

Physical Therapy
for patients after spinal surgery
with internal fixation devices

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- *After* spinal surgery, patients want to know when they are allowed to sit, to walk without a crutch, or to carry a weight.
- Physical Therapy consultation is one of the immediate postoperative managements.
 - Dwyer AP. Preoperative planning. In Watkins RG. Manual of internal fixation of the spine

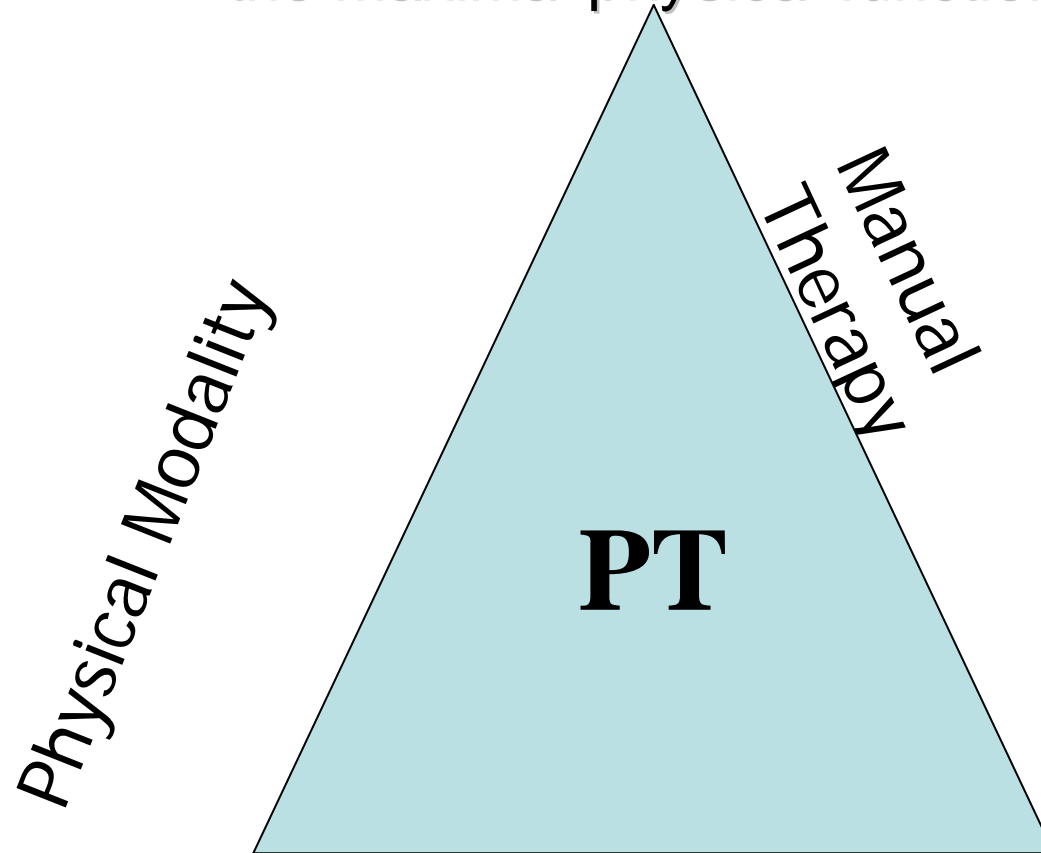


Individualized physical therapy

- help the joints and the muscles involved regain the movement in relation to an individual's body type and physical activities
- work in the best way with the newly operated spine.
- Physical therapists are trained to be sure to select movements that can be done safely around the surgery.



To provide the capability to recover
the maximal physical functions



Movement Therapy



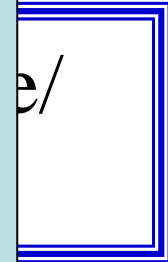
Phases of physical therapy intervention

- To educate the patient
- To promote healing of injured tissues
- To restore soft tissue, muscle, and/or joint mobility
- To develop neuromuscular control, muscle endurance, and strength in involved and related muscles
- To maintain integrity and function of associated areas

- To control pain
- To maintain range of motion
- To reduce swelling
- To maintain cardiovascular endurance
- To progress functional activities
- To educate the patient
- To increase soft tissue, muscle and /or joint mobility
- To improve neuromuscular control, muscle endurance, and strength
- To improve cardiovascular endurance
- To progress functional activities

Protection phase /

Acute stage



Physical agents

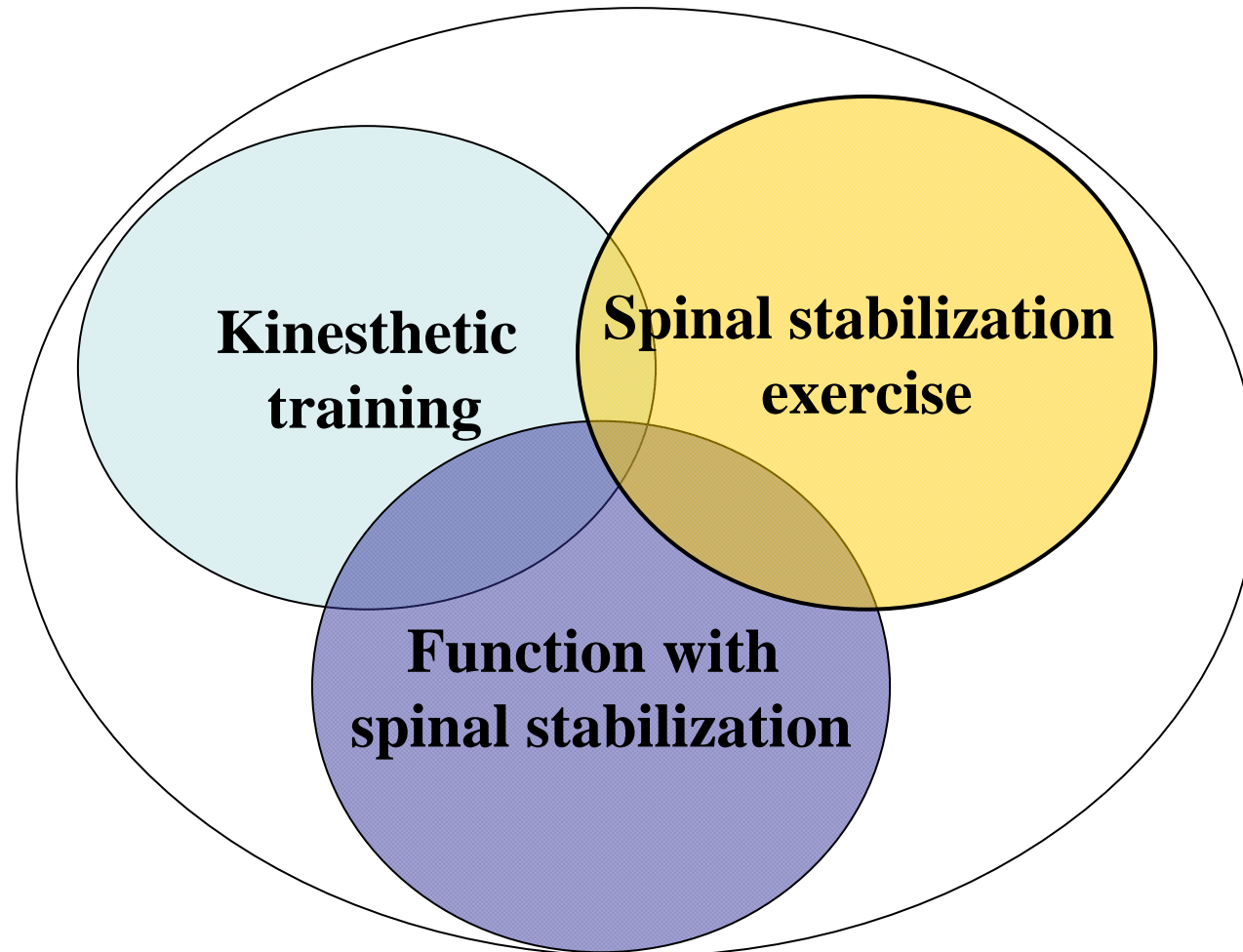
- Protection phase
 - **To control pain, edema, spasm**
 - Controlling pain is an important first step in allowing patients to regain their strength
 - **Ice**
 - **TENS**
- Controlled motion phase
 - **To promote healing of injured tissues**
 - **Warning:**
No modalities causing heat accumulated

Manual therapy

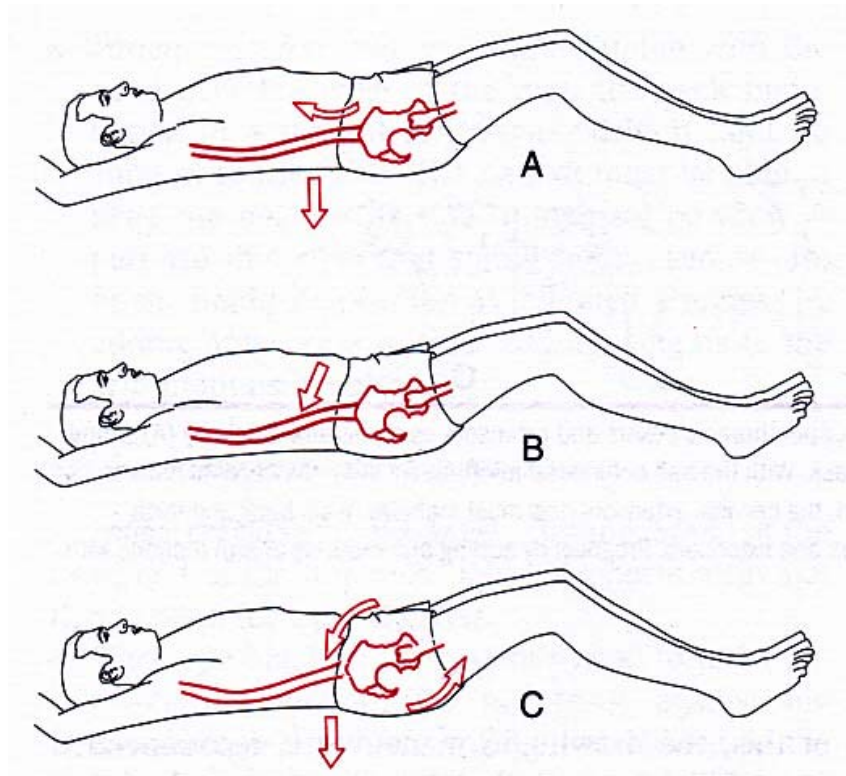
- Protection phase
 - To control pain, edema, spasm
 - Static contact
 - Superficial stroking
 - Muscle relaxation
 - Myofascial release
- Controlled motion phase
 - To promote healing of injured tissues
 - To restore soft tissue, muscle, and/or joint mobility
 - Myofascial release
 - Direct fascial technique
 - Deep friction massage

Movement therapy

Core stabilization

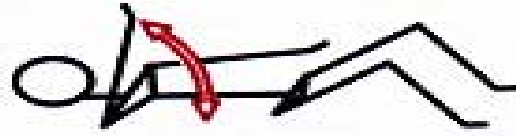


Activation of the stabilizing musculature in the lumbar spine

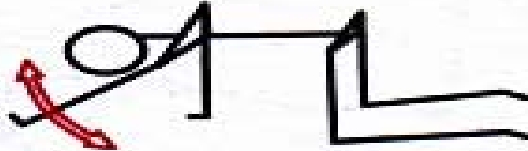


- Transversus abdominis
- Multifidus
- Contracting the abdominal or back muscles in a supine position strongly increased the implant loads

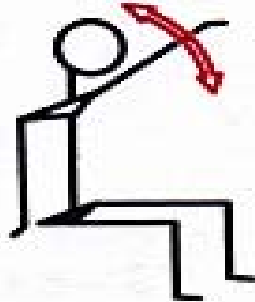
Supine,
hooklying



Quadruped

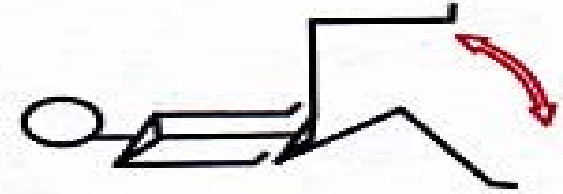


Sitting

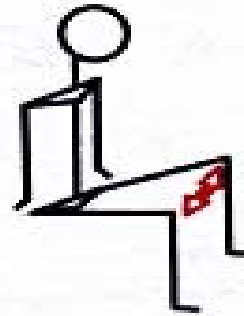


A

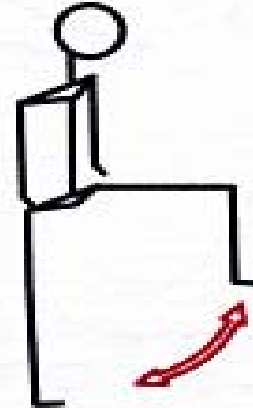
Supine,
hooklying



Sitting

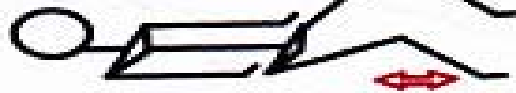


Standing

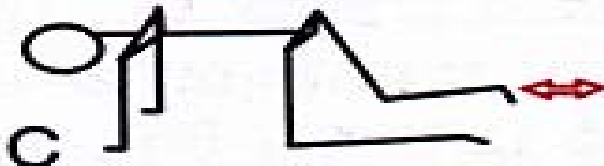


B

Supine,
hooklying



Quadruped



C



D Supine, hooklying



To educate the patient

- Safe progressions of exercise and stretching
- To avoid reinjury the part
- Safe body mechanics
- Ergonomic consultation



Safe body mechanics

- **Loads on an Internal Spinal Fixation Device During Physical Therapy**
- Antonius Rohlmann, Friedmar Graichen, and Georg Bergmann
- Physical Therapy Volume 82 · Number 1 · January 2002



Internal fixation devices

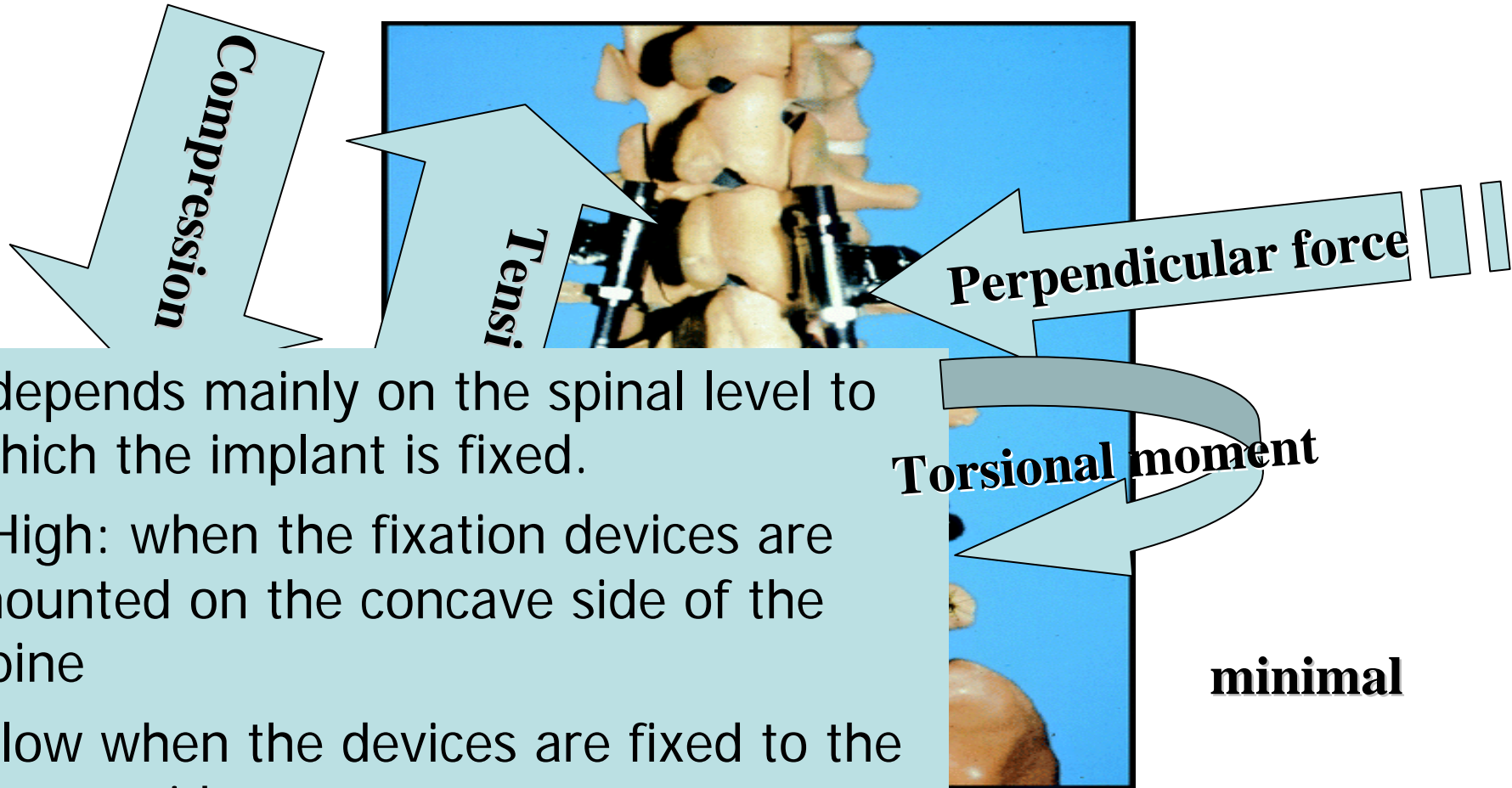
- A telemeterized implant
- degenerative instability or compression fractures
- anterior interbody fusion
- 1 or 2 intervertebral disks are removed and replaced by autologous bone grafts from the iliac crest.



Pedicle Screw breakage

- 6% to 7%
 - a major complication associated with internal spinal fixation devices.
- fail through fatigue fractures after a great number of loading cycles
- in most cases the implant loads stay nearly constant in the postoperative temporal course.
- Can occur more than half a year after surgery
- Not prove that fusion has not occurred.
- Even after fracture healing, the implants may be highly loaded.

the force components acting on the implant

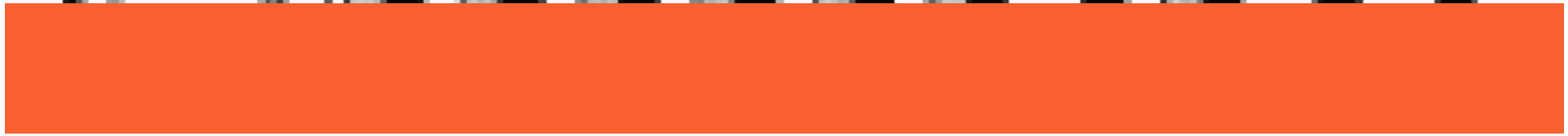
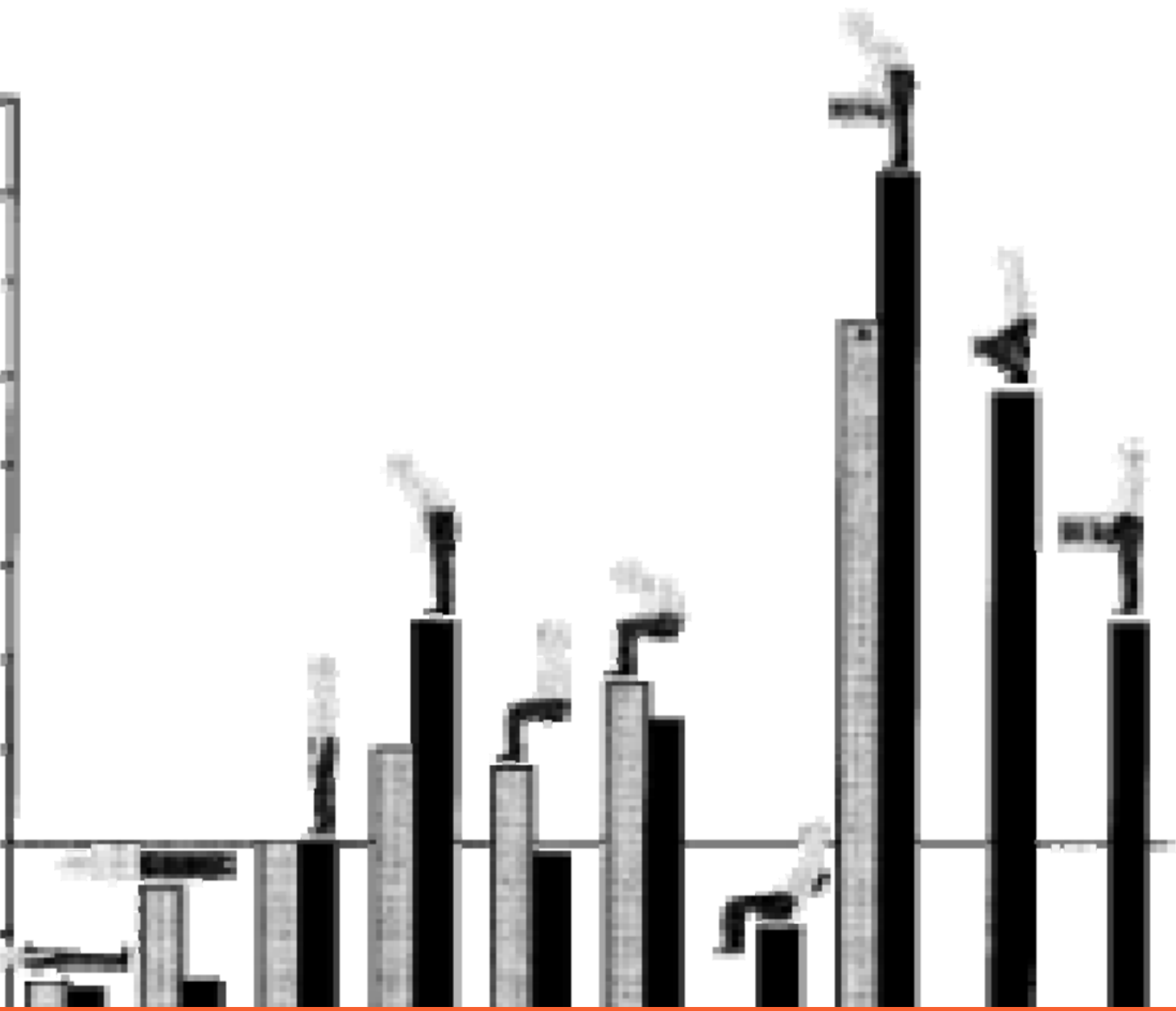


- depends mainly on the spinal level to which the implant is fixed.
- High: when the fixation devices are mounted on the concave side of the spine
- low when the devices are fixed to the convex side

minimal

Normalized to Standing in %

500
450
400
350
300
250
200
150
100
50



Bending moment

- depends mainly on the surgical procedure.
- high when the bridged region is distracted
 - when the distance of the upper and lower pedicle screws is increased
- low when it is compressed
- The implant loads are altered but not necessarily reduced due to insertion of a bone graft.

bending moments in the fixation devices
are small when the patients are lying.

- 26% for the supine position,
- 32% for the prone position,
- 34% for the side-lying position



Bending moments in the fixation devices when the patients are sitting

- 87% for sitting relaxed
- 101% sitting erect and actively straightening the back
 - back schools.
 - Muscle contraction
- the type of seats (stool, physical therapy ball, knee stool), as well as a padded wedge, has a negligible effect on the fixation device loads.



Protection phase

- To maintain integrity and function of associated areas
 - Static
 - Isometric
 - Extremities

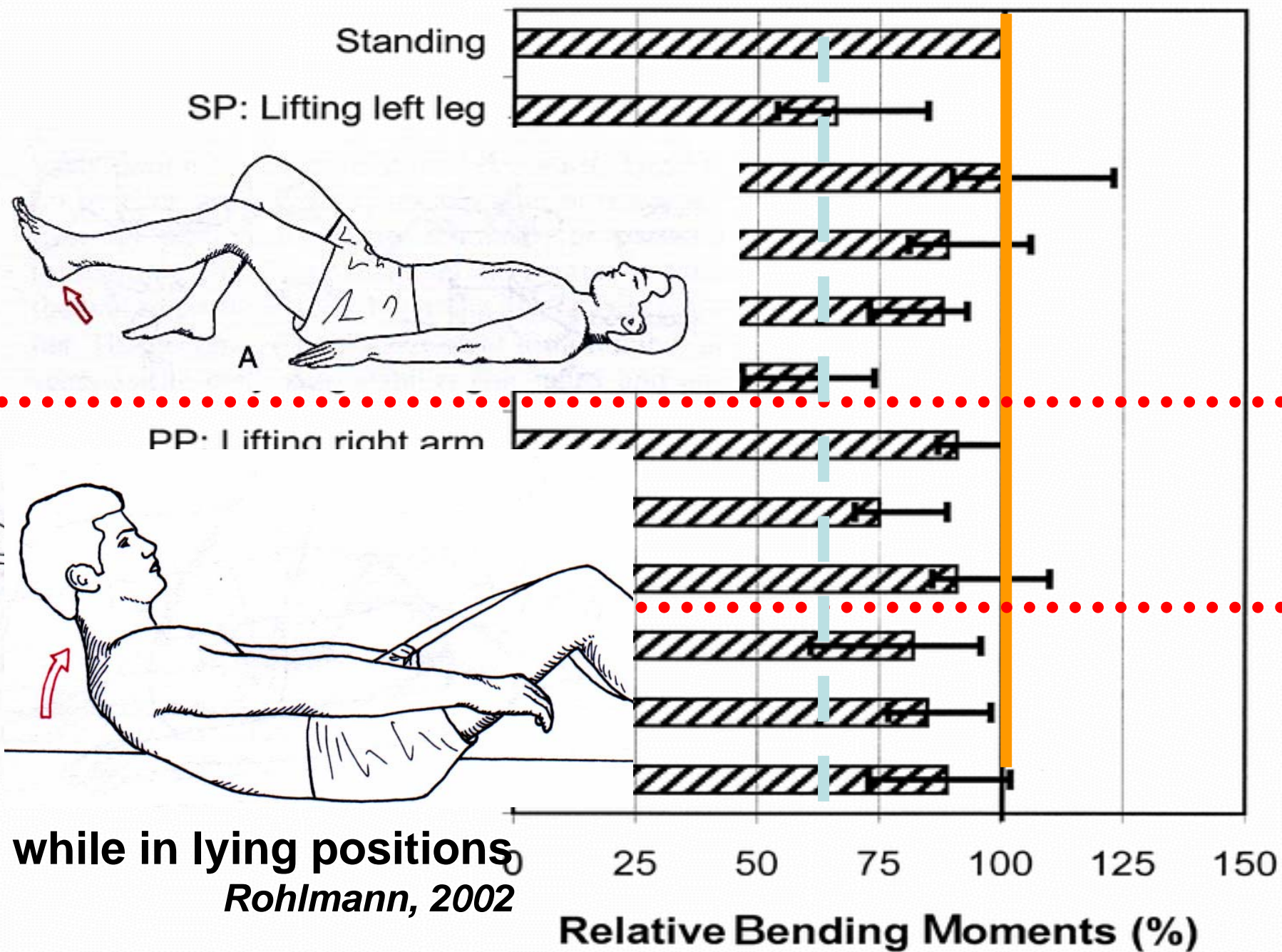


Sleeping:

- a mattress
 - high density foam rubber or polyfoam,
 - a thick plywood board, or an innerspring, extra-firm, or firm mattress
- Please do not sleep on a waterbed.
- Lie on your back,
 - place a pillow under your knees to slightly flex your knees and hips.
 - This decreases the tension on your nerve roots.
- Lie on your side, place a pillow between your legs.

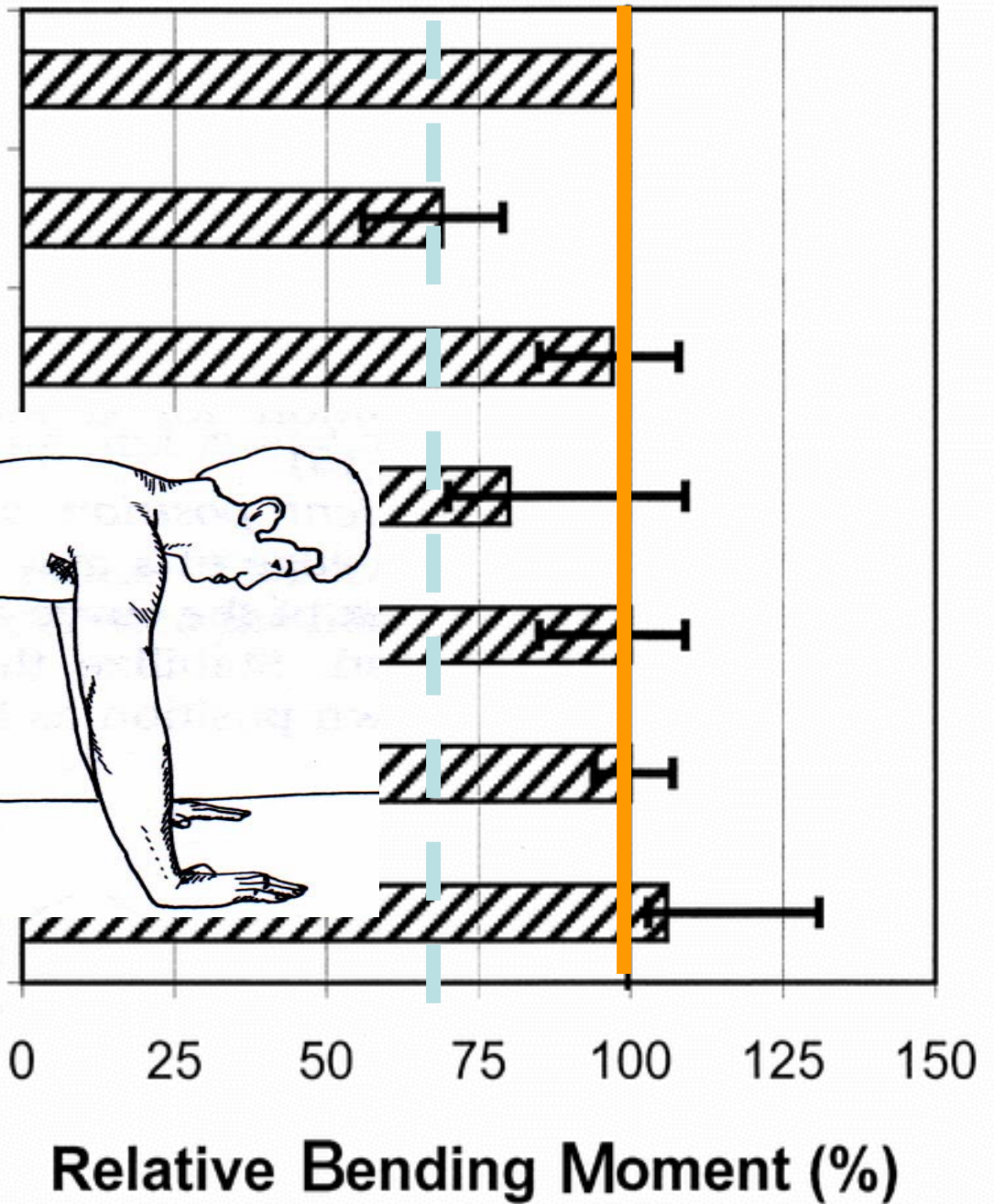
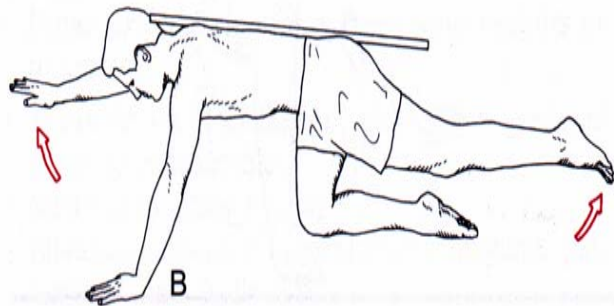
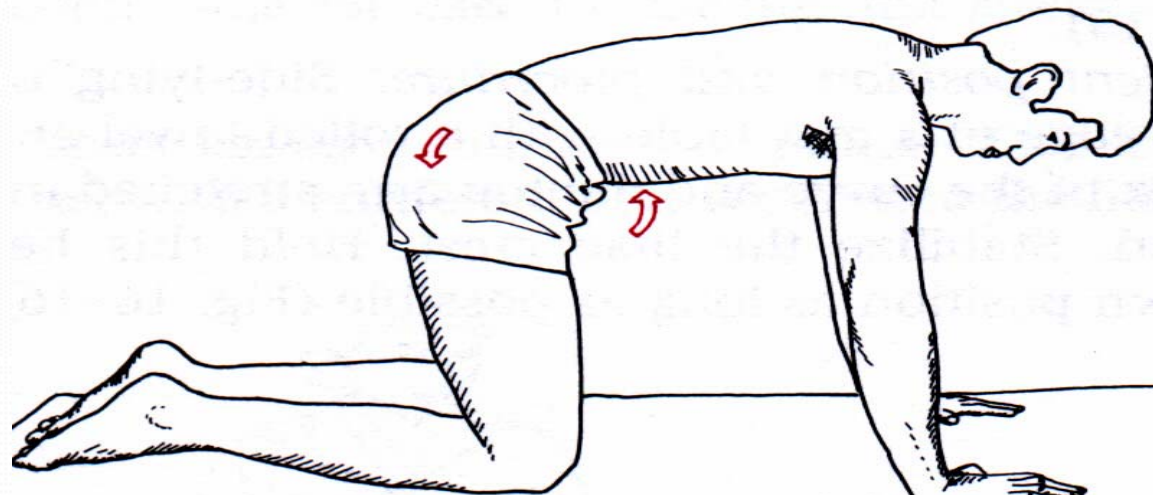
- **During this time the body is doing a lot of healing.**
- **The best rule for the first two weeks after surgery is**
 - **REST**
 - **short Walk**
 - **progressively walk around, go up and down stairs slowly**
 - **Wear the brace.**
- **must avoid sitting at all times, except for bathroom**
 - **strain on a healing spine**
 - **pressure on the wound**
 - **excessive sitting will stretch the wound, causing pain and disruption of healing.**





while in lying positions
Rohlmann, 2002

Standing (9)
 On hands and knees (9)
 Flexing lumbar spine (3)



Controlled motion phase

- **To restore soft tissue, muscle, and/or joint mobility**
- **To develop neuromuscular control, muscle endurance, and strength in involved and related muscles**
- **Dynamic**



Muscle training

- muscle facilitation
 - to gain strength
 - To provide stability following the surgery. :
- Muscles in the incision area
- Muscles weakened by nerve problems before the surgery
- Small muscles that work around each vertebra and help stabilize the spine.
 - protection



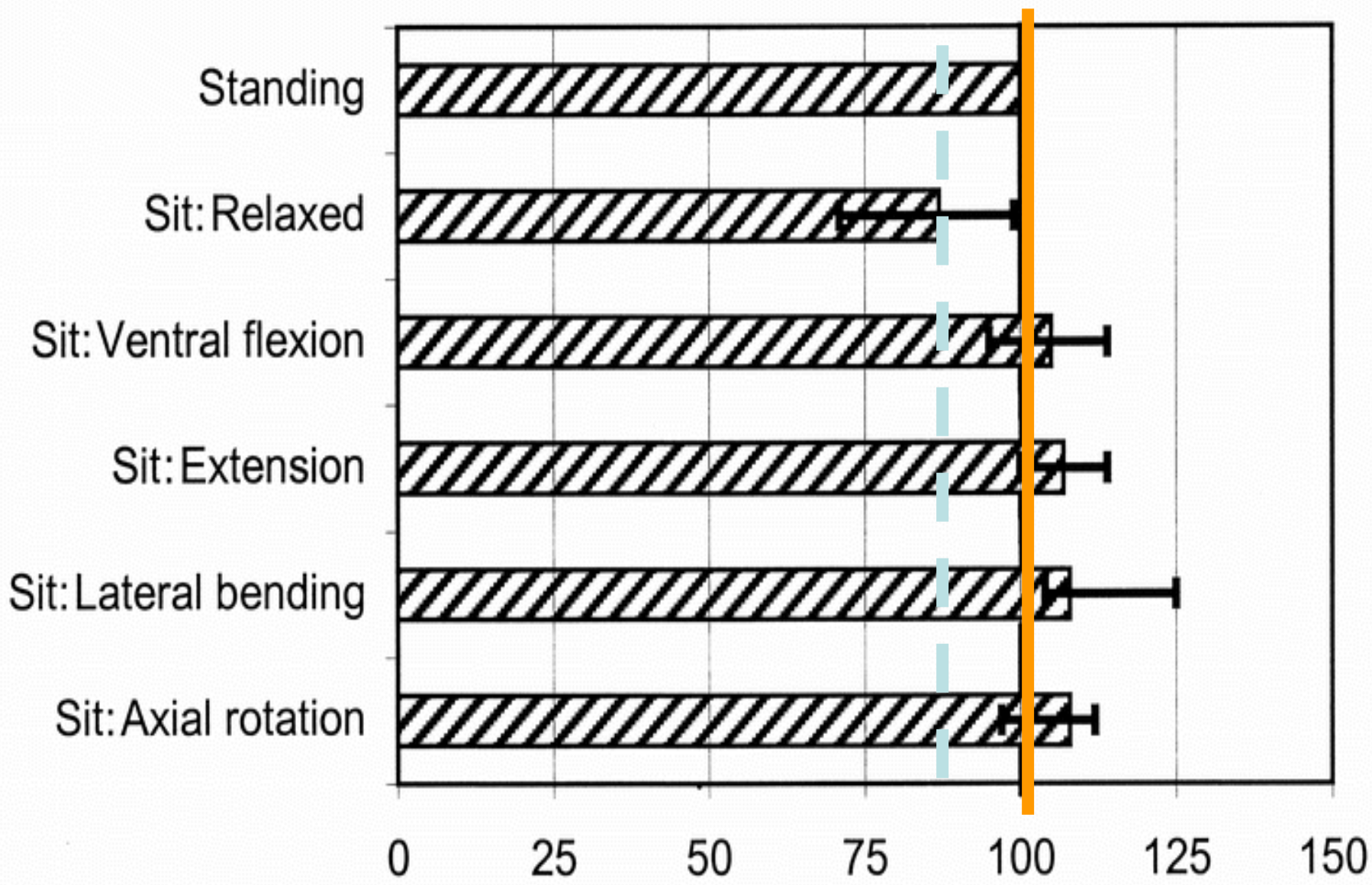
Tips

- Limit sitting to 30 minutes at a time for the next two weeks.
- Limit riding in a car
 - avoiding long trips.
 - get out and stretch 5-10 minutes every 30-45 minutes.
- DRIVING: Do not drive for 4-6 weeks.
- Keep your spine in neutral position; do not bend or twist.
- Keep everything in easy reach.
- Keep lifting to a minimum – no more than 5-10 pounds. (A gallon of milk weighs 8 pounds.)
- You may go up and down stairs.
- Perform exercises two times a day as prescribed by physical therapist

Return to function phase

- To increase soft tissue, muscle and /or joint mobility
- To improve neuromuscular control, muscle endurance, and strength
- To improve cardiovascular endurance
- To progress functional activities
- back to work and resuming more normal activities.
- Be very careful about lifting, bending and stooping.

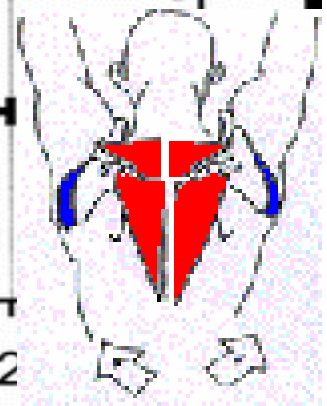
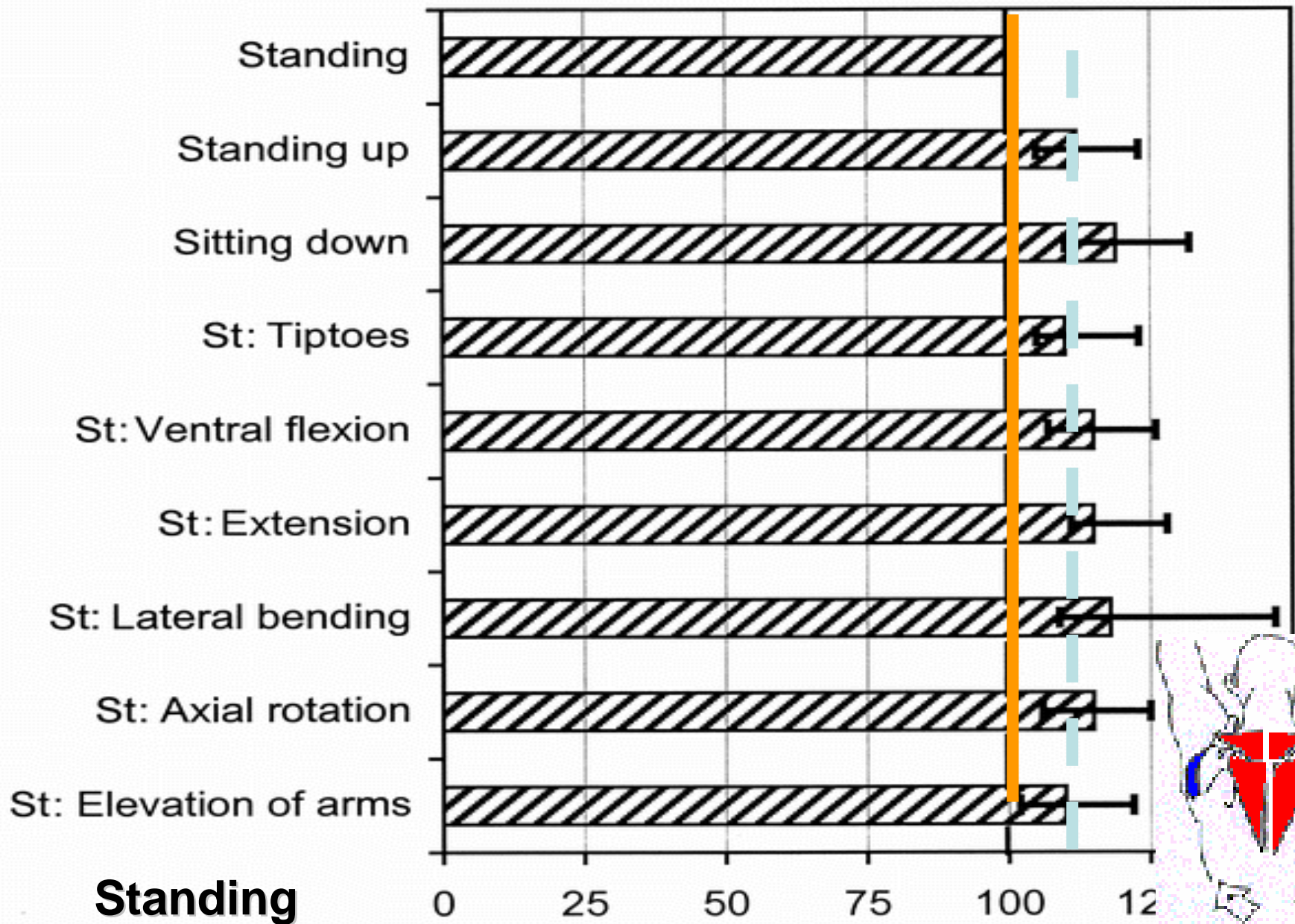




while sitting

Rohlmann, , et al. , 2002

Relative Bending Moment (%)



Standing

Rohlmann, , et al. , 2002

Relative Bending Moment (%)

Implant loads lower than for standing

- Recumbent body positions.
- Lying position
- Sitting relaxed
- Kneeling on hands and knees
- Flexing and extending the back in this position
 - not likely to increase the risk of screw breakage.



High loads

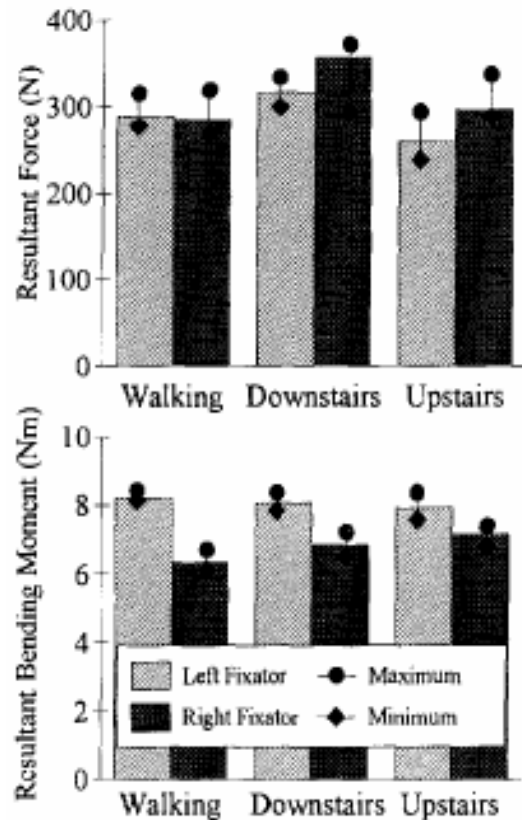
- Trunk Movements
 - Lateral bending
 - Axial rotation
 - Trunk flexion and extension
 - 111% and 120%.
- Movements of upper extremities in the standing position
- Change positions
 - Standing up
 - Sitting down
- Walking
 - The highest implant loads 128% x standing.

walking is the exercise that plays the major role concerning pedicle screw breakage

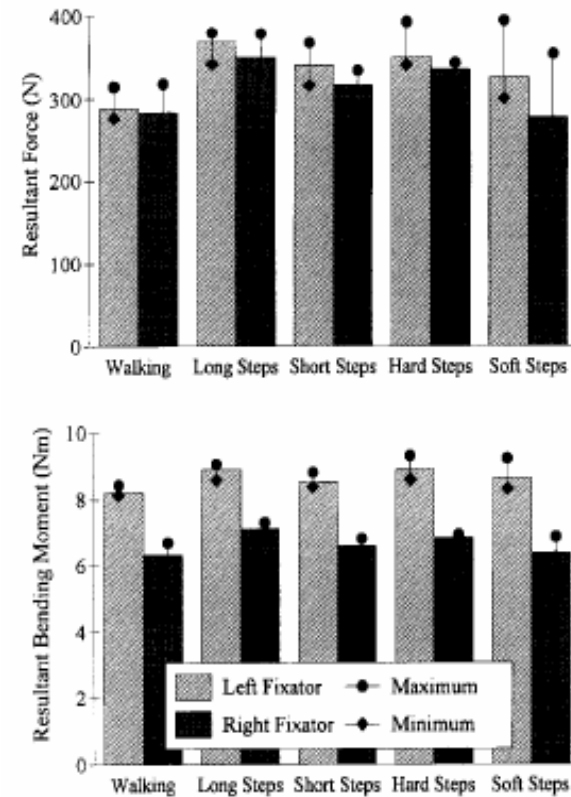


- the highest bending moments of all exercises studied
- it loads the fixation devices most frequently
- The walking speed has only a minor influence similar to those in a lying position for exercises where the spine does not have to carry the weight above
 - *Rohlmann, et al. 2002*
- Walking does not improve back strength.
- is a good exercise (?) to supplement a swimming program.

Walking, Up/down stairs



Walking with various steps



during activities such as

- hanging with the hands on wall bars,
- balancing the body on parallel bars with the legs in a vertical direction,
- hanging on the feet with the head upside down
- to nearly the same implant loads as lying in a supine position
- The pull of the partial body weight below the fixation devices is obviously compensated for by muscle forces.
- carrying a load
 - a slight effect on the bending moments in the fixation devices.

Brace (CORSET)

- The purpose of the brace is to eliminate the amount of motion that is transmitted to the spine in daily activities
- *a brace or harness does not reduce implant loads.*
- Immobilization and reduction of stress are very important to increase the probability of your fusion healing.
- The brace is to be worn at all times, except when sleeping or bathing.
- **Generally it will be worn until a good fusion is seen on x-ray. That may take from three to six months.**



Sitting:

- straight-back chairs.
- a 4-6 inch lumbar roll , a rolled-up towel or a lumbar support.
- corset or brace should suffice in maintaining the posture of your lower back.
 - prior to sitting up.
- Try not to sit longer than you are comfortable.
- Begin by sitting for approximately 30 minutes and increase this as your tolerance allows

Light Activity:

- Walking.
 - begin by walking up to 2 or 3 times daily. Start gradually, perhaps 1/8 to 1/4 mile. Increase your mileage to 1-5 miles 2-3 times a week as endurance improves.
- Lifting.
 - Do not lift over 10-15 pounds. Lift with your legs and not from your waist; remember to keep the object close to your body to decrease stress. Never lift with your legs straight and back bent forward.
- Bending and twisting are dangerous.
 - These activities significantly increase the stress on your back and may cause damage.
- Avoid strenuous pushing and/or pulling.

Aquatic exercises

- start by walking in the water.
- Do short laps in the pool with the water chest high.
- Lumbar stabilization exercise in water
 - Fundamental exercises
 - With kicks
- Aerobic exercise in water



Swimming is recommended

- **Swimming is good for rest, relaxation, and fitness.**
- **The optimal workout is approximately 45 minutes, 5 days per week.**
- **If you cannot swim**
 - **a kickboard and flippers to cruise across the pool.**
 - **the up and down flutter movements of the legs**
 - **improvement in the strength of your low back.**
- **If you are a swimmer**
 - **freestyle or backstroke.**
 - **Do not do the butterfly stroke, breaststroke or flip turns.**



Weight control

- **Many patients with back problems have a weight problem.**
- **If your abdomen is ``flabby," then your low back is ``flabby."**
- **Extra weight is a backpack sitting on your back stopping you from going forward.**
- **after one month swimming**
- **stationary bicycle each day to lose additional weight.**
- **near a mirror to be sure that your back position is straight. If you are not sure, wear your brace.**



Minimize trunk motion
Minimize trunk loading



To avoid

- lifting more than 15 pounds,
- bending at the waist, such as picking up objects off the floor
- stooping,
- kneeling, crawling and by bending forward at the waist.
- twisting motions.
- car accidents
- contact sports
- Situations that cause a fall, such as slippery and wet surfaces.

- Any patient's success in recovery from surgery depends on his or her willingness to work hard at home as well as with the therapist.
- Ideally, the surgery will take the patient a great deal of the way on the road to recovery
- The patient and therapist team can work together to make the recovery the best possible

