Andrew Stewart

Introduction, 313
 Definitions, 313
 Model surgery – principles, 314
 Stages of model surgery, 314
 Isolated mandibular surgery, 314
 Isolated maxillary or bimaxillary surgery, 314
 Model surgery – technique, 315
 Dental impressions, facebow record and occlusal registration, 315
 Transferring the maxillary model to the articulator, 316
 Articulating the mandibular model to the maxillary model, 318
 Maxillary movement, 318
 Mandibular movement, 319
 Construction of the occlusal wafer splints, 320
 Virtual model surgery, 323
 Conclusions, 324
 Acknowledgements, 324
 References, 324

14 Perioperative Considerations and Anaesthesia for Orthognathic Surgery, 325

Anne S. Blyth and Jelena Devic

Introduction, 325
 Preoperative assessment, 325
 Airway assessment, 327
 Medication, 327
 Premedication, 328
 Intraoperative care, 328
 Airway management, 328
 Patient positioning, 329
 Anaesthetic technique, 330
 Postoperative care, 332
 Antibiotics, 333
 Conclusions, 333
 References, 333

15 Postoperative Care, Nutritional Support and Oral Hygiene in the Orthognathic Surgical Patient, 334

Richard Cobb, Kelly Wade-Mcbane and Mehmet Manisali

- Postoperative care of the orthognathic surgical patient, 334
 - Introduction, 334
 - Ward-based care, 335
- Nutritional support, 337
- Oral hygiene measures, 338
 - Introduction, 338
 - Brushing techniques for the orthognathic patient, 338
 - Adjunctive chemotherapeutic agents, 339
- Conclusions, 339
- References, 339

16 The Soft Tissue Effects of Orthognathic Surgery, 341

Daljit S. Gill, Farhad B. Naini and Maarten Koudstaal

- Introduction, 341
- The immediate response to orthognathic surgery, 342
- Soft tissue changes with maxillary surgery, 342
 - The Le Fort I osteotomy, 342
 - Maxillary advancement, 343
 - Maxillary superior repositioning (impaction), 343
 - Maxillary inferior repositioning (setdown), 344
 - Maxillary set-back, 344
- Soft tissue changes with mandibular surgery, 344
 - Bilateral sagittal split osteotomy (BSSO), 344
 - Mandibular advancement, 344
 - Mandibular set-back, 345
- Genioplasty, 345
- Conclusions, 345
- References, 345

17 Early Orthognathic Surgery: Considerations for Surgical Management, 347

Pushkar Mehra and Larry M. Wolford

- Introduction, 347
- Diagnostic considerations, 348
 - General considerations, 348
 - Jaw growth considerations, 348
 - TMJ considerations, 348
 - Habitual considerations, 348
- Mandibular deformities, 349
 - Mandibular hypoplasia/retrognathism, 349
 - Mandibular retrognathism with TMJ disorders, 351
 - Mandibular hyperplasia/prognathism, 352
 - Mandibular osteotomy techniques for growing patients, 355
 - Inverted 'L' osteotomy (ILO), and vertical ramus osteotomy (VRO), 355
 - TMJ high condylectomy, 356
 - TMJ low condylectomy, 357
- Maxillary deformities, 357

- Maxillary anteroposterior hypoplasia, 357
- Maxillary anteroposterior hyperplasia, 358
- Maxillary vertical deformities, 358
- Maxillary osteotomy techniques for growing patients, 358
- Double jaw orthognathic surgery, 359
- Conclusions, 359
- References, 360

18 Stability of Orthognathic Surgery, 361

Tate H. Jackson and Brent A. Golden

- Introduction, 361
- The principles of stability, 361
 - Growth, 362
 - Physiological adaptation after surgery, 362
 - Rigid fixation, 364
- Surgical planning using the hierarchy of stability, 364
 - The UNC database, 364
 - The hierarchy of post-surgical stability, 365
 - Stability of Class II correction, 366
 - Stability of Class III correction, 368
 - Stability of early surgical treatment, 369
 - Stability of transverse correction, 370
 - Stability of asymmetry correction, 370
- Conclusion, 371
- Acknowledgements, 371
- References, 371

19 Management of Select Complications in Orthognathic Surgery, 373

David S. Precious

- Introduction, 373
- Orthodontic factors, 373
 - (i) Poor and/or inadequate bracket placement, 373
 - (ii) Bolton discrepancy, 373
 - (iii) Inappropriate transverse therapy, 374
 - (iv) Segmental vs. continuous archwire, 374
 - (v) Communication between the orthodontist and the surgeon, 375
- Maxillary surgery, 375
 - Ramping in maxillary advancement surgery, 375
 - Avoidance of the use of large pterygoid chisel to achieve pterygomaxillary separation, 375
 - Serious bleeding after Le Fort I osteotomy, 375
- Mandibular surgery, 376
 - Mandibular body osteotomy, 376
 - Sagittal split ramus osteotomy (SSRO), 376
 - SSRO and third molars, 376
- Summary of orthognathic surgery complications, 377
- References, 377

20 Patient Satisfaction and Patient-Centred Outcome Measures in Orthognathic Surgery, 378

Ceib Phillips and Caitlin Magraw

- Introduction, 378
- Immediate postoperative disturbances, 379
- Postoperative nausea and vomiting, 379

- Postoperative discomfort, 380
- Return to everyday life, 381
- Long-term disturbances and physical impacts, 382
 - Complications, 382
 - Function, 383
- Long-term satisfaction and perception of improvement, 384
 - Self-confidence, 384
 - Interpersonal support and relationships, 384
 - Quality of life, 384
 - Aesthetics, 385
 - Overall satisfaction, 385
- Recommendations, 386
- Acknowledgements, 386
- References, 386

Part II: Clinical Practice and Techniques

Section 1: Orthognathic Surgical Planning and Techniques, 393

21 Introduction: Perspectives on Treatment Planning, 394

Harvey M. Rosen

22 Le Fort I Osteotomy and Maxillary Advancement, 397

Helen Witherow and Farhad B. Naini

- Introduction, 397
- History of the Le Fort I osteotomy, 397
- Assessment of the maxilla, 398
- Anatomy, 399
 - Blood supply, 399
- Surgical technique, 401
 - Submental intubation, 401
- Surgical technique – Le Fort I osteotomy, 404
 - Technique, 404
 - Design of the osteotomy, 405
 - Nasal changes – specific considerations and minimizing undesirable changes, 408
- Variations of the Le Fort I osteotomy, 413
 - Quadrilateral (quadrangular) osteotomy, 413
 - Subspinal osteotomy, 414
- Complications associated with the Le Fort I osteotomy – occurrence, prevention and management, 414
 - Haemorrhage, 415
 - Nerve damage, 416
 - Positioning, 416
 - Stability, 416
 - Non-union, 416
 - Infection, 417
 - Undesirable nasal changes, 417
 - Dental problems, 417
 - Case examples, 417
- References, 420

23 Total Maxillary Set-Back Osteotomy, 422

Joel Ferri and Romain Nicot

- Introduction, 422
- Treatment planning, 423
- Surgical technique and considerations, 423
- General remarks, 423
- Case report, 425
- Acknowledgements, 427
- References, 427

24 Sagittal Split Osteotomy and Mandibular Advancement, 428

Christoph Huppa and Gavin Mack

- Introduction, 428
- Indications, 429
- Treatment planning, 430
- Preoperative orthodontics, 430
 - Anteroposterior orthodontic preparation, 431
 - Transverse orthodontic preparation, 431
 - Vertical orthodontic preparation, 431
- Surgical technique, 432
 - Third molars and mandibular osteotomies, 434
 - Osteosynthesis, 434
- Complications, 435
 - Neurosensory deficit, 435
 - Haemorrhage, 435
 - Unfavourable split, 435
 - Plate breakage, 435
 - Airway obstruction, 435
 - Relapse, 436
 - Fibrous union of the bone, 436
 - Infection, 436
- Postoperative orthodontics, 436
- Case report, 436
- References, 438

25 Mandibular Set-Back Procedures, 440

Manolis Heliotis and Shamiqque Ismail

- Introduction, 440
- Clinical assessment and planning, 440
- Preoperative orthodontic treatment, 441
- Surgical techniques, 442
 - Bilateral sagittal split set-back osteotomy versus the intraoral vertical subsigmoid osteotomy, 442
 - Bilateral sagittal split set-back osteotomy, 442
 - Intraoral vertical mandibular ramus osteotomy, 444
- Postoperative management, 444
- Orthodontic retention, 446
- Case report, 446
- Reference, 447

26 Surgical Correction of Vertical Maxillary Excess (VME), 448

Farhad B. Naini, Helen Witherow and Daljit S. Gill

- Introduction, 448

Diagnosis and aetiology, 448
 Presenting features of VME, 448
 Principles in planning the surgical correction of vertical maxillary excess, 453
 Lower anterior face height, 454
 Upper lip–maxillary incisor relationship, 455
 Orthodontic preparation, 456
 Surgical technique, 456
 Postoperative orthodontics, 458
 Case examples, 459
 Case 1, 459
 Case 2, 459
 Alternative treatment options, 459
 Conclusion, 462
 References, 462

27 Surgical Management of Vertical Maxillary Deficiency (VMD), 463

David J. David

Introduction, 463
 Pathology, 463
 The idiopathic deformity, 463
 Cleft lip and palate, 464
 Syndromal, 464
 Post-trauma, 464
 Iatrogenic, 465
 Treatment planning, 465
 Idiopathic vertical maxillary deficiency, 466
 Cleft lip and palate, 469
 Syndromes, 470
 Post-trauma, 470
 Iatrogenic, 471
 Surgical techniques, 473
 Ancillary surgical techniques, 476
 Outcomes and complications, 477
 Conclusions, 478
 Acknowledgements, 479
 References, 479

28 Surgical Correction of Skeletal Anterior Open Bite: Segmental Maxillary Surgery, 480

Johan P. Reyneke and Carlo Ferretti

Introduction, 480
 Development of the open bite malocclusion, 480
 Diagnosis, 481
 Treatment of growing patients, 482
 Treatment of skeletally mature patients, 482
 Orthodontic correction of anterior open bite, 482
 Combined orthodontic and surgical treatment, 482
 Vertical maxillary excess – orthodontic preparation, 482
 Planning the position of the interdental osteotomies, 483
 Surgery, 484
 The amount of superior repositioning of the maxilla, 484
 Mandibular position after autorotation, 487
 Correction of transverse discrepancies, 490
 Open bite secondary to short mandibular ramus with a normal condyle: mandibular surgery, 492

Orthodontic preparation, 492
 Surgery, 492
 Open bite secondary to a combination of vertical maxillary excess and short mandibular ramus, 492
 Open bite secondary to short mandibular ramus with condylar resorption, 492
 Idiopathic condylar resorption, 492
 Degenerative joint disease (osteoarthritis), 494
 Conclusions, 495
 References, 497

29 Surgical Correction of Anterior Open Bite: Differential Posterior Maxillary Impaction, 498

Farhad B. Naini, Andrew Stewart and Daljit S. Gill

Introduction, 498
 Diagnosis and aetiology, 499
 Presenting features, 501
 Principles in planning the surgical correction of skeletal anterior open bite, 507
 Approximate rules of thumb to aid chair side planning, 510
 Orthodontic preparation, 510
 Incisor inclination preparation, 510
 Levelling of the arches, 511
 Maxillary occlusal plane inclination and the smile curvature, 514
 Transverse maxillary deficiency, 514
 Surgical technique, 514
 Postoperative orthodontics, 519
 Conclusion, 519
 References, 519

30 Surgical Treatment of Anterior Open Bite with Mandibular Osteotomies, 521

Dale Bloomquist and Don Joondeph

Introduction, 521
 Aetiology and description of skeletal anterior open bite, 521
 Treatment decisions for surgery, 522
 Techniques for maximizing stability when anticlockwise rotation of the mandible is used, 524
 References, 528

31 Rotation of the Maxillomandibular Complex, 530

Johan P. Reyneke

Introduction, 530
 Principles of conventional treatment designs, 530
 Principles of rotation of the maxillomandibular complex treatment design, 533
 Geometry and visualization of the rotation of the maxillomandibular complex, 533
 Indications and treatment designs using the constructed maxillomandibular triangle, 535
 Control of the aesthetic treatment effect, 535
 Surgical compromise for orthodontic compromise, 536
 Orthodontic treatment considerations, 536

Rotation points and direction of rotation, 536
 Clockwise rotation of the maxillomandibular complex, 537
 Centre of rotation at ANS, 537
 Centre of rotation at the upper incisor tip, 541
 Centre of rotation at Pogonion, 542
 Centre of rotation at points posterior to ANS (i.e. zygomatic buttress or PNS), 544
 Counterclockwise rotation of the maxillomandibular complex, 545
 Centre of rotation at ANS, 545
 Centre of rotation at the zygomatic buttress, 546
 Centre of rotation at the PNS, 546
 Step-by-step development of a cephalometric surgical visual treatment objective, 548
 Reconciling the cephalometric prediction rotation point with the surgical rotation point, 552
 Stability after clockwise and counterclockwise rotation of the maxillomandibular complex, 552
 References, 553

32 Specific Considerations in the ‘Low Angle’ Patient, 555

Declan Millett

Introduction, 555
 Definition, 555
 Aetiology and consequences, 555
 Common features of low angle cases, 555
 Other features, 556
 Case assessment and treatment planning, 556
 General, 556
 Clinical and cephalometric assessments for a low angle case, 556
 Temporomandibular joint considerations, 557
 Soft tissue factors and lip musculature, 557
 Periodontal considerations, 558
 Restorative considerations, 558
 Cephalometric assessment, 558
 Treatment planning, 558
 Prediction of surgical outcome, 559
 Orthodontic management, 561
 Sequence of treatment, 561
 Pre-surgical orthodontics, 561
 Pre-surgical planning, 564
 Post-surgical orthodontics, 564
 Retention, 565
 Surgical aspects, 565
 Adjunctive procedures, 568
 Rhinoplasty, 568
 Mandibular re-contouring, 568
 Implants to improve facial contours, 568
 Lip and submental procedures, 568
 Post-surgical stability and evidence of effectiveness, 569
 Acknowledgements, 569
 References, 569

33 Osseous Genioplasty, 571

Ali Totonchi, Sima Molavi and Bahman Guyuron

Introduction, 571
 Anatomy, 571

Bone, 571
 Muscles, 571
 Nerves, 572
 Blood supply, 572
 Patient evaluation, 573
 Clinical examination, 573
 Patient and procedure selection, 574
 Surgical technique, 577
 Postoperative complications, 578
 References, 580

34 Asymmetries of the Maxilla and Mandible, 581

Farhad B. Naini, Mehmet Manisali and Daljit S. Gill

Introduction, 581
 Aetiology and classification, 582
 Classification of maxillary asymmetry, 582
 Classification of mandibular asymmetry, 585
 Clinical evaluation, 586
 Principles in planning the surgical correction of maxillary and mandibular asymmetry, 597
 Define the location and level (i.e. facial thirds) of the asymmetry, 598
 Define the type and extent of the asymmetry, 598
 Determine which tissues are involved, 599
 Correct transverse cants, 599
 Maintain/improve exposure of maxillary incisors, 599
 Maintain/improve lower anterior face height (LAFH) proportion, 599
 Maintain/improve sagittal skeletal relationships (maxilla, mandible and chin), 599
 Correct midlines (to facial midline), 599
 Improve dental occlusion, 600
 Orthodontic preparation, 600
 Preoperative model surgery, 600
 Surgical technique, 600
 Postoperative orthodontics, 602
 Case Examples, 602
 Case example 1, 602
 Case example 2, 603
 Case example 3, 604
 Case example 4, 605
 Conclusion, 606
 References, 606

35 Temporomandibular Joint Replacement Surgery in the Orthognathic Patient, 608

N. Shaun Matthews, Jonas Osher and Martyn T. Cobourne

Introduction, 608
 History of TMJ reconstruction, 608
 Alloplastic grafts, 608
 Autogenous grafts, 609
 Autogenous or alloplastic?, 609
 Guidelines for TMJ replacement, 609
 Surgical planning for TMJ reconstruction, 609
 Virtual planning, 610
 Surgical procedure, 611
 Orthognathic procedures, 612
 TMJ pathology related to the orthognathic patient, 612

Condylar resorption, 613
 Ankylosis, 613
 Condylar overgrowth, 613
 Surgical 'work-up', 613
 History, 613
 Examination, 613
 Investigations, 613
 Management, 613
 Case studies, 614
 Case 1: Idiopathic condylar resorption (ICR), 614
 Case 2: Iatrogenic malocclusion, 616
 Case 3: Post-traumatic facial asymmetry, 617
 Acknowledgements, 618
 References, 618

36 Surgically Assisted Rapid Maxillary Expansion, 620

Nigel Taylor and Paul Johnson

Introduction, 620
 Rapid maxillary expansion, 621
 Treatment planning – surgical options to widen the maxilla, 622
 Patient selection and case assessment for SARPE, 623
 SARPE protocol, 624
 Presurgical orthodontic considerations, 624
 Evaluation of surgical techniques for SARPE, 624
 General complications, 625
 Dental complications, 625
 Postoperative management and appliance activation, 625
 Bone-borne appliance, 626
 Complications, 627
 Evidence for stability of expansion achieved with SARPE, 627
 The future, 627
 References, 628

37 Mandibular Midline Osteotomy, 630

Dale Bloomquist and Don Joondeph

Introduction, 630
 Literature review, 631
 Techniques, 632
 Conclusion, 634
 References, 634

38 Segmental Surgery of the Maxilla, 635

Jocelyn M. Shand and Andrew A. Heggie

Introduction, 635
 Treatment planning, 636
 Surgical technique, 636
 Segmental Le Fort I osteotomy, 636
 Anterior maxillary segmental osteotomy, 638
 Wassmund technique, 638
 Wunderer technique, 639
 Posterior maxillary segmental osteotomy, 639
 Case report, 640
 Acknowledgment, 641
 References, 641

39 Total Subapical Mandibular Osteotomy, 642

Jonathan Sandler, Alison Murray and Peter Doyle

Introduction, 642
 History of the technique, 642
 Case 1, 643
 Case 2, 644
 Discussion, 645
 Conclusions, 646
 References, 646

40 Endoscopy in Maxillary and Mandibular Orthognathic Surgery, 647

Katherine P. Klein, Natalie N. Tung and Maria J. Troulis

Introduction, 647
 Maxillary orthognathic surgery, 648
 Mandibular orthognathic surgery, 648
 Endoscopic orthognathic surgery for the orthodontist, 650
 Future directions, 652
 References, 652

41 The Role of the Orthognathic Surgeon in Facial Feminization Surgery, 654

Keith Altman

Introduction, 654
 Male and female faces: aesthetics, 654
 Surgical procedures of special interest to the orthognathic surgeon, 655
 Forehead reduction, 656
 Planning, 656
 Surgical procedure, 657
 Rhinoplasty, 658
 Cheek implants, 658
 Surgical procedure, 659
 Angle shave and taper, 659
 Planning, 659
 Surgical procedure, 659
 Genioplasty, 660
 Planning, 660
 Surgical procedure, 660
 Discussion, 661
 References, 662

42 Contemporary Approach to Surgical Timing in Orthognathic Surgery: The 'Surgery First' Concept, 663

Federico Hernández-Alfaro and Raquel Guijarro-Martínez

Introduction, 663
 Surgery first, 664
 Concept, 664
 Inclusion criteria, 665
 Exclusion criteria, 665
 Diagnostic workup, 666

Preoperative planning, 666
 Surgical protocol, 666
 Postoperative orthodontics, 669
 Definition of the appropriate timing for surgery, 669
 References, 673

43 Neurosurgical Access Surgery: The Role of the Orthognathic Surgeon, 675

Helen Witherow, Daniel Archer and Simon Stapleton

Introduction, 675
 History of skull base surgery, 676
 Anatomy of the skull base, 676
 The skull base, 676
 Anterior skull base, 676
 Middle cranial fossa, 677
 Anatomy of the infratemporal fossa, 677
 Posterior skull base, 677
 Pathology, 678
 Access osteotomies, 678
 General techniques, 679
 Coronal flap, 679
 Calvarial bone grafts, 680
 Access to the anterior part of the anterior cranial base and treatment of the frontal sinus (removal of the frontal bandeau/frontal bar), 681
 Access to the central compartment, 681
 Transmandibular approach to the central compartment, 682
 Access to the lateral compartments/infratemporal fossa/middle cranial fossa, 684
 Complications, 688
 Secondary correction of complications, 688
 References, 689

44 Obstructive Sleep Apnoea Syndrome, 690

Ashraf Messiha, Ben Gurney and Piet Haers

Introduction, 690
 PCAV Risk Score Index, 692
 Patient risks, 692
 Clinical analysis, 692
 Anatomical measurements, 693
 Volumetric analysis, 693
 Pathophysiology, 694
 Treatment planning, 694
 Preoperative work-up, 695
 Choice of surgical technique in treatment planning, 695
 Surgical technique, 696
 Perioperative, 696
 Maxilla, 696
 Mandible, 697
 Chin, 698
 Closure, 698
 Postoperative, 698
 New developments, 698
 Case report, 698
 Conclusions, 699
 References, 700

45 Mandibular Intraoral Distraction Osteogenesis, 701

Cesar A. Guerrero, Gisela I. Contasti-Bocco and Aura Marina Rodriguez

Introduction and history, 701
 Indications, 701
 Contraindications, 701
 Mandibular widening, 701
 Surgical technique, 704
 Bilateral mandibular lengthening, 704
 Posterior body osteotomy, 704
 Surgical procedure, 705
 Parasymphiseal osteotomy, 705
 Surgical procedure, 705
 Distraction protocol, 707
 Unilateral mandibular lengthening, 707
 Ramus lengthening procedure, 707
 Postoperative considerations, 711
 References, 712

46 Maxillary Intraoral Distraction Osteogenesis, 713

Cesar A. Guerrero

Introduction and history, 713
 Indications, 714
 Contraindications, 714
 Maxillary Le Fort I level advancement, 714
 Surgical technique, 714
 Maxillary Le Fort I level advancement in clefts, 716
 Surgical technique, 716
 Modified Le Fort III midface advancement, 716
 Subcranial Le Fort III midface advancement, 718
 Distraction protocol, 718
 Postoperative considerations, 718
 References, 720

Section 2: Adjunctive Surgery, 721

47 Introduction: Adjunctive Surgery, 722

Foad Nahai

References, 723

48 Rhinoplasty and Nasal Changes In Relation to Orthognathic Surgery, 724

Mehmet Manisali and Leila Khamashta-Ledezma

Introduction, 724
 Nasal analysis, 725
 Basic steps in rhinoplasty, 727
 Nasal function following maxillary osteotomies, 729
 Aesthetic changes in the nose following orthognathic surgery, 729
 Alar region, 729
 Nasal tip and supratip region, 730
 Nasolabial angle, 731
 Nasal dorsum, 732

Columella, 732
Nasal septum, 732
Intraoperative procedures to manage nasal changes with orthognathic surgery, 732
Alar base cinch suture, 732
Pyriform guttering, 734
ANS recontouring/subspinal osteotomy, 734
V-Y closure, 735
Septal trimming and septal fixation with suture, 735
Secondary nasal procedures following orthognathic surgery, 736
Alar soft tissue techniques, 736
Septoplasty, 736
Columellar retraction, 736
Dorsal augmentation, 736
Concluding remarks, 736
References, 737

49 Deep Plane Facelift, 739

Farhad Ardehshirpour, Craig S. Murakami and Wayne F. Larrabee

Anatomy, 739
Preoperative evaluation, 740
Assessment, 740
Counselling and consent, 741
Photography, 741
Surgical technique, 741
Anaesthesia and positioning, 741
Submentoplasty, 741
Skin incisions, 741
Skin flap elevation, 743
Superficial musculo-aponeurotic system (SMAS) flap, 743
SMAS draping, 744
Skin redraping, 744
Skin closure, 744
Dressing, 745
Postoperative care, 745
Complications, 745
Haematoma, 745
Scarring/flap necrosis, 745
Alopecia, 745
Facial nerve injury, 746
Loss of sensation, 746
Parotid injury, 746
Infection, 746
Submental deformities, 746
Ear deformity, 746
References, 746

50 Soft Tissue Resuspension, 747

Alistair R.M. Cobb and Jonathan A. Britto

Introduction, 747
Surgical technique, 747
Discussion, 750
Acknowledgements, 750
References, 750

51 Soft Tissue Augmentation and Fat Grafting, 751

Mehmet Manisali and Rahul Jayaram

Introduction, 751
Fat grafting, 751
Biology of fat grafting, 752
Surgical technique, 754
Harvesting, 754
Refinement and preparation, 754
Placement, 754
Postoperative care, 755
Complications, 755
Discussion, 755
Conclusions, 756
References, 757

52 Aesthetic Surgery of the Submental-Cervical Region, 758

Tirbod Fattahi

Introduction, 758
Anatomy, 758
Submental fat, 758
Platysma muscle, 759
Submental and cervical skin, 759
Position of mandible and chin, 759
Aging process, 759
Surgical options and evaluation, 759
Surgical procedures, 760
Submental liposuction, 760
Cervicoplasty, 760
Genioplasty, 760
Discussion, 762
Conclusion, 762
References, 762

53 Surgical Options for Aesthetic Enhancement of the Lips and Perioral Region, 763

Joe Niamtu

Introduction, 763
Patient assessment and communication – not everyone needs bigger lips, 763
Mucosal reduction cheiloplasty procedure, 764
Complications, 766
Case presentations, 766
Cutaneous lip reduction, 768
Intraoral soft tissue surgery for excessive gingival display, 773
References, 774

Section 3: Orthognathic Surgery in the Cleft Patient and Orthognathic Aspects of Craniofacial Surgery, 777

54 Introduction: Craniofacial Surgery, 778

Jesse A. Taylor and Scott P. Bartlett

References, 779

55 Developmental Disorders of the Craniofacial Complex, 780

Martyn T. Cobourne and David P. Rice

- Introduction, 780
- Development of the craniofacial region, 781
 - Embryonic development of the face, 781
 - Embryonic development of the secondary palate, 781
- Oro-facial clefting, 781
 - Epidemiology, 782
 - Molecular genetics, 783
- Holoprosencephaly, 784
 - Molecular genetics, 784
- Fetal alcohol syndrome, 784
- Ectodermal dysplasia, 784
 - Molecular genetics, 785
- Pierre Robin syndrome, 785
 - Molecular genetics, 785
- Hemifacial microsomia, 786
 - Molecular genetics, 786
- Treacher Collins syndrome, 786
 - Molecular genetics, 786
- Nager syndrome, 787
 - Molecular genetics, 787
- Miller syndrome, 787
 - Molecular genetics, 787
- Craniosynostoses, 787
- Single suture synostosis, 788
- Non-syndromic craniosynostosis, 788
- Syndromic craniosynostoses: Apert, Crouzon and Pfeiffer, 788
 - Molecular genetics, 789
- Muenke syndrome, 789
 - Molecular genetics, 789
- Saethre–Chotzen syndrome, 789
 - Molecular genetics, 789
- Craniofrontonasal syndrome, 790
 - Molecular genetics, 790
- Carpenter syndrome 1 and 2, 790
 - Molecular genetics, 790
- Greig cephalopolysyndactyly syndrome, 790
 - Molecular genetics, 790
- Chromosomal abnormalities causing craniosynostosis, 790
- Mouse models of craniosynostosis, 790
- Frontonasal dysplasias 1–3, 790
 - Molecular genetics, 792
- Cleidocranial dysplasia, 792
 - Molecular genetics, 792
- References, 792

56 Orthognathic Surgery in the Patient with Cleft Lip and Palate, 796

Alexander C. Cash and Alistair R.M. Cobb

- Introduction, 796
- Prevalence, 797
- Treatment planning, 797
 - General factors, 797
 - Medical input, 798
 - Dental input and orthodontic retention, 798

- Records, 800
 - Timing, 800
- Factors in planning orthognathic care, 800
 - Surgical input (adjunctive), 801
 - Dental/periodontal health and tooth quality factors, 801
 - Orthodontic factors, 802
- Facial features, 803
- Soft tissue approaches to the maxilla, 804
- Maxillary surgery, 805
- Segmental surgery, 806
 - Maxillary horseshoe osteotomy, 806
- Distraction osteogenesis, 806
 - Choice of distractor type, 806
 - Le Fort I distraction, 806
 - Transport distraction, 807
 - Early mandibular distraction in Pierre Robin sequence for compromised airway, 807
- Management of hard palate fistulas at the time of cleft orthognathic surgery, 808
- Adjunctive surgery to improve facial contouring following orthognathic procedures, 808
 - Free fat grafting to the face, 808
 - Cleft rhinoplasty, 808
 - Cleft lip revisions and augmentation, 809
 - Facial implants, 809
- Retention and outcomes, 809
- Psychological input, 810
- Speech and language input, 810
- Patient input, 810
- Acknowledgements, 811
- References, 811

57 Craniofacial Asymmetry: Causes and Management, 813

Pravin K. Patel, Ronald Jacobson and Linping Zhao

- Introduction, 813
- Causes and classification of craniofacial asymmetry, 813
 - Congenital causes of asymmetry, 814
 - Developmental causes of asymmetry, 820
 - Acquired causes of asymmetry, 821
- Evaluation and assessment, 823
 - Component facial analysis, 823
 - Three-dimensional data acquisition and manipulation, 825
- Principles of symmetry reconstruction, 826
 - Surgical armamentarium, 826
 - Staging and timing of intervention, 830
 - Orthodontic considerations, 835
- Summary, 835
- References, 836

58 High Level Maxillofacial Osteotomies, 838

Stephen Dover

- Introduction, 838
- Indications for midfacial osteotomies, 839
- Preoperative assessment, 840
- Surgical procedures, 841
- References, 845

59 Le Fort-based Maxillofacial Vascularized Transplantation, 846

Chad R. Gordon, Harlyn K. Susarla, Edward Swanson, Seenu Susarla, Mehran Armand, Gerald Grant, Leonard B. Kaban and Michael J. Yaremchuk

Introduction, 846
Le Fort II-based allotransplantation, 847
Le Fort III-based allotransplantation, 847
Orthognathic planning for maxillofacial allotransplantation, 847
Facial identity and cross gender transplants, 849
Pre-clinical investigation in swine, 849
Planning and practice, 849
Conclusions, 851
Disclosures, 851
References, 851

Section 4: Appendix, 853

60 Orthognathic Surgery – One Patient’s Perspective, 854

Tania Murphy

Introduction, 854

My orthognathic surgical treatment, 855
Advice on preoperative patient preparation, 855
Conclusions, 856
References, 856

61 Responding to Patients’ Psychological and Social Needs Following Orthognathic Surgery, 857

Henrietta Spalding

Introduction, 857
Living with a disfiguring jaw condition, 857
The cultural context, 858
How do facial deformities affect patients and their families?, 859
How to respond to patients’ needs, 860
How healthcare professionals can support their patients adjusting to their different appearance, 861
 What does each element of FACES mean in practice?, 861
The graded approach, 863
 The delivery of FACES in a healthcare setting, 863
References, 865

Index, 867

Foreword



Auguste Comte (1798–1857) said: *‘One does not know a science completely without knowing its history.’* It is, therefore, appropriate that this book is dedicated to Professor Hugo Obwegeser and introduced by him in a most informative and delightful contribution – *‘A Life’s Work.’*

History has provided us with several great clinicians, ‘giants’ in their own right, on whose shoulders we could stand. This comprehensive book on modern orthognathic surgery edited (and authored) by Farhad B. Naini and Daljit S. Gill, is proof of the sound foundation laid by ‘giants’ and the subsequent development of the science by succeeding generations of clinicians.

Several factors distinguish surgical orthodontic correction of dentofacial deformities from most clinical treatment approaches:

Firstly, the diagnosis, treatment planning and correction of dentofacial deformities requires the expertise of several specialized clinicians. In this respect, the key players are the Orthodontist and the Maxillofacial surgeon, while the expertise of the Periodontist, Prosthodontist, general dental practitioner, and medical practitioner may be required in some cases.

Secondly, the treatment goals in orthognathic surgery are multifactorial. The major factors that should be considered when planning treatment are: improving facial aesthetics, the establishment of a functional occlusion, maintaining or increasing the airway space, the establishment and/or maintenance of periodontal health, healthy temporomandibular joints and, certainly, resolving the patient’s main complaints.

Thirdly, there are very few treatments in the medical and dental fields that can provide such accuracy in planning and predictability of treatment outcomes before commencement of treatment.

Finally, according to a well-known proverb, ‘a sorrow shared is halved while a pleasure shared is doubled.’ Successful orthognathic treatment outcomes can be shared and enjoyed equally by the surgeon, the orthodontist and, most importantly, the patient. The fact that the functional and aesthetic changes that follow orthognathic surgery are in most cases life changing allows the patient to appreciate the aesthetic and functional changes and share the pleasure with their families and friends, which is unique in respect of the correction of dentofacial deformities.

In the text, the editors have assembled an extremely talented and knowledgeable group of authors from a variety of specialties and have addressed a wide range of topics from basic diagnosis and treatment planning to the treatment of complex cases. The book is clearly a culmination of passion and exceptional hard work and offers current and scientific orthognathic treatment approaches.

A sound scientific approach, experience, and effective and efficient technical craft will all come together to make the treatment of patients occur smoothly and successfully. Orthognathic surgery, however, also demands an artistic approach as well as an imagination. Armand Trousseau (1801–1867), a French surgeon, told his students:

‘Medicine consists of science and art in a certain relationship to each other, yet wholly distinct. Science can be learned by anyone, even the mediocre. Art, however, is a gift from heaven. So you cannot count yourselves amongst the great doctors by simply acquiring knowledge. Knowledge ... gives the artist fresh inspiration. Therefore, learn as much as you can ... but your learning must be the basis for your art, not an end to itself. A little less science and a little more art, Messieurs!’

Albert Einstein's (1879–1955) view of the importance of an imagination is equally interesting:

'Imagination is more important than knowledge. For knowledge is limited to all we know now and understand, while imagination embraces the entire world, and all there ever will be to know and understand.'

Orthognathic surgery is a science and an art. This landmark publication will not only serve as an important scientific reference and guide to many clinicians,

but also as an inspiration to develop the art and imagination required to treat patients with dentofacial deformities successfully. I believe that this reference text will find its way onto the bookshelf of every clinician interested in the management of patients with dentofacial deformities.

Johan P. Reyneke
BChD, MChD, FCOMFS(SA), PhD
July, 2016

Preface

'Aesthetics and Function in Harmony'

Orthognathic surgery holds a unique position within medicine and surgery. Firstly, it is a subspecialty of two distinct surgical specialties: Oral and Maxillofacial Surgery and Orthodontics. Secondly, orthognathic surgical treatment, from the intricate details of diagnosis and treatment planning through to the finesse of surgical technique, requires the perfect blend of art and science. Finally, unlike many other parts of medicine and surgery, patients do not just 'need' such treatment; they also 'desire' the treatment, and the combined functional and aesthetic improvements may be, quite literally, life-changing for the orthognathic patient.

'It is astonishing with how little reading a doctor can practice medicine, but it is not astonishing how badly he may do it.'

Sir William Osler (1849–1919)

The fundamental purpose of this book is to provide clinicians with comprehensive information regarding diagnosis and treatment planning, and detailed, up-to-date, step-by-step descriptions of the specific operative techniques in orthognathic surgery and relevant procedures from allied specialties.

There is some 'method' in the arrangement of the book. Considerable thought was given to the order of the chapters, which have been grouped into themed sections. This format should provide a logical sequence to the reader. Attempts have been made to reduce repetition, other than where a similar procedure has been described with certain nuances of technique, which readers may find useful. Any clinician faced with a difficult situation will always benefit from knowledge of several methods to deal with the problem at hand.

The first chapter is a special introduction by Professor Hugo Obwegeser, the leading pioneer of orthognathic surgery. It is a pleasure to dedicate this textbook to Professor Obwegeser. Countless patients owe him the possibility to lead a normal life, and many surgeons owe him success and satisfaction in their profession. The photograph of Professor Obwegeser at the beginning of the book was taken by Hengameh Naini, in the Obwegesers' garden in Schwerzenbach, Switzerland. Professor Obwegeser asked if we didn't mind if he didn't wear a suit and tie. He wanted to be shown as himself, 'not all dressed up.' 'I was raised

on a farm, and that is still where my heart lies.' Professor Obwegeser expressed his enthusiasm for this book, and his desire 'to hold the book in his hands.' The editors hope that he is pleased with the result.

The rest of the book is separated into two parts. A house cannot be built on sand – a firm foundation is required. Therefore the chapters in Part I (Principles and Planning) cover the fundamental principles, background considerations and essential information that should be firmly grasped by the orthognathic clinician. Part II (Clinical Practice and Techniques) is separated into four sections. Section 1 covers Orthognathic surgical planning and techniques; Section 2 covers Adjunctive surgery; Section 3 covers Orthognathic surgery in the cleft patient and orthognathic aspects of craniofacial surgery; and finally Section 4 has two chapters that will provide useful 'food for thought' for the orthognathic clinician.

Many of the authors invited to contribute chapters to this book are *the* internationally renowned leaders in their field, and all have established reputations in their respective sphere of interest. The list of contributing authors reads like a veritable *Who's Who* of the masters of Orthognathic Surgery and allied specialties. The contributing authors remit was to provide chapters that were comprehensive and practical, to analyse the scientific literature for their chosen subjects, and, more importantly, to augment their chapters with technical knowledge and wisdom gathered from long-term clinical experience and careful scrutiny of their techniques and clinical results, which legitimately deserves to be considered as a vital part of our 'evidence base'. Referencing has been thorough, but selective rather than exhaustive.

The most important part of learning orthognathic surgery remains the apprenticeship – when basic knowledge has been learned, and the higher trainee spends time with an experienced surgeon and orthodontist team. Observing an experienced clinical team with a patient and their family on the clinic or on the ward is invaluable, and teaching surgical technique in the operating theatre is almost invariably a one-to-one experience. To paraphrase a famous Oslerian maxim: *to study [orthognathic surgery] without books it to sail an uncharted sea, while to study books without patients is not to go to sea at all.* To compile and write a comprehensive book chapter on a specialist topic must be a labour of love because the intellectual and

emotional effort put into such an endeavour is incalculable. The editors' desire is that the chapters in this book will be used by higher trainees to enhance higher surgical training on diagnostic and treatment planning clinics, on the ward and in the operating theatre.

Throughout the book there is an emphasis on accurate diagnosis and logical treatment planning, as well as the step-by-step description of technical procedures, and the intricacies of surgical technique, detailed in such a way that both the experienced clinician and the higher surgical trainee may understand the technical subtleties.

It may be reasoned that undertaking research educates the researcher more thoroughly than anyone else; by the same token, having had the opportunity to edit manuscripts from the most accomplished individuals in the field of orthognathic surgery, has been of enormous value to us. We sincerely hope that our readers derive as much pleasure and benefit from reading this book as we have from compiling and editing it.

Farhad B. Naini and Daljit S. Gill
March 2016

Acknowledgements

No project of this magnitude is complete without acknowledgements. Individual credits to the museums, libraries, archives and medical journals for permission to reproduce and redraw some of the figures are provided in the respective figure legends throughout the book.

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My sincere thanks are due to the late and much missed Mr Raymond Edler (Consultant Orthodontist) and Mr Peter Blenkinsopp (Consultant Oral and Maxillofacial Surgeon - retired). At the age of 23, as a young House Surgeon, it was on their orthognathic clinics at the Norman Rowe Maxillofacial Unit that I first experienced the life-changing results of orthognathic surgery, undertaken at the highest level of expertise.

My thanks to my friend Professor Aron D. Wahrman, Professor of Plastic and Reconstructive Surgery, Temple University, Pennsylvania, whose knowledge of the history of medicine and surgery appears inexhaustible, and to the Robert H. Ivy Society of Plastic Surgeons, for a number of the figures in Chapter 2.

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Though impossible to fully express in words, my enduring love and deepest appreciation goes to my parents and brother. I have had the honour to proof read a number of my father's books over the years, and his exploration of the greatest minds of past ages. However, one sentence always remains in my mind - the opening words of wisdom from his book *The Genuine Face of Omar Khayyam* - and that is 'You are what you read.' Finally, to my wife Hengameh - my heart and soul - whose kindness and wisdom are simply wonderful. Hengameh is an animal behaviourist, and her chosen profession is also her deep passion. Yet she made time in her already packed schedule to create the illustrations for my chapters. This book would simply not have been possible without her dedication.

Farhad B. Naini
March 2016

I would like to thank my grandparents and parents for their unfailing help, and thank my wife, Balpreet, and my children, Aran and Anika, for their love and patience.

Daljit S. Gill
March 2016

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We are donating part of the royalties for this book to *Changing Faces*, the leading UK charity that supports and represents people who have disfigurements to the face, hand or body from any cause, thereby complementing medical and surgical interventions by

addressing the psychological and social challenges posed by such disfigurements. We are donating the rest of the royalties to animal welfare charities chosen by Hengameh Naini, and support her hope that the human species will eventually look beyond considerations of narrow self-interest and learn to include animals within our sphere of morality.

Farhad B. Naini and Daljit S. Gill
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Chapter 1

Introduction: Orthognathic Surgery – A Life’s Work

Hugo L. Obwegeser

Introduction, 1	New procedures, 6
Historical remarks, 1	Segmental alveolar osteotomies, 7
How did the sagittal splitting procedure come into being?, 1	Problems of maxillary anomalies in secondary cleft deformity cases, 8
Trauner’s inverted L-shaped osteotomy of the ramus, 3	The Le Fort III + I osteotomy, 9
My first successful sagittal splitting of the mandibular ramus, 3	The correction of hypertelorism, 11
My final technique for many years, 3	Recurrence, 16
International reaction, 4	Special instruments, 17
Transoral chin correction, 4	Concluding remarks, 20
The mobilization of the maxilla – its history, 5	Acknowledgements, 20
Operative technique for mobilization of the maxilla, 6	References, 20
Modifications of the procedures, 6	

Introduction

Dr Farhad B. Naini has asked me to write an introduction to this definitive textbook on Orthognathic Surgery. I am very grateful for the honour. My intention is to compose a commentary on the development of orthognathic surgery. Firstly, however, I must express my gratitude to my teachers. It is due to them that I developed the ability to produce new ideas (Figure 1-1). I initially received general surgical training for six months in the military services and an equivalent period in a country hospital in my native town. Following this I had the privilege to train for two years with Hermann von Chiari at his Viennese Institute for Pathology and Microbiology. I then spent six years training in dentistry and maxillofacial surgery with my teacher Richard Trauner at the Maxillofacial Unit of the Dental School of the University of Graz. I spent another five months training in plastic and reconstructive surgery with Sir Harold Gillies in Basingstoke, London, and later six months with Eduard Schmid in Stuttgart. Norman Rowe and Paul Tessier were very good friends and colleagues of mine, and we learned from each other. All I know I owe to my teachers.

Historical remarks

The wish to correct deformities of the maxillo-mandibular complex is an old desire. It was mainly mandibular anomalies that led to a desire for the development of corrective surgery. V.P. Blair (1907),¹ F. Kostečka (1934),² and others developed ideas and techniques to cut the body or the ramus of the mandible for repositioning into a planned new occlusion. Their procedures did not satisfy my teacher Richard Trauner, as the results had too many problems. He suggested that we needed to develop another osteotomy that would produce broad contacting bone surfaces and as such have better prerequisites for early bony union and reduce the likelihood for relapse.

How did the sagittal splitting procedure come into being?

Due to my teacher’s request it was my obligation to develop an idea for a procedure that would fulfil his intentions. As I very much disliked skin incisions in the visible regions of the face for surgery on the facial

My teachers

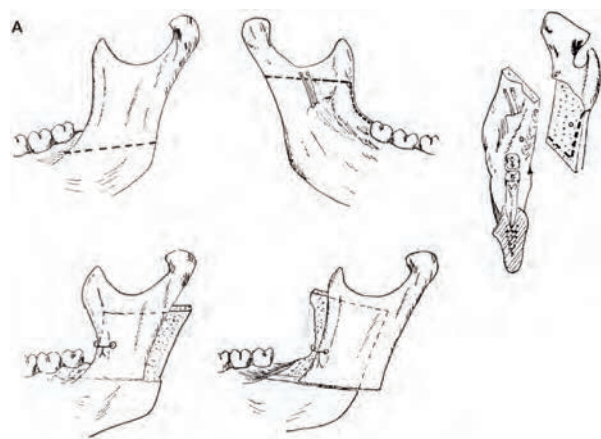


- Hermann Chiari
- Richard Trauner
- Eduard Schmid
- Harold D. Gillies
- Norman Rowe
- Paul Tessier



Fig. 1-1 My teachers (anticlockwise): Professor Hermann von Chiari, Chief of the Institute of Pathology and Microbiology of the University of Vienna. Professor Richard Trauner, Chief of Dentistry and Maxillofacial Surgery, University of Graz, Austria. Professor Eduard Schmid, Chief of the Klinik für Gesichtschirurgie, Marienhospital, Stuttgart. Sir Harold Gillies, International founder of Plastic and Reconstructive Surgery, Basingstoke, England. Mr Norman Rowe, Chief of Department of Oral Surgery, Basingstoke, England. Dr Paul Tessier, Chief of the Department of Plastic Surgery, Military Hospital, Paris.

skeleton, I had to find a transoral procedure. I took a cadaveric mandible and turned it around in my hands in order to view it from every direction. By doing so I realised that the vertical splitting of the ramus would produce the ideal situation in relation to the desired goal. However, how could it be split without damaging the mandibular nerve in its canal? In order to find that out I decided to make horizontal cuts about every five millimetres in the ramus. The resultant findings proved very promising. No instrument should touch the area of the mandibular canal. It became obvious that I had to cut the lingual cortical plate of the mandible just above the entrance of the mandibular nerve into the mandible. Another cut of the lateral cortical plate had to be placed somewhere close to the angle, either above or in front of it, but towards the angle in order to correct an unpleasant angle anomaly. That would provide enough raw bone surface contact for fast bony union, independently of whether the mandible would be repositioned in a posterior or an anterior position, or even when a rotation of the mandible was necessary (Figure 1-2).



from J. O.O.O. 10:677,1957

Fig. 1-2 Drawings of my sagittal splitting technique (from: Obwegeser, 1957).³

Trauner's inverted L-shaped osteotomy of the ramus

My chief, Richard Trauner, liked my idea. He himself had the intention to perform his idea, an inverted L-shaped osteotomy of the ramus. Trauner's technique required both a transoral and a transfacial approach. The first patient in whom we attempted to produce our ideas was an edentulous young lady, on 17 February 1953. Due to the use of the acrylic splints fixed to the jaws for intermaxillary fixation, the surgery became rather chaotic and somewhat of a mess.

My first successful sagittal splitting of the mandibular ramus

The next case was a 24-year-old female with an intact dentition, but with a protruding position of the mandible. We operated on her on 22 April 1953. This time the procedure went very well (Figure 1-3). The patient's right side was operated using Trauner's technique of the inverted L-shaped osteotomy; it was satisfactory.

I now had the opportunity to perform my first sagittal splitting procedure of the mandibular ramus on the patient's left side. My operation proceeded without any problems. The segments of the split ramus fitted together nicely after the mandible was fixed in the new occlusal position by intermaxillary fixation. It did not require any further fixation. So I proceeded to close the soft tissues tidily over the anterior ramal rim. The result was very pleasing and remained stable over 33 years (Figure 1-4).

My final technique for many years (Figure 1-5)

In the early days, when I was forming my ideas into practical procedures, we operated under sedation and local anaesthesia. General intubation anaesthesia was, in those days, only available for the radical surgery required in cancer cases. Nowadays, the orthognathic patient almost invariably receives general anaesthesia, usually with nasal intubation. A rubber prop is placed between the upper and lower teeth on one side, which keeps the mouth open while operating on the contralateral side. The vestibular mucosa is infiltrated with a 1% local anaesthetic solution plus vasoconstrictor, from the premolar region up to the coronoid process. The incision goes through the mucosa and the periosteum, almost in the depth of the vestibulum, and follows cranially along the anterior crest. The periosteum is elevated in the areas of the bone cuts to be performed, inferiorly above the angle and cranially above the lingula back to the posterior border. Next, the cortical cuts are undertaken. For that I cut on the lingual side the anterior rim with a carbonate burr in order to allow good vision further posteriorly. I use a 3 mm fissure burr to cut the lingual cortical bone above the lingula, to the depth that blood points appear, as far back as the posterior border. The lateral cut is normally performed in the angle area; however, in cases of severe retromandibulism I may go forward to the extent that I will be close to the mental foramen. To connect both osteotomies I produce a vertical cut. For that I use, for safety reasons, a rose burr, making one perforation after the other on the lingual side of the crest, just through the cortical plate. Finally, they are

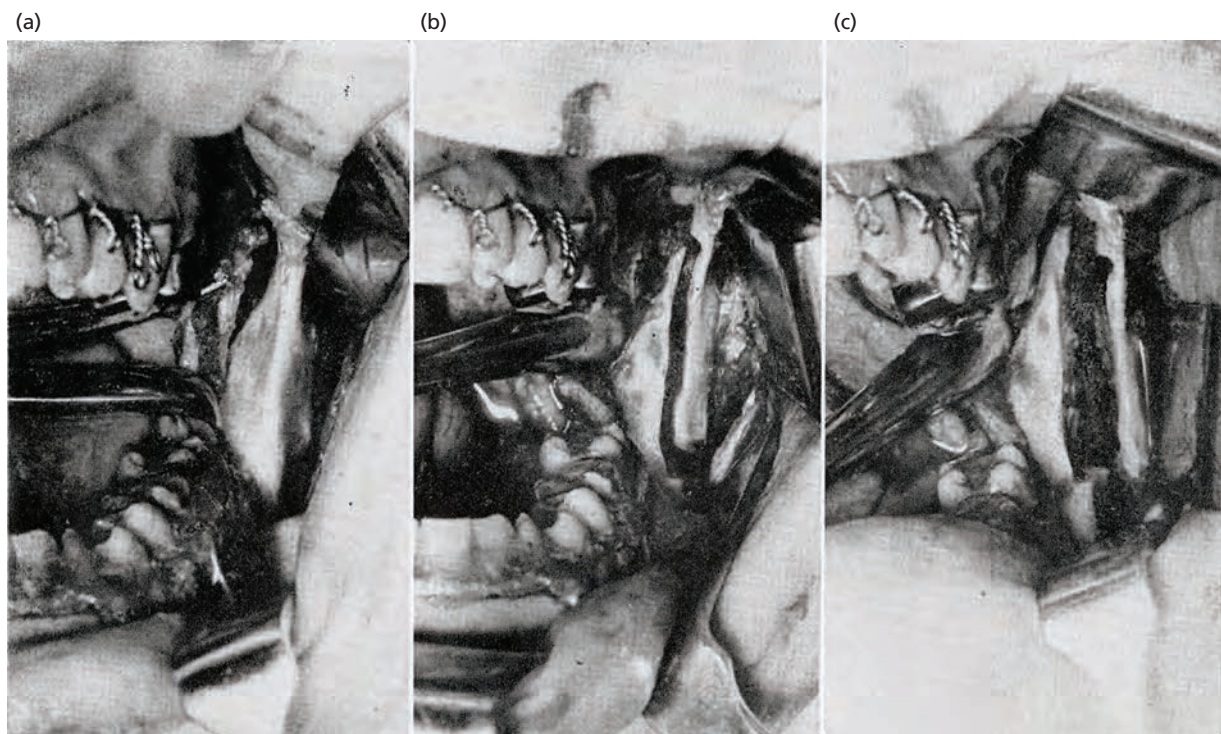


Fig. 1-3 Intraoperative photographs (from: Obwegeser, 1957).³

The first successfully operated sagittal split: Graz, Austria, 22 April, 1953



Fig. 1-4 My first successful sagittal splitting case (from: Obwegeser HL. Mandibular Growth Anomalies. Springer, 2001).³¹

connected with a bone cutting burr. I want to be certain that I will not be too deep in the ramus, thereby reducing the risk of damage to the mandibular nerve. My nephew, Joachim Obwegeser, prefers to make this connecting cut by the use of a saw. Using the wedge

osteotome, I open the cut gently and not too deeply. Next I use my bone spreader forceps, inserted into the vertical cut, in order to open the cortical plates (see Figure 1-5). Normally, the split opens the cortical plates right through to the posterior border; if not, the posterior border is cut under direct vision with a broad splitting osteotome. By employing this technique I was able to avoid damage to the nerve. Fixation screws will have to be carefully placed.

My final technique for many years

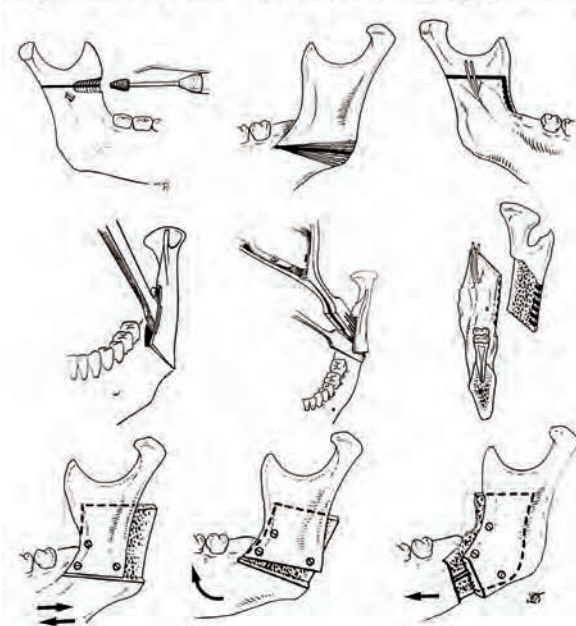


Fig. 1-5 My final technique for the sagittal splitting procedure for many years (from: Obwegeser HL. Mandibular Growth Anomalies. Springer, 2001).³¹

International reaction

After publication of the sagittal splitting osteotomy procedure in *Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology* (1957),³ I was invited to lecture on the subject in various countries. The transoral sagittal splitting procedure went around the world after I had published it in detail and had finally lectured on it in a postgraduate course to the American Association of Oral Surgeons, in 1966, at the Walter Reed Hospital. This procedure conquered the professional world all around the globe. It is now in daily use, probably in every country in the world. It is the procedure of choice for every specialist dealing with maxillomandibular anomalies.

Transoral chin correction

The same is true with the transoral sliding chin correction, a procedure that I published together with the

Transoral sliding chin procedure

(H. L. Obwegeser 1957, 1958)



Fig. 1-6 My technique and first case of transoral sliding chin procedure (from: Obwegeser HL. Mandibular Growth Anomalies. Springer, 2001).³¹

sagittal splitting procedure (1957).³ It does not require a detailed description here (see Chapters 3 and 33). Otto Hofer (1942)⁴ was obviously the first to have the idea to increase the prominence of the chin by cutting its inferior rim off the mandibular body. However, he demonstrated the procedure on a cadaver via an extraoral approach. I got the idea when I investigated the lateral cephalometric radiograph of a patient with a very retruded chin. It was so obvious that there was the material I needed. I performed it right away on the patient. The technique was simple and the result very convincing (Figure 1-6). My personal friend and colleague, Otto Neuner (1965),⁵ developed the idea of using a double step, in order to obtain greater increase in chin prominence. I, eventually, also performed a triple step procedure (1970a).⁶

The mobilization of the maxilla – its history

The mobilization of the maxilla had been the intention of many surgeons who desired to correct maxillomandibular anomalies. Georg Axhausen from Kiel, Germany, published three articles describing osteotomies of the maxilla, for the correction of its position after trauma (1934),⁷ and in cases due to

other aetiological factors resulting in anomalies of the maxilla (1936 and 1939).^{8,9} However, his publications did not describe the technique in a way that would permit other surgeons to carry out the procedure. In 1942, Karl Schuchardt,¹⁰ from Hamburg, published the mobilization of the dislodged upper jaw of a war injury and its repositioning using traction weight. He wrote that the procedure would be hardly used for the correction of maxillary deformities in secondary cleft cases.

Sir Harold Gillies worked hard on this subject, as did Norman Rowe. During my training with Sir Harold, in 1951–52, I had on several occasions the privilege to watch or even assist him. He was definitely the pioneer for the final mobilization procedure of the maxilla, because he opened the cleft and rotated the palatally dislocated alveolar segments laterally so far that they could fit with the mandibular teeth. However, he did not dislocate them anteriorly. He filled the very large steps in the canine fossae with cancellous bone grafts from the iliac crest. To the great surprise of his observing visitors the grafts healed, without infection, despite the fact that the region was not completely covered with a vestibular flap or any other mucous membrane on its raw surface on the sides of the maxillary and nasal cavities. That pioneering

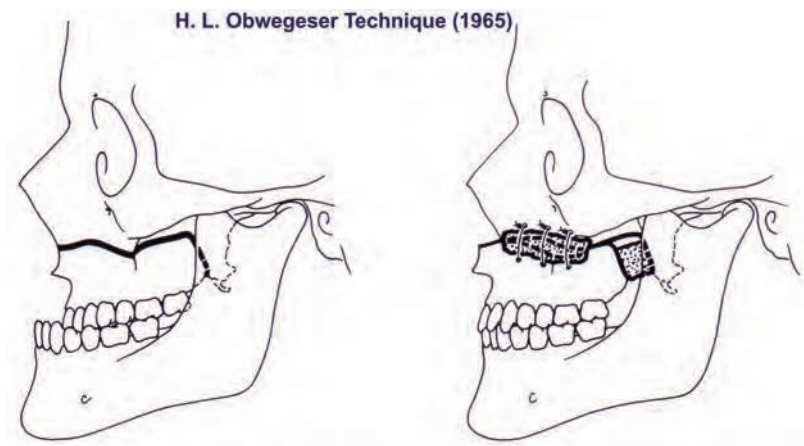


Fig. 1-7 Drawings of my technique of Le Fort I anterior repositioning (from: Obwegeser, 1969).²⁸

Gaps within bone-segments should always be filled with bone (H. L. Obwegeser)

step allowed me to advance the mobilized maxilla up to 20 millimetres and more. These bone grafts, together with the graft that I always place behind the tuberosity and the pterygoid processes, have become to me a *conditio sine qua non* (Figure 1-7). In 1986, R. Drommer published a very interesting article on 'The History of the Le Fort I Osteotomy'.¹¹ He stated very clearly that 'Hugo Obwegeser' was the first to publish a procedure that every experienced surgeon should be able to perform. It was in 1962 at the South American International Conference on Oral Surgery in Buenos Aires, Argentina, when I first reported on my successful mobilization of the maxilla (Obwegeser, 1962).¹² The procedure could be performed together with the transoral splitting of the rami. However, the first patient in whom I operated on both jaws was on 5 September 1969; that is, 16 years after the first publication of the sagittal splitting of the mandibular ramus and 7 years after the publication of the Le Fort I-type osteotomy and mobilization of the maxilla.

Operative technique for mobilization of the maxilla

The patient normally receives nasal intubation anaesthesia. In addition, I infiltrate the vestibulum with 1% local anaesthetic solution plus a vasoconstrictor. The incision goes all the way round in the vestibulum, however, only when the palatal mucosa is free of scars. Next, the periosteum is raised cranially. In the piriform aperture, the mucosa is raised from the floor of the nose and from the septum for at least 15 mm. The septum osteotome separates it from the palate. I use an oscillating saw for the circular osteotomy. Just prior to this, I separate the tuberosity from the pterygoid process with an elastic special tuber osteotome. This prevents the saw cutting further posteriorly and avoids damage to the regional blood vessels.

For many years I used the anterior down fracture technique to get the maxilla loose. My nephew, Joachim Obwegeser (1997),¹³ suggested to me to start in the posterior region with down fracturing, by the

use of my bone separating forceps. Only after that, with the same instrument, the anterior down fracture is performed. The maxilla must be mobilized to the extent that it can easily be overcorrected with a pair of tweezers. The fixation of the maxilla in the new position has to follow the plan. In cases when the mandible also has to be repositioned a preoperatively prepared occlusal splint guarantees the position in which the maxilla has to be fixed. Next the mandibular osteotomy is completed and then fixed in the new occlusion. Whether the jaws are fixed with wires, or plates and screws, you always have to keep in mind that the tendency of the pull of the musculature is to bring the jaws back to their initial position. This means that some use of intermaxillary elastics may be useful to maintain the new dental occlusion.

With these three procedures, orthognathic surgery experienced an explosion throughout the world.

Modifications of the procedures

I received visiting observers from all over the world. Some had the idea to alter the position or the direction of the cortical cuts in the sagittal splitting of the mandibular rami, and went on to name the modified procedure according to their own name (K. Schuchardt, 1954;¹⁴ Dal Pont, 1959 and 1961;^{15,16} E.E. Hunsuck, 1968;¹⁷ B.V. Epker, 1977;¹⁸ etc.). However, I still believe that my original technique for the mandible as well as for the maxilla remains the best solution to the clinical problems.

New procedures

In September 1967 Paul Tessier published for the first time his techniques for the mobilization of the middle third of the facial skeleton (Le Fort III-type osteotomy) and for dislocating the orbital conus including their contents (hypertelorism operation).¹⁹

Between 1953 and 1967 several ideas were published for repositioning the whole mandible.^{20,21} I myself published a technique that I named the transoral angle

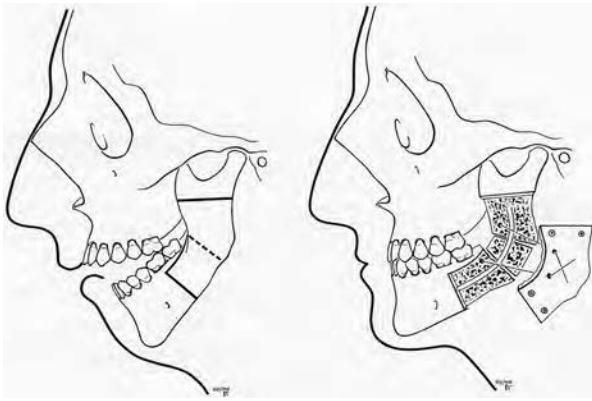


Fig. 1-8 Drawings of my transoral angle osteotomy (from: Obwegeser HL. *Mandibular Growth Anomalies*. Springer, 2001).³¹

osteotomy (1964) (Figure 1-8).²² In cases of posterior vertical maxillary excess, Karl Schuchardt (1954)¹⁴ had the idea of cranially repositioning the lateral maxillary segments, thereby allowing the mandible to autorotate anteriorly and close the occlusion (Figure 1-9 a–d). In my experience, in a very high percentage of cases, that procedure led to relapse of the anterior open bite.

For the correction of an edentulous antemandibulism I wanted to get rid of the internal fixation with the help of acrylic splints, fixed to both jaws. For that reason I produced a bilateral sagittal splitting as far anterior and close to the mental foramen as possible. By doing so I was able to fix the large segments of the

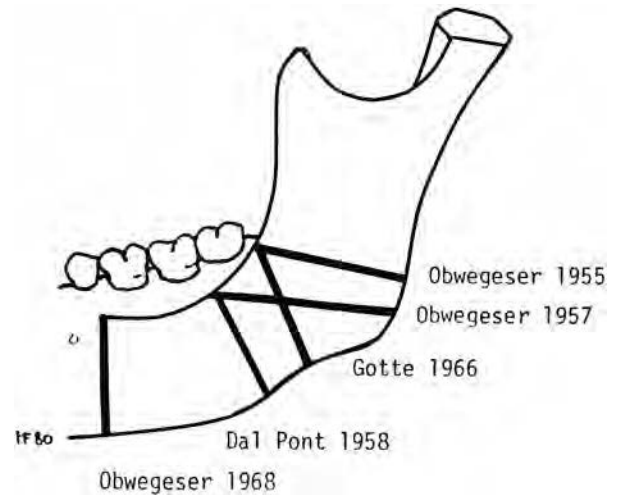


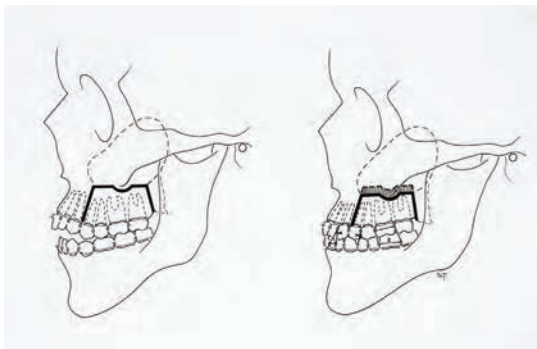
Fig. 1-10 Some variations of lateral cortical cut for the sagittal splitting procedure by different authors (from: Obwegeser, 1968).²³

mandible in the desired position using a circumferential wire in the ramus region as well as in the body of the mandible (1968).²³ There are many minor alterations of the original sagittal split osteotomy, and it is not possible to mention them all in detail (Figure 1-10).

Segmental alveolar osteotomies

Heinz Köle deserves the honour of various segmental osteotomies of the alveolar processes in the maxilla as

(a)



(c)



(b)



(d)



Fig. 1-9 Schuchardt's procedure for correcting a maxillary open bite: (a) technique; (b) case before surgery; (c) occlusion after additional bridge work; (d) amount of relapse after one year.

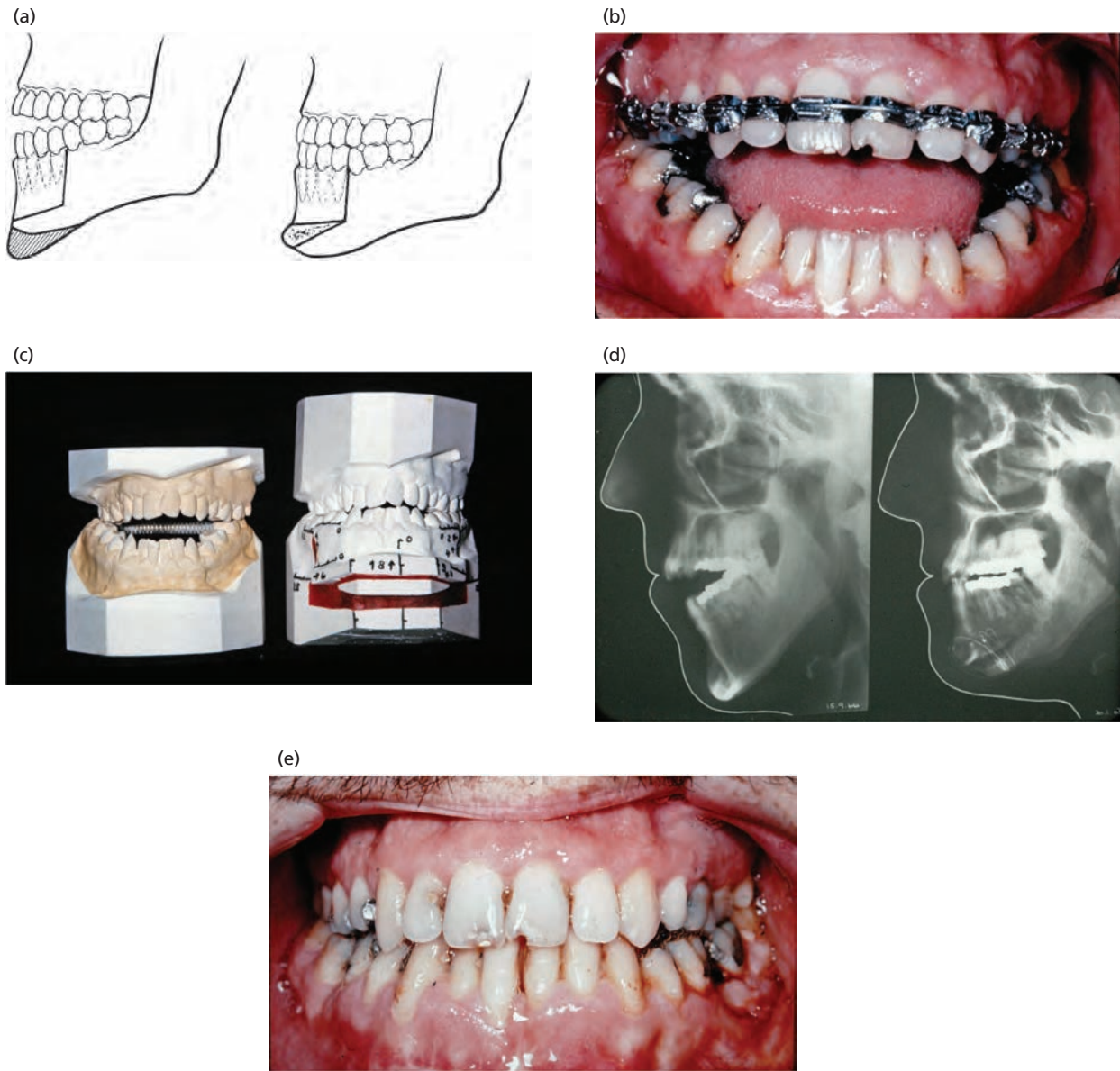


Fig. 1-11 H. Köle’s technique for closing an anterior mandibular open bite: (a) The technique in a drawing; (b) Case before surgery; (c) Model operation; (d) Lateral skull radiographs before and after surgery; (e) Occlusion after one year. (From: Obwegeser HL. Mandibular Growth Anomalies. Springer, 2001.)³¹

well as in the mandible (Figure 1-11 a–e).²⁴ With the possibilities of alveolar segmental osteotomies, and with the repositioning of the mandible and the maxilla, unlimited corrective techniques are available (Figure 1-12 a–c). Joachim Obwegeser (1987)²⁵ described a circular splitting of the mandible, which is a useful technique for the correction of certain types of cases of independent occlusal and mandibular body anomalies (Figure 1-13).

Problems of maxillary anomalies in secondary cleft deformity cases

Severe deformities of the maxilla tend to occur in secondary cleft deformity cases. Nevertheless, the dislocated parts of the maxilla must be mobilized and repositioned. Accurate model surgery defines the amount and the direction of the required repositioning

of the alveolar segments. Sir Harold Gillies undertook the very important and pioneering work in this subject. He, together with Norman Rowe, rotated the segments so far laterally that they could occlude with the mandible (Gillies and Rowe).²⁶ For that the cleft had to be widely reopened and in a later session closed again. Gillies bone grafted the defects in the steps of the canine fossae with perfect results, although the bone grafts could not be completely covered on the side to the antral and nasal cavities. That step was the pioneering work for the correction of severely collapsed maxillary arches. He only rotated the alveolar segments but did not reposition them also anteriorly; that was my contribution to the Le Fort I repositioning.

The secondary cleft deformity cases are the most challenging to correct properly. However, it is a fascinating subject and very pleasing for both the surgeon

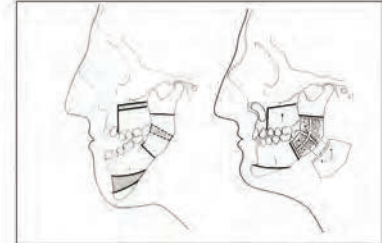
(a)
Transoral angle osteotomy (H.L. Obwegeser 1964)
 plus Schuchardt's maxillary open bite procedure



(b)



Transoral Angle-Osteotomy
 (H. Obwegeser, 1964)



(c)



Fig. 1-12 Case of maxillomandibular long face plus open bite: (a) Before surgery; (b) Model operation plus drawings of planned surgery; (c) Result of surgery.

and even more so for the patient. The planning is undertaken as for any orthognathic surgery case: first, on a tracing of the lateral cephalometric radiograph, the ideal profile line is drawn. The model surgery shows all the details of the required osteotomies. The

surgeon will have to decide the technical feasibility of reproducing in the patient what the model surgery demonstrates is required (Figure 1-14 a–d).

For independent correction of occlusal and mandibular body anomalies it's circular split of J.A. Obwegeser (1986,1987) is the solution for that problem.

H.L. Obwegeser



Fig. 1-13 Joachim Obwegeser's circular splitting of the mandible (from: Obwegeser HL. Mandibular Growth Anomalies. Springer, 2001).³¹

The Le Fort III + I osteotomy

After I had the privilege to observe Dr Paul Tessier perform a Le Fort III-type osteotomy, I then performed it. However, soon I had a case to correct presenting with severe micro- and retromaxillism. It was obvious that the forward repositioning of the middle third would not produce a satisfactory result. There would still remain some lack of vertical height. For that reason, in addition to the Le Fort III osteotomy, I separated the maxillary complex with an additional Le Fort I mobilization. That allowed me (Obwegeser, 1969)^{27,28} to reposition the maxilla in a good occlusal relationship with the inferior dentition (Figure 1-15). The gap that remained then between the cranial half of the middle third and the maxilla I filled with cancellous bone grafts from the iliac crest. The final result was very pleasing and with it a new

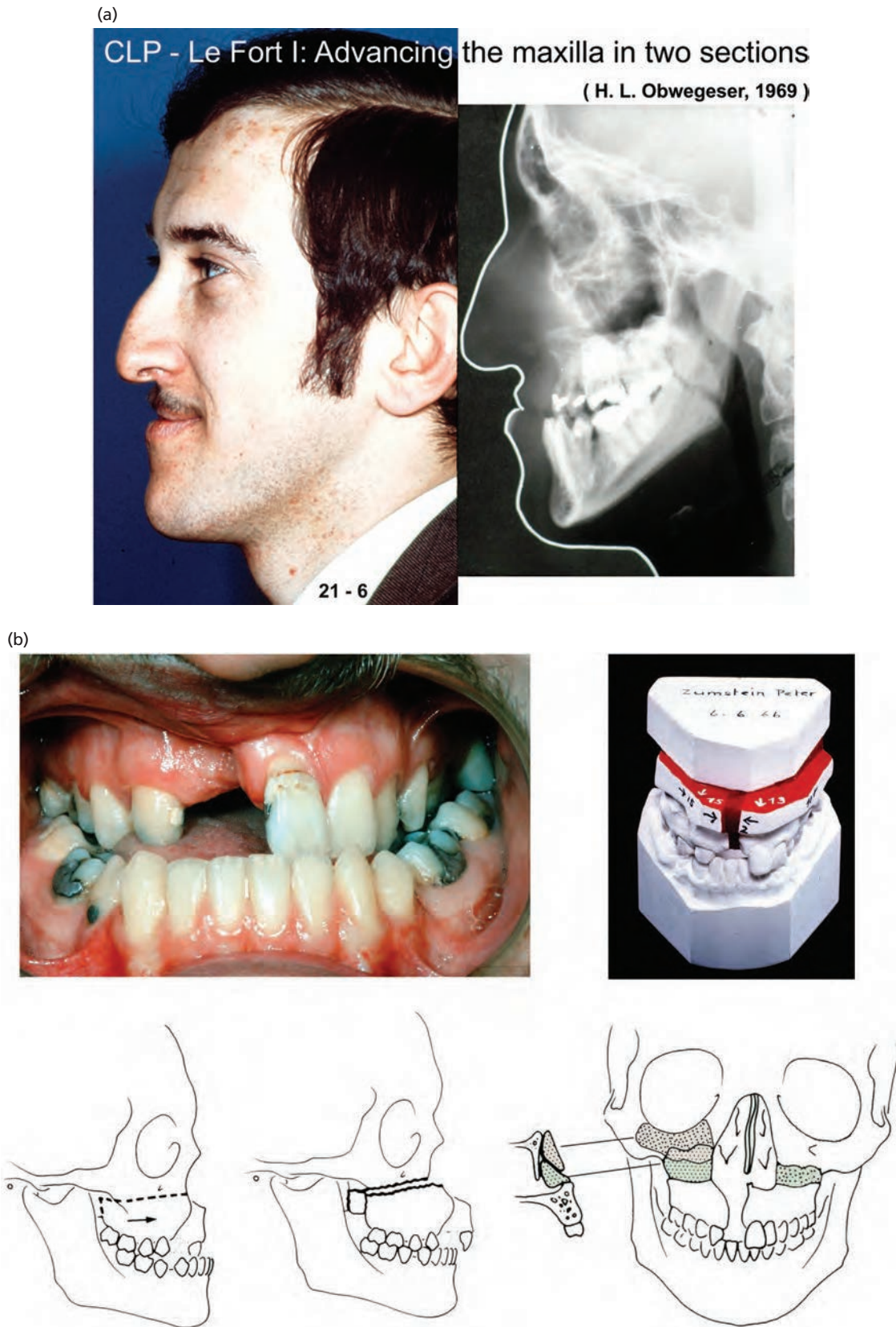


Fig. 1-14 Case of secondary cleft deformity: Retromaxillism plus collapse of the maxillary arches: (a) Before surgery; (b) Model operation and drawings of planned surgery; (c) Lateral skull radiographs and occlusion before and one year and three months after surgery; (d) Profile view before and three months after surgery. (From: Obwegeser HL. Mandibular Growth Anomalies. Springer, 2001.)³¹

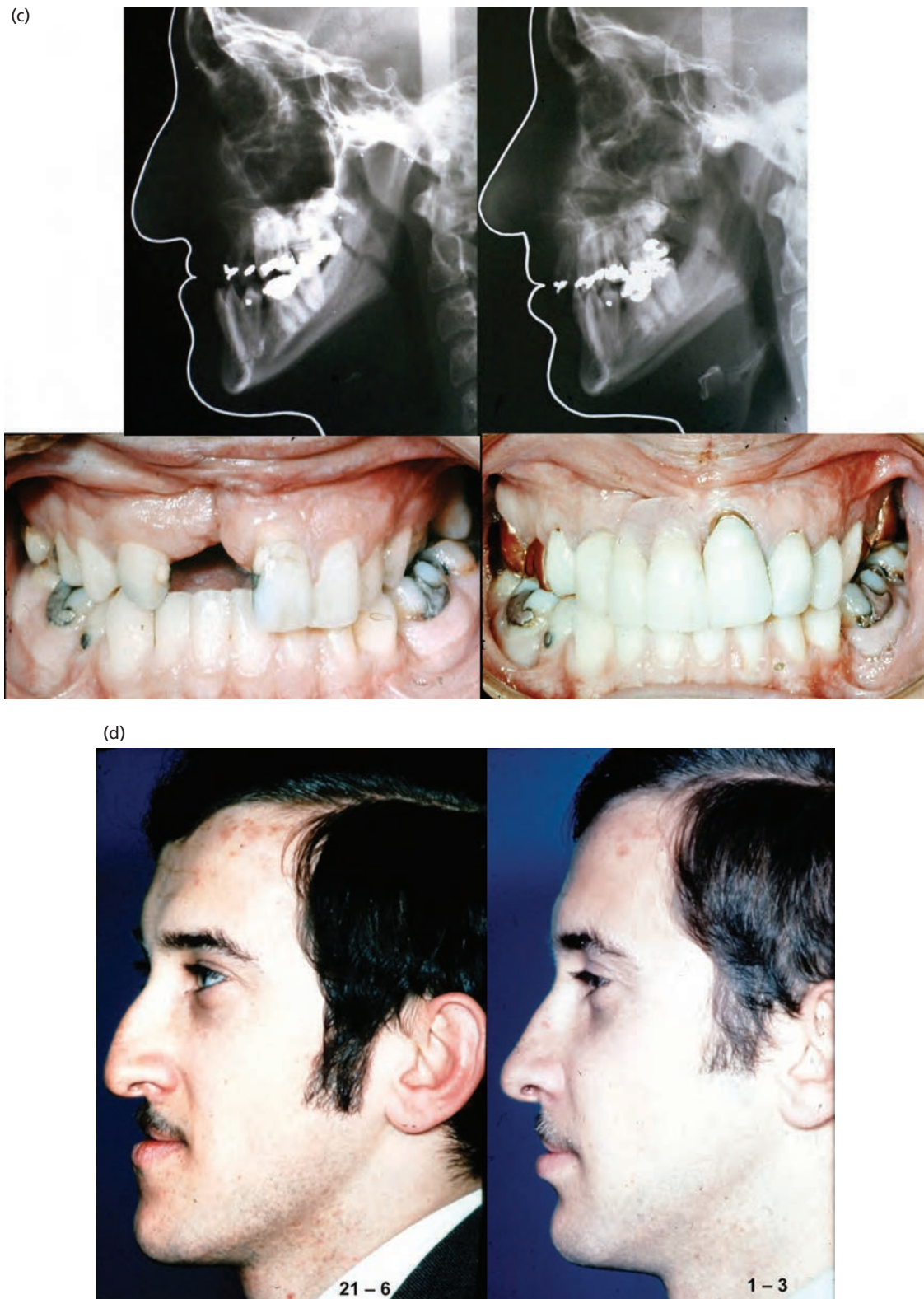


Fig. 1-14 (Continued)

variation of the middle third advancement was born (Figure 1-16 a,b).

The correction of hypertelorism

Dr Paul Tessier described the principal technique of rotating dislocated orbital coni together with their contents. His transcranial approach is the key to the

problem. A subcranial approach was also published, but is more complicated than the approach described above.

The correction of a unilateral dislocation of the orbit is a straightforward procedure, producing a good result. A symmetrical bilateral dislocation is not much more difficult to correct (Figure 1-17 a-d). There is no question that we have to operate on these patients in

LF III + LF I, H. L. Obwegeser, 1969

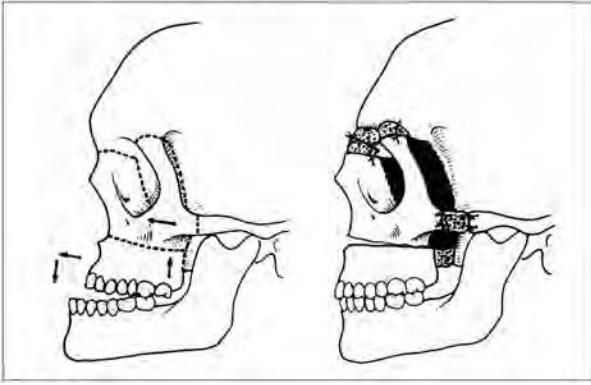


Fig. 1-15 H.L. Obwegeser’s technique for a combined Le Fort III+I operation. (From: Obwegeser, 1969.)²⁸

childhood because of their eyes, although we are fully aware that such early correction may interfere with the subsequent growth of the maxilla. That means we have to inform the patient that after the age of 18 years a second operation will be required to obtain the final result. I learned this by treating a very convincing case – Antonio – which I describe as the case of my life (H. Obwegeser, G. Weber, H.P. Freihofer, H.F. Sailer, 1978) ‘Facial duplication – the unique case of Antonio’. *J Maxillofacial Surgery* 6: 179–198.²⁹

Antonio was referred to me at the age of 10 years (Figure 1-18). He was born with a median facial cleft, two complete noses and two fully developed premaxillae and altogether seven incisor teeth. My treatment plan was formulated based on Tessier’s procedure for the correction of hypertelorism (Figure 1-19).

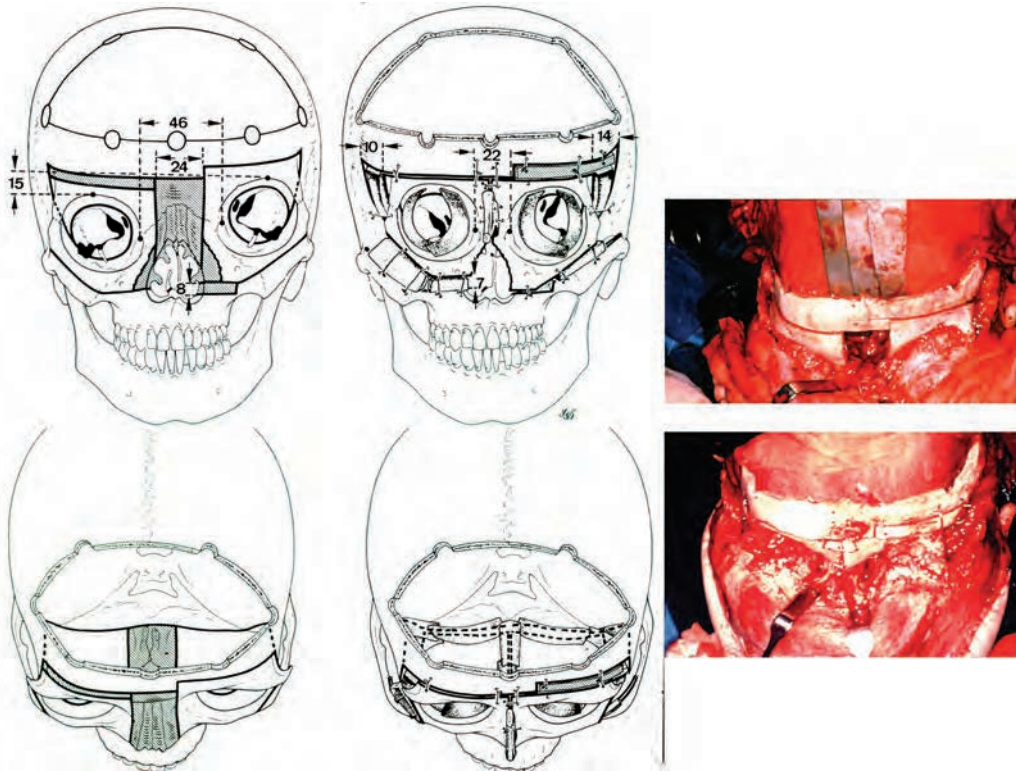


Fig. 1-16 Case of micro-retromaxillism: (a) Occlusion and lateral skull radiographs before and after surgery; (b) Profile and front views of case before and 2 years and 10 months after surgery. (From: Obwegeser HL. *Mandibular Growth Anomalies*. Springer, 2001.)³¹

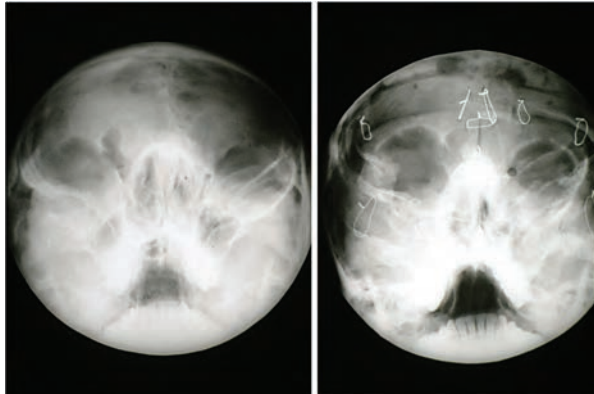
(a) Asymmetric Hypertelorism



(b)



(c)



(d)



Fig. 1-17 Case of asymmetric hypertelorism. (a) Front view and semi-axial skull radiograph before surgery; (b) Planned operation and operation pictures; (c) Semi-axial radiographs of the skull before and after the correction; (d) Patients front views before and after the correction.



Fig. 1-18 Antonio – the case of my life. (From Obwegeser et al., 1978.)²⁹ Patient presented with midfacial duplication and medial facial cleft. Left: situation after birth; Right: at age of 10.

The operation was performed on the 4 July 1969. The first operation went well. After the neurosurgeon (G. Weber) had raised the skull flap he found, to our great surprise, two cristae galli. In those days neither tomography nor MRI was yet available. That meant I had to plan the case on the basis of conventional radiographs and according to my imagination. The two cristae galli solved the problem of how much of the cranial base I would have to excise (Figure 1-20) – they provided the answer (Figure 1-21). I planned the operation with military precision, step by step, including the necessary time that would be required for each step. This was typed and handed to every person working on the case. The operation was started at 8.00 in the morning and ended precisely according to my written plan at

3.00 o’clock the following morning. I had to resect both premaxillae with the seven incisor teeth.

Eventually, we achieved a result that allowed a good functional occlusion for mastication and acceptable anterior dental aesthetics, so that nobody would miss his front teeth! However, at this stage there was still a long way to go. The primary result was very pleasing, but a purulent infection compelled the neurosurgeon to remove the large bone flap of the skull and I removed the bone grafts for the reconstruction of the lateral orbital defects. The Children’s Hospital managed to treat the meningitis. In due course, the patient was discharged home with a helmet. Ten months later he returned with a severe discrepancy of the middle third of the face and the mandible. The latter was far

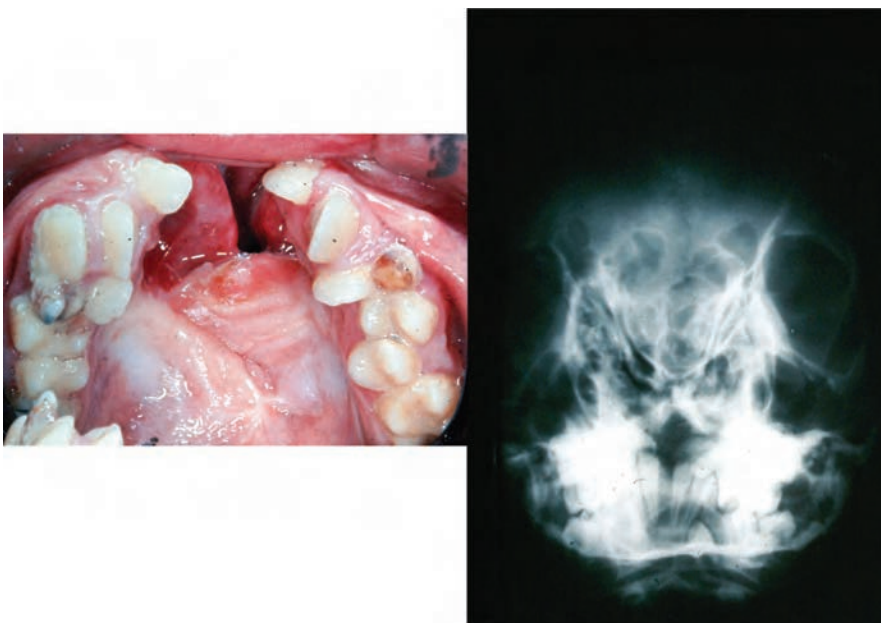


Fig. 1-19 Patient’s maxilla with two premaxillae plus skull semi-axial radiograph.

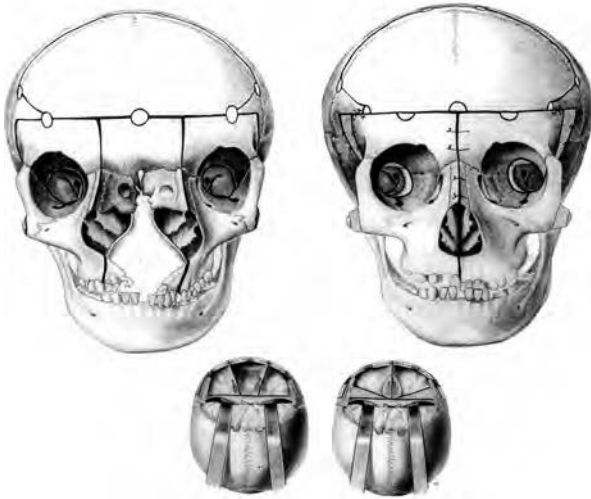


Fig. 1-20 Drawings of planned operation.

in front of the maxilla, as the mandible had grown forward but the maxilla had not. I corrected the condition with a Le Fort I advancement in two sections and a repositioning of the anterior mandibular alveolus. The primary result was quite pleasing (Figure 1-22).

Thirteen months later the neurosurgeon reimplanted the skull flap again after he had autoclaved it. The same immediate infection caused him to remove it again. I said to him do not worry; I will make him a new skull covering. So I did, 10 months later. I took

from the right side of the chest four ribs, and from the left three ribs. As they had been taken already during the first intervention the regeneration was somehow sclerosed bone. Despite this I managed to split the ribs. So I had 14 half-ribs for the reconstruction of the large skull defect. There were no postoperative problems. The patient could now leave without a helmet. Finally, the whole defect was covered with bone made from his own ribs (Figure 1-23). However, the face changed very much in the following years (Figure 1-24). I decided to wait until he was at least 18 years of age. When he returned the presentation was that of a severe midface retrusion and mandibular prominence, due to lack of forward growth of the maxilla and zygomatic bones and lower half of the nose, and overgrowth of the mandible – the patient described his own appearance as 'monstrous' (Figure 1-25). After evaluation of the situation it was obvious that I had to posteriorly reposition the mandible in addition to its anterior alveolar segment, and the maxilla and the inferior periorbital region had to advance (Figure 1-26). The result was very convincing (Figure 1-27). In addition, the missing columella had to be reconstructed. For that I planned a caterpillar flap with an L-shaped cartilage taken from the ribs (Figure 1-28). There were no complications but a nice result of the nose and the profile was produced. The patient was discharged home as a man with a normal face, albeit with some scars. He could eat everything. The missing incisors were not obvious. The quality of his speech

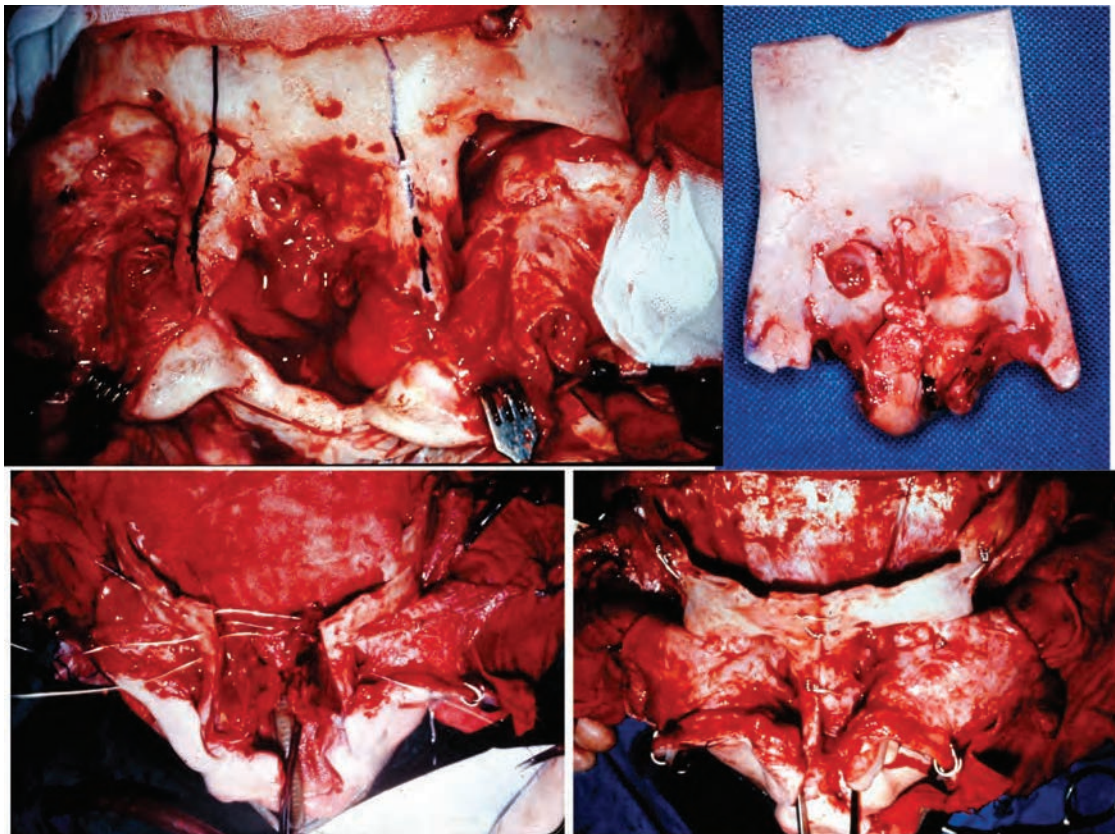


Fig. 1-21 Skeletal situation during and after correction plus excised part of forehead area.



Fig. 1-22 Patient after surgery plus radiograph.

was good enough for his native town to employ him in the city’s telephone business (Figures 1-29 and 1-30). His nasal airway was excellent and so was the view of the nose from below (Figure 1-31). Twenty-five years later I visited him in his home town in southern Italy. We met on the road like father and son, with much enthusiasm on both sides (Figure 1-32).

In summary, I must confess that I learnt a great deal by treating Antonio. First, to never give up, and second, to avoid operating on the maxilla until its growth has ceased. That is what I now advise every young colleague.

Recurrence

There are many possibilities for relapse and recurrence of a deformity. While a patient’s skeletal growth has not ceased, there will always remain the possibility that further growth will alter the result of surgery. The mandible will continue to grow normally as long as the condyles have not been involved. On the contrary, the maxilla will almost cease to grow after it has been surgically exposed. A further cause for a postoperative change may be due to hyperactivity in the condyles growth regulators. We believe that there are two; one for growth in length and the other for growth of mass

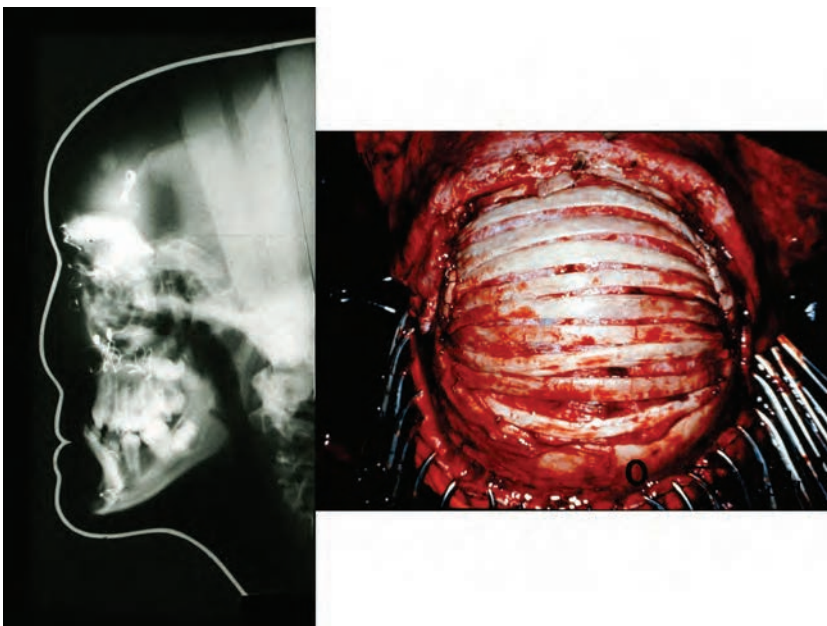


Fig. 1-23 Patients lateral skull radiograph after removal of cranial plate due to infection plus view of reconstruction of skull defect with 14 half ribs.

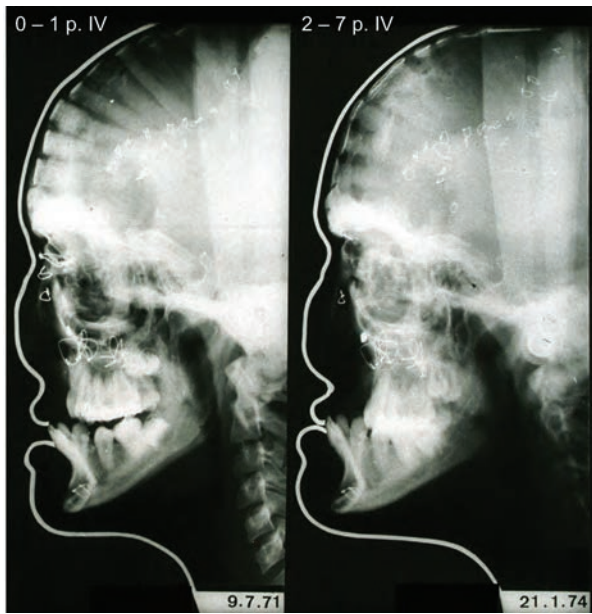


Fig. 1-24 Lateral skull view with slight retromaxillism on the left side and 2.5 years later with severe facial deformity.

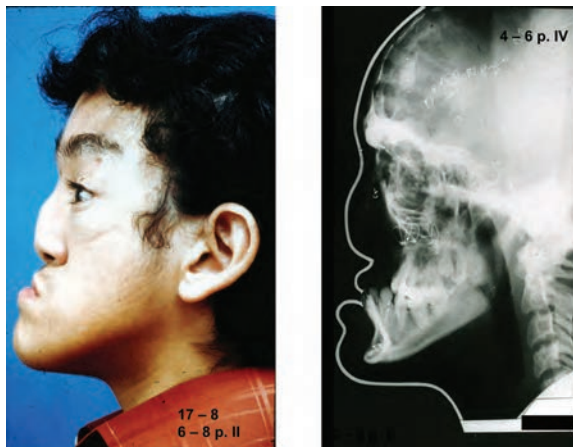


Fig. 1-25 Patients profile at age 17 years and 8 months and his lateral radiograph at age 18.

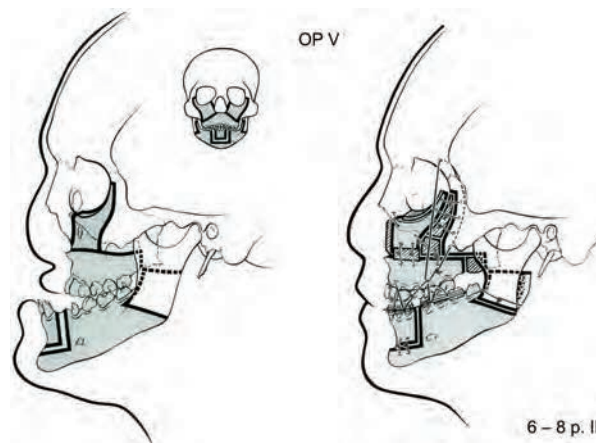


Fig. 1-26 Drawings of the skeletal situation and the planned correction.

(Obwegeser and Makek, 1986).³⁰ The relapse following Schuchardt's procedure for correction of an anterior open bite due to the inferior position of the lateral maxillary alveolar segments is probably due to the fact that the maxillary sinuses are reduced in their size, without an additional connection to the nasal cavity. That was John Hovell's explanation when I discussed the problem with him; I think he was right. Muscular force may be another cause for relapse, certainly in cases with greater neuromuscular aetiology.

Special instruments

For all the procedures that I have developed, I also developed special instruments in order to make the surgery less difficult. These instruments facilitate the surgery to a great extent. For me, it was mandatory for these instruments to be available when I was operating. These surgical instruments are sold all over the world by various companies as 'Obwegeser Instruments'. Most of them are of no use in my hands as they have been altered from my original designs. Only the Medicon Company (in Tuttlingen, Germany) and KLS-Martin-Company (also in Tuttlingen, and in Jacksonville, PO Box 50249, Florida 32250-0244 USA) have asked me to check their instruments from time to time to guarantee permanent best quality according to my original designs.

The same is true with the surgical hand piece for the drill burr. The usual hand pieces are too short for our work in the depth of our operating fields. I asked W & H Dentalwerk Bürmoos (GmbH, Austria, 5111 Bürmoos), a famous Austrian hand piece producer for drill burrs, to make a longer hand piece, which can hold any burr with a shaft of 2.35 mm diameter. They were able to make it to my great satisfaction. I recommend it very much for working on the skull, in particular for the sagittal splitting technique. The same company also produces a special electro motor for use in surgery in the operating room.