DONACION 25 ENE. 2000

A

Second Edition

BIBLIOTECA A.A.O.T.

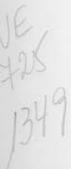
# Clinical Biomechanics Of Spine

Augustus A. White III, MD, DMed Sci

Professor of Orthopedic Surgery Harvard Medical School; Orthopedic Surgeon-in-Chief Beth Israel Hospital Boston, Massachusetts

Manohar M. Panjabi, PhD, DTech

Professor of Orthopedics and Rehabilitation, and Mechanical Engineering Director of Biomechanics Research Yale University School of Medicine New Haven, Connecticut





1990

#### Contents

#### 1

# Physical Properties and Functional Biomechanics of the Spine • 1

Manohar M. Panjabi and Augustus A. White III

- 3 . Intervertebral Disc
- 19 . Spinal Ligaments
- 28 . The Vertebra
- 45 . Functional and Multisegmental Spinal Unit
- 55 . Mathematical Models
- 56 . The Rib Cage
- 58 Spinal Muscles
- 67 . The Spinal Cord
- 71 . Nerve Roots
- 74 . Clinical Biomechanics
- 76 . Notes

#### 2

#### Kinematics of the Spine • 85

- 86 . Terms and Definitions
- 90 . Kinetics and Muscle Activity
- 92 . The Occipital-Atlanto-Axial Complex (C0-C1-C2)
- 97 The Middle and Lower Cervical Spine (C2-T1)
- 102 . The Thoracic Spine
- 106 . The Lumbar Spine
- 112 . The Sacroiliac Region
- 115 . Comparison of Regional Characteristics and Variations
- 118 · Age, Sex, and Spine Kinematics
- 119 Disease and Spine Kinematics
- 120 . Clinical Biomechanics
- 121 Notes

#### 3

#### Practical Biomechanics of Scoliosis and Kyphosis • 127

Augustus A. White III and Manohar M. Panjabi

128 .	PART	1:	SCOL	JOSIS

- 128 . Anatomic Considerations
- 128 . Normal Kinematics
- 130 . Biomechanical Definition of Scoliosis
- 131 Etiologic Considerations
- 136 Biomechanical Considerations Involved in Prognosis
- 138 Prevention
- 138 Biomechanical Considerations Involved in Treatment
- 145 . Mechanics of Different Treatment Methods
- 155 . Conclusions

#### 155 . PART 2: KYPHOSIS

- 155 . Anatomic Considerations
- Biomechanical Definition of Thoracic Kyphosis
- 156 Etiologic Considerations
- 158 · Prognosis
- 160 . Treatment of Thoracic Kyphosis
- 162 . Spine Deformities-Traditional and Future
- 163 . Clinical Biomechanics
- 163 . Notes

#### 4

#### Practical Biomechanics of Spine Trauma • 169

- 170 . General Clinical Considerations
- 170 . Mechanism of Injury
- 172 Update of Research Studies of Spine Trauma
- 183 Summary and Conclusions
- 184 . Some Cogent Studies of Spinal Cord Trauma
- A Systematic Approach to Analysis of Mechanism of Injury and Classification of Spine Trauma
- 192 Review of Some Specific Cervical Spine Injuries
- 224 Flexion Injuries
- 227 . Acute Post-Traumatic Cervical Disc Herniation
- 229 Extension Injuries
- 242 . Clay Shoveler's Fracture
- 244 Review of Some Specific Thoracic and Lumbar Spine Injuries
- 258 Review of Special Injuries to the Spine
- 265 Clinical Biomechanics
- 267 . Notes

5

# The Problem of Clinical Instability in the Human Spine: A Systematic Approach • 277

- 278 Introduction
- 283 PART 1: OCCIPITAL-ATLANTO-AXIAL COMPLEX (C0-C1-C2)
- 283 Occipital-Atlantal Joint (C0-C1)
- 283 Biomechanical Factors
- 285 Clinical Considerations
- 287 Atlanto-Axial Joint (C1-C2)
- 287 Anatomic Considerations
- 292 Biomechanical Factors
- 293 Clinical Considerations
- 302 Recommended Evaluation System
- 302 Recommended Management
- 302 PART 2: THE MIDDLE AND LOWER CERVICAL SPINE (C2-T1)
- 303 Anatomic Considerations
- 303 Biomechanical Factors
- 304 Clinical Considerations
- 309 Treatment Considerations
- 314 Recommended Evaluation System
- 323 Twelve Significant Signs of Cervical Spine Trauma
- 324 Recommended Management
- 327 PART 3: THE THORACIC SPINE (T1-T10) AND THE THORACOLUMBAR SPINE (T11-L1)
- 328 Anatomic Considerations
- 329 Biomechanical Factors
- 330 Clinical Considerations
- 333 Treatment Considerations
- 338 Recommended Evaluation System
- 339 Recommended Management
- 342 PART 4: THE LUMBAR AND LUMBOSACRAL SPINE (L1-S1)
- 342 Anatomic Considerations
- 345 Biomechanical Factors
- 349 Spinal Stenosis and Instability
- 349 Spondylolysis, Spondylolisthesis, and Instability
- 351 Treatment Considerations
- 351 Recommended Evaluation System
- 360 Recommended Management
- 362 Part 5: THE SACROILIAC JOINT AND PUBIS
- 362 Anatomic Considerations
- 362 Biomechanical Factors
- 364 Clinical Considerations
- 365 Recommended Evaluation System

#### 366 • PART 6: SOME THEORETICAL CONSIDERATIONS ON THE BIOMECHANICS OF INSTABILITY

- 366 Displacement
- 366 . Ligaments and Stability
- 368 Displacement and Cord Encroachment
- 369 . Conclusion
- 370 . Clinical Biomechanics
- 373 . Notes

#### 6

#### The Clinical Biomechanics of Spine Pain • 379

Augustus A. White III and Manohar M. Panjabi

- 380 Etiologic Considerations
- 407 Diagnostic Considerations
- 422 . Treatment of Spine Pain
- 454 · Prophylaxis and Ergonomics
- 462 . Clinical Biomechanics
- 465 . Notes

#### 7

# Spinal Braces: Functional Analysis and Clinical Applications • 475

Augustus A. White III and Manohar M. Panjabi

- 476 . Historical Background
- 477 . Functions of Spinal Orthoses
- 478 Biomechanical Factors
- 483 Clinical Review of Spine Regions and Their Specific Orthoses
- 504 . Conclusion
- 506 . Clinical Biomechanics
- 507 Notes

#### 8

## Biomechanical Considerations in Surgical Management of the Spine • 511

- 512 PART 1: SURGICAL DECOMPRESSIONS
- 514 . Decompression in the Cervical Region
- 524 . Decompression in the Thoracic Region
- 525 . Decompression in the Lumbar Region
- 527 Guidelines for Selecting a Surgical Procedure

- 528 PART 2: SPINE FUSIONS
- 528 . Clinical Biomechanics of Spine Fusion
- 541 Evaluation of Constructs in the Occipitocervical Region
- 542 Evaluation of Surgical Constructs in the Upper Cervical Spine
- 547 Evaluation of Surgical Constructs in the Middle and Lower Cervical Spine
- 558 Evaluation of Surgical Constructs in the Thoracic Spine
- 559 Evaluation of Surgical Constructs in the Lumbar and Sacral Spine
- 565 Spinal Fusions in the Management of Primary and Metastatic Tumors
- 568 Some Guidelines on the Biomechanics of Postoperative Management of Patients Undergoing Spinal Fusions
- 570 PART 3: SURGICAL CONSTRUCTS EMPLOYING METHYLMETHACRYLATE
- 570 . Biomechanical Factors
- 574 Principles and Indications for the Use of Methylmethacrylate
- 574 Analysis of Some Specific Constructs
- 579 PART 4: BIOMECHANICAL CONSIDERATIONS IN THE ART AND SCIENCE OF SPINE INSTRUMENTATION
- 580 . Wires, Mesh, and Screws
- 582 . Spinal Implants
- 587 Cervical Spine Implants: C0-C7
- 589 . Synopsis of Spine Implants: C0-C7
- 590 . Thoracic, Lumbar, and Lumbosacral Spine Implants
- 608 Sacroiliac Joints and Pelvis
- 608 Synopsis of Spine Implants: T1-S1
- 608 . Tongs and Traction
- 610 . Generalizations on Implant Prototypes
- 619 PART 5: AN ANALYSIS OF THE MECHANICS OF SPINE OSTEOTOMIES
- 619 . Basic Osteotomy
- 619 Cervical and Cervicothoracic Osteotomy
- 620 . Lumbar Spine Osteotomies
- 622 · Clinical Biomechanics
- 625 Notes

9

Biomechanics A to Z • 635

Manohar M. Panjabi and Augustus A. White III

Author Index • 697

Subject Index • 703