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Opinion

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Dynamic neuromuscular stabilization (DNS) exercises may endorse cardioplasticity after cardiac surgery: an opinion

Abstract

Dynamic Neuromuscular Stabilization (DNS) is an emerging rehabilitation approach based on developmental kinesiology principles that aims to optimize posture, breathing, core stability, and neuromuscular coordination. In recent years, DNS has gained attention in cardiovascular rehabilitation because of its potential role in improving cardioplasticity, which refers to the adaptive structural and functional changes of the cardiovascular system in response to therapeutic interventions and physical activity. DNS emphasizes diaphragmatic breathing, postural alignment, and integrated movement patterns, which may positively influence autonomic regulation, respiratory efficiency, circulation, and cardiac function. The application of DNS exercises in cardiac rehabilitation focuses on restoring efficient breathing mechanics, enhancing thoracoabdominal coordination, reducing sympathetic overactivity, and improving overall functional capacity. Through controlled activation of deep stabilizing muscles and coordinated movement patterns, DNS may support cardiovascular endurance, oxygen utilization, and recovery following cardiac surgery or cardiovascular disorders. Additionally, DNS-based interventions can contribute to improved balance, mobility, and quality of life while minimizing excessive cardiovascular strain during rehabilitation. Current evidence suggests that integrating DNS into conventional cardiac rehabilitation programs may enhance cardiopulmonary efficiency and promote favourable neurocardiac adaptations. However, the available literature remains limited, and further randomized controlled trials are required to establish standardized protocols and confirm long-term clinical benefits. This review highlights the theoretical basis, physiological mechanisms, and therapeutic potential of DNS in promoting cardioplasticity and improving cardiovascular health outcomes.

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Introduction

Dynamic Neuromuscular Stabilization (DNS) is a rehabilitation method based on developmental kinesiology that focuses on ideal posture, diaphragmatic breathing, spinal stabilization, and coordinated movement patterns. DNS exercises may contribute to *cardioplasticity,* which refers to the heart's ability to adapt structurally and functionally in response to physiological demands, exercise, rehabilitation, and neural regulation.

Dynamic Neuromuscular Stabilization (DNS) exercises are increasingly used in post-operative rehabilitation to improve breathing, posture, trunk stability, and functional recovery. After cardiac surgery, DNS-based exercises may help restore efficient respiratory mechanics, reduce complications, and improve overall cardiopulmonary functions.[1-3] Several rehabilitation approaches claim betterment after cardiac surgery but their effect is limited upto improving cardiopulmonary functions. The fundamental aim of any rehabilitation technique is to mitigate physical, cognitive, or psychological impairment and optimize functional independence through targeted therapeutic interventions. Techniques achieve this by promoting tissue healing, restoring neuromuscular control, and facilitating neuroplasticity to improve the patient's overall quality of life. However, implementation of exercises which also include core muscle stabilization and neuromuscular control may foster the cardio plasticity after surgery.

Common cardiac surgeries in which DNS exercises can be implemented include a) Coronary artery bypass grafting (CABG), b) Valve replacement surgery (Aortic, mitral and tricuspid), c) Open-heart surgery, d) Heart transplant and ventricular assist devices (LVADs). In case of congenital cardiac surgery DNS has limitation because of limited language processing ability. Post-surgical patients often experience Pain and reduced mobility, Shallow breathing, Decreased lung expansion, Weak core muscles, Poor posture, Fatigue and reduced exercise tolerance, Atelectasis. DNS exercises aim to address these impairments safely and progressively.

DNS supports cardioplasticity indirectly through improved autonomic nervous system regulation, better breathing mechanics, enhanced circulation, reduced cardiac workload, Improved physical conditioning, chest expansion, strengthening of core muscles and motor control.

Physiological Basis of DNS exercises are as follows

DNS Exercises

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Somatosensory integration and central control

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Improved diaphragmatic breathing and deep core musculature

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Enhanced oxygenation & venous return

↓

Improved autonomic regulation

↓

Improved functional capacity and hemodynamic

↓

Reduced cardiac stress

↓

Positive cardiovascular adaptation (Cardio plasticity)

Goals of DNS Exercises for cardioplasticity is to improve cardiopulmonary efficiency, enhance autonomic balance, promote efficient oxygen utilization, improve circulation and venous return, reduce sympathetic overactivity, improve exercise tolerance, enhance functional endurance, improve diaphragmatic breathing, enhance thoracic expansion, restore postural alignment, improve trunk stabilization, reduce respiratory complications, improve circulation and oxygenation, increase functional independence

Methodology

Table 1 DNS Exercises for Cardio plasticity after cardiac surgery

Exercise	Technique	Benefit
1. Diaphragmatic Breathing Exercise	• Lie in crook lying position • Place one hand on chest and one on abdomen • Inhale deeply through the nose • Expand abdomen while keeping chest relaxed • Exhale slowly through pursed lips	• Improves oxygen exchange • Enhances parasympathetic activity • Reduces heart rate and stress
2. Three-Month Supine Stabilization Position	This developmental position activates deep core stabilizers while maintaining proper breathing patterns. • Supine lying • Hips and knees flexed to approximately 90° • Neutral spine maintained • Controlled diaphragmatic breathing	• Improves breathing efficiency • Enhances trunk stability • Reduces unnecessary muscular energy expenditure
3. Rib Cage Expansion Exercise	• Deep inhalation with lateral rib expansion • Controlled slow exhalation	• Improves thoracic mobility • Enhances lung ventilation • Supports efficient cardiac function
4. Quadruped DNS Position	• Assume quadruped posture • Maintain neutral spine • Coordinate breathing with trunk stabilization	• Improves circulation • Enhances neuromuscular coordination • Promotes functional endurance
5. Seated DNS Postural Exercise	• Sit upright maintaining neutral spinal alignment • Activate deep core muscles gently • Perform slow diaphragmatic breathing	• Improves posture • Reduces thoracic restriction • Supports cardiopulmonary efficiency
6. DNS Crawling Patterns	• Developmental crawling patterns improve integrated body movement and cardiovascular conditioning.	• Improves functional mobility • Enhances muscular endurance • Supports cardiovascular adaptation

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Precautions

DNS exercises should be performed carefully in patients with:

- Unstable cardiac conditions
- Severe arrhythmias
- Uncontrolled hypertension
- Acute heart failure
- Severe respiratory distress

Monitoring of 1) Heart rate, 2) Blood pressure, 3) Oxygen saturation, 4) Fatigue level is important during exercise sessions is very important to avoid any cardiovascular event.[1,4-11]

Discussion

Cardiac surgery is frequently associated with postoperative complications such as reduced pulmonary function, impaired mobility, decreased exercise tolerance, pain, altered posture, respiratory muscle weakness, and autonomic imbalance. These complications may negatively affect cardiovascular recovery and delay the restoration of functional independence. Rehabilitation strategies that address both musculoskeletal and cardiopulmonary dysfunction are therefore essential in promoting cardioplasticity and enhancing postoperative recovery. Dynamic Neuromuscular Stabilization (DNS) exercises have emerged as a promising therapeutic approach for improving neuromuscular coordination, respiratory efficiency, and cardiovascular adaptation following cardiac surgery.

DNS is based on developmental kinesiology and emphasizes optimal diaphragmatic breathing, spinal stabilization, postural alignment, and coordinated movement patterns. After cardiac surgery, patients commonly demonstrate shallow breathing, reduced thoracic expansion, and compensatory movement strategies due to pain and sternotomy-related restrictions. DNS exercises facilitate activation of the diaphragm and deep core stabilizing muscles, which may improve ventilation, oxygenation, and respiratory mechanics. Improved diaphragmatic function can reduce accessory muscle overactivity and enhance cardiopulmonary efficiency, thereby supporting postoperative cardioplastic changes.

Another important aspect of DNS is its influence on autonomic nervous system regulation. Cardiac surgery often leads to increased sympathetic activity and reduced parasympathetic tone, contributing to fatigue, elevated heart rate, anxiety, and impaired cardiovascular recovery. DNS breathing and stabilization techniques may promote parasympathetic activation through controlled respiration and improved thoracoabdominal coordination. This autonomic modulation can help improve heart rate variability, circulation, and cardiovascular adaptability during rehabilitation.

DNS exercises may also contribute to improved functional mobility and physical endurance. Postoperative patients often experience balance deficits, reduced trunk stability, and decreased confidence in movement. DNS-based rehabilitation encourages efficient movement patterns and proximal stability, which can improve gait, balance, and overall physical performance. Enhanced functional capacity may further support cardiovascular conditioning and facilitate gradual progression toward daily activities and exercise tolerance.

In addition, DNS may reduce excessive mechanical stress on the thoracic region by promoting proper posture and movement mechanics during recovery. Improved postural control and breathing synchronization can decrease energy expenditure during functional tasks and optimize cardiovascular workload. These effects are particularly valuable in patients recovering from coronary artery bypass grafting, valve replacement surgery, or other major cardiac procedures.

Despite the growing interest in DNS for cardiac rehabilitation, scientific evidence remains limited. Most available studies focus on respiratory mechanics, musculoskeletal stabilization, and neurological rehabilitation rather than direct cardiac outcomes. Therefore, more randomized controlled trials with larger sample sizes are needed to evaluate the long-term effects of DNS on cardioplasticity, autonomic regulation, exercise tolerance, and quality of life after cardiac surgery. Future research should also investigate standardized exercise protocols, duration of intervention, and integration with conventional cardiac rehabilitation programs.

Overall, DNS exercises appear to be a safe and beneficial adjunct to postoperative cardiac rehabilitation. By improving breathing efficiency, neuromuscular coordination, postural stability, and autonomic balance, DNS may support cardio plastic adaptations and enhance recovery following cardiac surgery.

Conclusion

Dynamic Neuromuscular Stabilization exercises may support cardioplasticity by improving breathing efficiency, autonomic nervous system balance, circulation, posture, and functional endurance. DNS can be a valuable complementary approach in cardiac rehabilitation and preventive cardiovascular physiotherapy when combined with conventional exercise and medical management.

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None.

Conflicts of interest

The author declared that there are no conflicts of interest.

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