

Subject Index

A

Alloys

- nickel, 10-18
- shape memory alloy, 10-18
- titanium, 10-18, 75-78

Aluminum bone tube models, 12-18

Araldite disks, 14-18

ASTM Committee F-4

- Medical and Surgical Materials and Devices, 1-2

ASTM Standard F 383, 3-9

- modifications of, 9

Axial strain, 29-33, 68-78, 80-85

- versus rod geometry, 90-98

B

Bending tests

- ASTM Standard F 383, 4, 7-8
- critique of, 26
- effect of hole, 5-8
- four-point method, 22-23
- Grosse-Kempff nail, 60-64
- interlocking versus noninterlocking rods/nails, 54-59, 60-64, 68-78
- Küntschner nail, 5-6, 7-9
- rod geometry, 89, 92-94
- shape memory alloy nail, 10, 15-18
- various rods/nails, 22-23, 68-78, 92-94

Biomet Interlocking rod, 67

- insertion, 75
- stiffness measurements, 75-78

Bone loss, 63-64

Bones plates

- versus intramedullary rods, 87

Bone tubes, artificial, 12-18, 66-78

Brooker-Wills rod, 67

- axial strain, 80-85
- bending tests, 60-64
- clinical evaluation, 119-128, 130-135
- cyclic loading, 45-51, 82-83
- insertion, 69, 75, 119-128
- stiffness measurements, 45-51, 68-78
- strength, 45-51
- torsion tests, 45-51, 60-64, 80-85

C

Clinical evaluations

- Brooker-Wills rod, 119-128, 130-135

Ender nail, 161-174

femur nonunions, 154-160

Grosse-Kempff rod, 130-135, 181-188

Hansen-Street nail, 152-153

Küntschner nail, 130-135, 143-151, 154-160

nail impaction versus interlocking nailing, 130-135

Rush pin, 175, 179-180

Complications

intraoperative

Brooker-Wills rod, 119-128

case histories, 98-101

effect of reaming, 112-117

Hansen-Street nail, 153

Küntschner nail, 112-117

Küntschner Y-nail, 146-148

nail impaction versus interlocking nailing, 132-135

Schneider nail, 112-117

Zickel nail, 36-37

postoperative

Brooker-Wills rod, 121-128, 132-133

case histories, 98-101

effect of reaming, 112-117

Ender nail, 168-169

Grosse-Kempff rod, 132-133, 183-188

Hansen-Street nail, 153

hip fractures, 146-148

Küntschner nail, 132-133

nail impaction versus interlocking nailing, 132-135

Rush pin, 180

Schneider nail, 112

Computer programs

for nail geometry, 88-89, 92

for Zickel nail insertion, 37-42

Cross-nailing (*see* Distal locking rods; Interlocking rods/nails)

D

Deformation

shape memory nail, 10-18

Diameter, reamed bone hole, 93-96

Diameter, rod/nail

effect on rigidity, 3-9

effect on strength, 3-9

Distal locking rods (*see also* Interlocking

Distal locking rods (*cont.*)
rods/nails mechanical testing of), 44-51, 80-85

E

Ender nail, 67
insertion of, 68, 162, 168-169
postoperative complications, 168
rigidity of, 68-78
Extraction of rod, 10-18, 41

F

Femoral bursting, 41-42, 87-105, 133
case histories, 98-104
Femur
aluminum model of, 12-18
cadaver specimens, 21-24, 27-29, 45-51, 53-59, 80-85, 89-98
fractures of (*see* Fractures, femur)
plastic model of, 66
Fixation
dynamic, 28-33
static, 28-33, 53-59
Fracture callus, 115-116
Fractures
femur, 35, 41, 98-100, 109-111, 120, 152-153, 175-180, 181-188
comminuted versus uncomminuted, 108-117
intraoperative, 41-42, 87-105, 133
nonunion of, 154-160
hip, 137-151, 161-174
peritrochanteric, 162-166
subtrochanteric, 35, 102
unstable, 65-66

G

Geometric modeling
femur, 37
insertion, Zickel nail, 37-42
Grosse-Kempf nail, 67
axial strain tests, 29-33
bending tests, 60-64
clinical evaluation of, 130-135, 181-188
complications, postoperative, 108, 183-188
failures, 183
physiological loading, 54-59
rigidity of, 45-51, 75-78
shear strain tests, 28-33
stiffness measurements, 68-78
strength, 45-51
torsion tests, 45-51, 54-59, 60-64, 80-85

H

Hansen-Street nail
clinical evaluation, 152-153
insertion, 152-153
Hip
fractures, 137-151, 161-174
Hoop stress, 90-98

I

Impaction, nail, 132-135
Insertion (*see also* Reaming)
Brooker-Wills rod
intraoperative complications, 119-128
operative procedure, 121
computer-aided design of, 37-42
Ender nail, 162, 168-169
Hansen-Street nail, 152-153
Küntscher nail, 112-117
Küntscher Y-nail, 139-143
laboratory simulation
various rods/nails, 10-18, 68-75, 85-98
Zickel nail, 37-42, 68-75, 85-98
Rush pin, 175-179
Schneider nail, 146-148
shape memory alloy nail, 10-18
Zickel nail, 68-75, 85-98
computer-aided design of, 37-42
intraoperative complications, 36-37
Interfaces, fracture
movement of, 53-59
Interlocking rods/nails (*see also* Biomet rod; Brooker-Wills rod; Distal locking rods; Grosse-Kempf nail; Russell-Taylor nail; Titanium alloys; Utah nail; Williams Y-nail; Zickel nail)
versus noninterlocking, 28-33, 54-59, 60-64, 67-78, 130-135

Intramedullary rods/nails
clinical evaluation, 98-100, 108-117, 119-128, 130-135, 137-151, 152-153, 154-160, 161-174, 175-180, 181-188
geometry of, 88-89, 92, 105
laboratory testing, 3-9, 10-18, 20-24, 26-33, 44-51, 53-59, 60-64, 65-78, 80-85, 87-105

K

Knee pain
postoperative complication, 168
Küntscher nail
bending tests, 4-9
clinical evaluation, 108-117
cyclic loading, 8

rigidity tests, 4-8, 68-78
torsion tests, 4-6
used for femur nonunions, 154-160
used for trochanteric fractures, 137-151
 biomechanical evaluation, 138-139
 nail plate comparison, 138-139

L

Loading

cyclic
 Brooker-Wills nail, 45-51, 82-83
 Grosse-Kempf rod, 45-51, 82-83
 Küntscher nail, 8
 Utah nail, 82-83
physiological
 Grosse-Kempf nail, 27-33, 54-59
 interlocking versus noninterlocking
 rods/nails, 66, 68-78
 Russell-Taylor nail, 27-33, 54-59

Loosening

nails in osteoporotic bone, 44-51

M

Manufacturers

design input, rods/nails, 1
role in standardization, 1

Model, bone, 12-18, 66-78

N

Nail plate repair

hip fractures, 138-139

Nickel alloys, 10-18

Nonunions, fracture

intramedullary nailing of, 154-160, 156-159

O

Operative procedures

Brooker-Wills rod, 121, 131
complications of (*see* Complications)
Ender nail, 162, 168-169
Grosse-Kempf rod, 131
Hansen-Street nail, 152-153
Küntscher Y-nail, 131
reaming, 111-112
Rush pin, 175-179

Operative table

Maquet, 111
modified Berivon, 176-177

Osteoporosis, 48-49

hip fractures, 137-139, 145-148, 161-174
rod loosening, 44-51

Osteosynthesis

shape memory alloy rods, 10-18

P

Penetration tests, 23-24, 90, 92-98

Physiological loading, 26-33, 54-59, 66, 76-78

Plastic bone model, 66, 68-78

Pseudoarthroses, 154-160

Push-out forces (*see also* Penetration tests), 90

R

Reaming (*see also* Insertion)

bone canal diameter, 93-95
clinical evaluation
 fracture callus formation, 115-116
 Küntscher nail, 108-117
 Schneider rod, 108-117
penetration tests, 23-24, 93-96

Rigidity tests

Grosse-Kempf rod, 46-51, 68-78
interlocking versus noninterlocking rods/
 nails, 60-64, 68-78
Küntscher nail, 4-8, 68-78
osteoporotic versus normal bone, 46-51
rod/nail geometry, 89, 92-93

Rosette strain gage, 28-33

Rush pin

clinical evaluation, 175-180
operative procedure, 176-179

Russell-Taylor nail, 67

axial strain; 28-33
dynamic/static fixation, 28-33
insertion, 75
physiological loading, 27-33
shear strain, 28-33
stiffness measurements, 68-78
torsion tests, 54-59, 68-78

S

Sampson rod, 67

insertion, 69
stiffness measurements, 68-78
torsion tests, 68-78

Schneider nail

clinical evaluations, 108-117
intraoperative/postoperative complications, 112

Shape memory alloy, 10-18

Shear strain, 28-33

Silicon heater

for experimental nail deformation, 10

Slotted cloverleaf nail, 67-78
 Slotted versus unslotted nails
 mechanical testing of, 54-59
 Spring-back angle, 23-24, 46, 62-63
 Stainless steel pin, 175-180
 Standardization
 medical/surgical equipment
 ASTM Committee F-4, 1-2
 ASTM Standard F 383, 3-9
 static bend and torsion testing of intramed-
 ullary rods
 ASTM Standard F 383, 4
 Starting hole
 and femur perforation, 97-98, 101-105
 Stiffness (*see* Rigidity tests)
 Strain gages, 28-33
 Strength
 distal locking rods/nails, 45-47, 50-51
 Küntscher nail, 8
 osteoporotic versus normal bone, 45-51

T

Temperature, elevated
 shape memory alloy nail deformation, 10,
 12, 15-18
 Test methods (*see* ASTM Standard F 383; Ax-
 ial strain; Bending tests; Computer
 programs; Geometric modeling; Hoop
 stress; Loading; Penetration tests; Ri-
 gidity tests; Shear strain; Spring-back
 angle; Torsion tests)
 Titanium alloy nail, 10-18, 67
 insertion, 75
 stiffness measurements, 75-78
 Torsion tests
 ASTM Standard F 383, 4
 Brooker-Wills rod, 80-85
 critique of, 26

Ender nail, 68-78
 Grosse-Kempf nail, 45-51, 54-59, 60-64,
 68-78, 80-85
 interlocking versus noninterlocking rods/
 nails, 54-59, 60-64, 68-78
 Küntscher nail, 4-6
 osteoporotic versus normal femurs, 45-47,
 50-51
 rod/nail geometry, 89, 92-94
 Russell-Taylor nail, 54-59, 68-78
 testing method, 23
 Utah nail, 80-85
 various rods/nails, 54-59, 68-78, 89, 92-
 94
 Zickel nail, 68-78
 Trauma patients, 120-121, 131-133, 175,
 182

U

Utah nail
 axial strain, 80-85
 cyclic loading, 82-83
 torsion tests, 80-85

W

Walking gait
 and laboratory testing, rods/nails, 26-33,
 66, 76-78
 Williams Y-nail, 67
 insertion, 75
 stiffness measurements, 68-78

Z

Zickel nail, 67
 insertion, 36-42, 69
 stiffness measurements, 68-78