REHABILITATION OF THE CERVICAL SPINE

Erica Witter-Davis, DC, DACBSP®, CSCS®

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OBJECTIVE

- To determine the effects of physical therapy and exercise programs for the cervical spine
- To determine the rate and time of return to play for cervical spine injured athletes

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CERVICAL RADICULOPAHTY

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EFFECT OF EXERCISE ON CERVICAL RADICULOPATHY

- Liang et al ~ 2019 to analyze the effects of exercise for treating patients with cervical radiculopathy
- 7 databases were searched for randomized controlled trials ~ exercise alone or exercise with other treatment (conventional, massage, acupuncture)

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INCLUSION CRITERIA

- Publication must be RCT
- Participants must be patients with cervical radiculopathy
- Intervention in the treatment group was exercise (without restriction for control group)

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EXCLUSION CRITERIA

- Studies that did not meet the inclusion criteria
- Both the treatment group & control group included exercise therapy
- Studies were conducted in the form of letters, abstracts, reviews, or comments
- Studies could not extract relevant data
- The cervical radiculopathy patients were treated with surgery

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OUTCOME MEASURES

- Visual analog scale (VAS)
- Neck Disability Index (NDI)
- North American Spinal Association
  - Quality of life
  - 36- Short Form Health Survey SF-36
  - 12 –Short Form Health Survey SF-12

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STUDY CHARACTERISTICS

- References: 3786 (1738 duplicates, 1858 were excluded) 180 reviewed the full text & excluded leaving only 10 RCT
- 871 Participants
  - 424 Treatment group
  - 447 Control group
- Trial sample size ranged from 41 -192
- Intervention period was reported between 10 days – 2 months

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RESULTS

- Some evidence exists on the mechanisms of exercise providing symptom relief for cervical radiculopathy patients
- Many studies: exercise can promote analgesia in a variety of chronic musculoskeletal conditions
- Exercise can reverse and prevent the development of hyperalgesia in both neuropathic pain and muscle pain

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RESULTS

- They conclude that exercises may be effective in relieving pain in cervical radiculopathy patients
- Improvement of the cervical function was achieved by restoring the normal muscle balance through strengthening the muscles and stretching tight muscles
- Significant improvement of the NDI (Cleland et al)
  - Scapular strengthening
  - Deep neck flexor exercises

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LIMITATIONS

- Exercises could not be blinded for doctors & patients ~ may lead to unavoidable performance bias
- Exercise treatment often consists of various interventions & typically also combined with other treatments
  - Difficult to isolate the effects of a single intervention
- Meta-analysis was performed
  - Different patient groups
  - Different exercise program
  - Different follow-up periods
  - Different outcome evaluators

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RETURN TO PLAY FOR ATHLETES

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RETURN TO PLAY POST CERVICAL SURGERY

- Robben et al. ~2021 create tentative guidelines for rehabilitation & RTP after cervical spine surgery (foraminotomy, laminectomy, laminoplasty, single-level fusion, multilevel fusion) in the general athletic population
- Panel of medical practitioners – quota of 3 individuals /discipline (Neuros, Orthos, PT & Rehab. Med. Practitioners)

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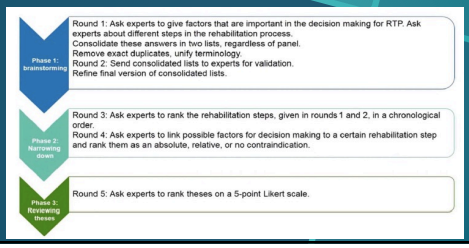
THE APPROACH

- 5 step analysis approach
  - Brainstorming phase
  - Validation phase
  - Ranking (chronological order)
  - Contraindication & criteria to start each rehab step
  - Ranking of Contraindication & criteria (5-pont)



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BRAINSTORM

1. Which factors did they think can affect the decision making for RTP after cervical spine surgery?

2. What are the different steps in the rehabilitation from operation to return to competition?

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OTHER FACTORS

1. Personality & comorbidity of the patient
2. Type of sport
3. Sporting experience pre-op (physical shape & acquired technique)
4. Fear
5. Pre/post-op signs & symptoms
6. Commitment to therapy
7. Belief (support staff)

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TABLE 2. Overview of the Accepted Theses

1. Theses concerning absolute contraindications or criteria concerning the RTP process.
Education about treatment plan and pain mechanisms must start preoperatively. Expectations must be discussed and patient beliefs must be mapped.
Medication must initially be adequate and with minimal side effect. After being comfortable during activities of daily life (ADLs), progressive reduction of pain medication can be considered.
Physiotherapy cannot be started without permission of the surgeon.
Passive physiotherapy techniques may not replace active techniques. It can be used complementary.
Manipulation techniques may not be used when there is severe osteoporosis or in case of (primary) spinal tumor or metastases.
When treating (muscular and articular) restrictions and gives, a minimal wound healing must be present and adequate rehabilitation has not spontaneously resolved these restrictions and gives.
Workload of stabilization exercises for the neck must be progressively increased.
Before continuing to functional, dynamic, and high-load exercises, sufficient neck mobility and motor control is necessary.
Return to work must not be started when there is uncontrolled pain in daily life, surgical complications, or when the patient has sedative side effect of pain medication, which could interfere with his or her job.
If necessary for the job, sufficient neck mobility and motor control must be present before returning to work.
Return to a specific sport requires sufficient low pain scores, mobility, and motor control. Previous rehabilitation steps went comfortably.
To continue to the next step in the return to specific sport process, patients must have made enough progress in the previous steps.
Restarting noncompetitive neck-loading activities requires sufficient comfort during previous steps.
Return to competition requires sufficient comfort during previous steps.
An unstable arthrodesis is always a reason to forbid return to sport.
An unstable arthrodesis is always a reason to forbid return to contact sports.
An unstable arthrodesis is always a reason to forbid high-energetic sports.
2. Theses concerning relative contraindications or criteria concerning the RTP process.
When there is a cerebrospinal fluid leak, the start of early reactivation, ADL tasks, and physiotherapy should be postponed.
Before continuing to functional, dynamic, and high-load exercises, no risk behavior should be present. Patients should be able to assess their own physical possibilities.
During return to work, the workload should increase progressively. Ergonomic changes in the environment can be made.
When starting sports hardening, functionality and pain should be kept under control.
Peer pressure from parents/team mates/trainers… should be avoided.
Financial reasons should not accelerate RTP.
In case of fear of reinjury, postponing return to competition can be necessary.
Following parameters should be considered in the RTP process: type of sport (low or high energetic, recreationally or professionally, contact or no-contact, individual or team sport, place on the field, and point-of-time in play season), sporting experience preoperatively (shape and technique), patient beliefs, cognitive level, fear of reinjury, fear of RTP, personality patient, comorbidity (eg, diabetes, smoking, and personal history of healing problems), duration of preoperative complaints, remaining complaints postoperatively, adherence to therapy, beliefs of trainer, manager, and teammates.

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KEY MESSAGE
PHASE 1

A. Rehabilitation should start before surgery with education.
- underlying pathology
- expectations
- pain mechanism
- cognitions & beliefs (pre-op & at the right time)

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PHASE 1

- Physiotherapy guidance can be advised
- Not all agreed this was mandatory
- Implementation of ADL

NOTE: proper wound healing, NO CSF leakage, adequate pain medication with minimal side effects

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KEY MESSAGE
PHASE 2

B. Rehabilitation should be tailored to the patient as well as the type of surgery

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PHASE 2

- Physiotherapy with surgeon's permission
- Must be active therapy exercise (strengthening)
- Progression of stabilization training (sufficient neck mobility & motor control)
- Progression from nonimpact aerobic activity to dynamic impact activity

NOTE: passive physiotherapy i.e. manual therapy can be used complimentary if standard rehabilitation does not resolve muscular & articular restrictions.

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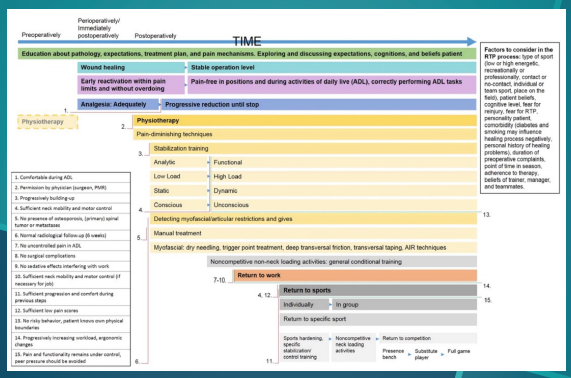
GUIDELINES & TIMELINE



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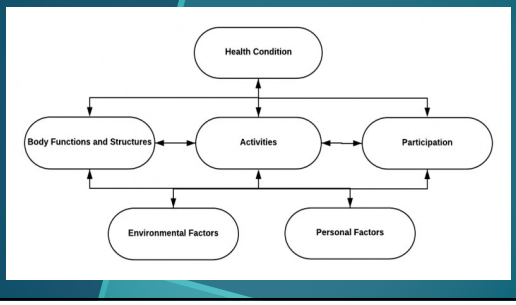
INTERNATIONAL CLASSIFICATION OF FUNCTIONING MODEL



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KEY MESSAGE PHASE 3

C. An unstable arthrodesis is an absolute contraindication for RTP

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ANTERIOR CERVICAL MICRODISCECTOMY & FUSION

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EFFECTS OF REHABILITATION FOLLOWING ACDF SURGERY

- Cerezci et al. ~ 2022 to determine the effects of physical therapy & exercise programs after ACDF for patient's pain treatment
- 40 patients (23 males, 17 females)
- mean age 45.5 years
- Underwent the same ACDF (single-level cervical disc herniation) 2019 - 2020

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EXCLUSION

- Neurological deficits
- multiple level disc herniations
- Additional degenerative vertebral diseases
- BMI >25 kg/m^2
- Smoking habits

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STUDY DESIGN

GROUP A

- Patients who did not apply for post-op physical therapy
- 20 total
  - 12 men
  - 8 women

GROUP B

- Patients who applied for post-op physical therapy & complied with treatment
- 20 total
  - 11 men
  - 9 women

- Oswestry Disability Index (ODI)
- Visual analog pain scale (VAS)
- C2-7 cervical alignment angles

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STUDY DESIGN

- All patients underwent the same physical therapy exercises program
- Each exercises was taught by a specialist, doctor of physical therapy
- Standard home exercise programs were provided

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PHASE 1 PREOPERATIVE EVALUATION

- Patient informed about surgery
- Active resting phase (0-3 weeks)
- Patient mobilized under supervision of PT on 1st post-op day
- TENS unit used if necessary to control pain
- Patient able to change their position ~ 30 min. intervals
  - Emphasized to maintain correct posture, avoid cervical hyperextension, lifting & bending for 6 weeks, keep the lumbar region straight, restrict any cervical rotation

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PHASE 2
EARLY PROTECTIVE

- 4-8 weeks
- Nape-neck exercises are allowed @ 6 weeks (pain-free limits) under supervision
- Swimming & running can start at 6 weeks
- Evaluation of pain & compliance to the exercise program or performed weekly

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PHASE 3
DYNAMIC

- 8 weeks – 6 months
- Cervical tilt exercises
- Core exercises (exclude exercises that increase pain)
- Control weekly visits ~ recommended until the end of 12 weeks post-op
  - After 12 weeks ~ examination are performed at 6 weeks intervals
- Specialized doctor & PT ~ conduct once every 3 weeks
- Patients are enrolled in a kinetic chain strengthening exercise program
  - Proprioceptive exercises (customized)

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PHASE 4
RETURN TO SPORT/ACTIVITY

- 6 months +
- Patient may attend sports activities
- Low resistance, high-repetitive activities are preferred
- Contact sports are allowed
  - The risks of trauma or falling or discussed in detail with the patient
  - Choosing a sport/activities is based on the patient's preference
  - Special precautions & customization of the program

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RESULTS

- Patients who did not continue the exercises program regularly had a longer period of pain despite improvement in pain intensity
- Significant difference in post-physical therapy VAS value and ODI value in Group B vs. Group A~ 6 months post-op
- No significant difference in C2-7 cervical lordosis angle in Group B vs Group A ~ 6 months post-op

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THEIR THOUGHTS

- Early stages – emphasis on the importance of relaxation of irritated and swollen nape-neck muscles
- Subsequently strengthening the muscles using isometric exercises
- Caution – providing neck exercises too early
  - Early onset can provoke post-op pain
  - Completion of fusion process is 3 months
  - Gradually loosening the cage, graft or plate ~ by straining the neck musculature
  - Potentially rather dangerous especially those with osteoporosis
- Home exercise program (HEP) ~ should continue for 2 years

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RETURN TO PLAY AFTER ANTERIOR DISCECTOMY & FUSION (ACDF)

- Watkins et al. ~ 2018 to determine the rate & time of RTP among Pro athletes after ACDF
- Prospective & retrospective review of patient charts, diagnostic studies, internet search (used to determine date of RTP & length of career post-op)
- 27 total procedures on 26 athletes: 12 NFL, 5 NHL, 5 MLB, 3 NBA, 1 MLS
- 1 athlete retired prior to conclusion of this study

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THE METHOD

- Immobilized - cervical collar 2-12 weeks post-op
- Rigidity of the fixation improved over the course ('82 –'16) of the study ~ shortening the period of immobilization
- If asymptomatic & evidence of stability of radiograph ~ start walking, use recumbent bike & hands-free elliptical immediately after surgery
- PT started 6 weeks post-op ~ trunk stabilization exercises, building strength & endurance of L/S stabilizing muscles

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REHABILITATION

- Progress to chest-out posture & scapula stabilization exercises
- C/S rehab program focuses on building strength & endurance of postural spinal stabilizing muscles rather than direct force on the C/S musculature

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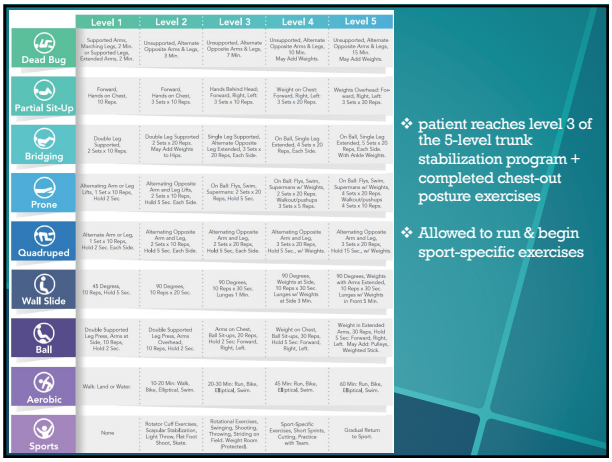

- patient reaches level 3 of the 5-level trunk stabilization program + completed chest-out posture exercises
- Allowed to run & begin sport-specific exercises

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RETURN TO PLAY CRITERIA

1. Status of at least 6 months post-op
2. Normal examination results
3. Successful completion of rehabilitation program
4. Evidence of fusion & stability on radiographs (preferably CT)

Note: no motion on flexion/extension radiographs & no radiolucency around fixation on CT & radiograph

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RESULTS

- 26/27 procedures showed clinical & radiographic evidence of fusion
- 7.3 months ~ mean time until radiographic evidence of fusion
- 20/25 athletes RTP
- 5 who did not RTP ~ 3 had pre-op radiculopathy and 2 had myelopathy
- No cases of catastrophic spinal cord injury after RTP

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RESULTS

- 9.5 months ~ mean time to RTP in a pro game
- 11/20 athletes RTP in the 1st possible game of the next season
- others were delayed as their sport may not be in season or did not get picked up by a team
- mean career length after fusion in their respective sports was 3.2 years
  - NBA avg. 5.6 years
  - NFL avg. 2.3 years

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LIMITATIONS

- Limitations: multiple surgical techniques, confounding factors (residual kyphotic deformity, adjacent-level susceptibility to injury, fusion @ C3-C4, 2-level fusions, syrinx), no control group, surgeon clearance

Studies in greater detail: kyphotic deformities, congenital stenosis, multi-level pathology, long-term outcome including post-career quality of life

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CONCLUSION

- Confirms current literature findings ~ approx. 80% of pro athletes are able to return to sport at 9 months after a single level ACDF
- These findings will help athletes, physicians, and teams better predict and manage the outcome after ACDF surgery

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Range of Motion Chiropractic

2850 ARTESIA BLVD. STE. 201
REDONDO BEACH, CA 90278
310.978.7807
drdavis@rangeofmotionchiro.com

Thank you !

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