

Feeling hot! hot! hot! Can ventilation improve posture?

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Summary

A case study by Guy's and St Thomas (GSTT) Wheelchair Service, Kings College Hospital Rehabilitation Engineering Division (RED) and the company wheelAIR.

Collectively, we experimented with a new airflow product manufactured by wheelAIR. It was integrated into a custom seating backrest to help manage the user's posture, and simplify his care.

Aims & Objectives

The aim of incorporating wheelAIR into the custom backrest was to help a service user with extreme temperature regulation issues. He required his clothes changing up to four times a day. The aim was to get this down to once a day.

Background

Rafael is a 52-year old man with cerebral palsy, learning disability, asthma, and previous respiratory failure and cardiac arrest. He also has a large abdominal mass on his right abdomen. While sitting, this causes some impingement of his stomach into his right hip and femur.

Rafael has complex postural seating needs. In addition to the abdominal mass, he presents with fixed pelvic obliquity higher left, scoliosis concave left, limited left hip flexion (75°), and posterior rib hump/prominence on the right, which causes some truncal rotation forwards right. Due to his complex presentation, Rafael uses a custom contoured seat cushion and backrest.

Rafael lives with his mother (main carer) and receives daily care via a care package. Rafael has longstanding issues with general overheating and perspiration all year which has had an impact on his wheelchair seating. Rafael's mother reported that Rafael perspires heavily in his wheelchair and that she has had to manage this by:

- changing his T-shirt 4x/day
- constantly wiping perspiration off his face
- four fans to cool him down
- changing in situ slings 2x/day due to perspiration
- towel behind his back and sling to absorb perspiration
- Rafael was also reported to scratch his knees and forehead when he gets hot
- redness on his back

Studies show that both cushion and backrest of a wheelchair heat up 7% (2.2°C) within 30 minutes, rising further as time progresses. This was amplified by Rafael's overheating and perspiration complications. If the back temperature has risen above the starting neutral, the wheelAIR system has the possibility of cooling the user's back temperature on average 2.5°C or 7% within 3 minutes, dropping to 8°C or 16% after 30 minutes of use (in a 24°C environment).

Rafael previously had ventilation holes in his carved foam backrest, Matrix, Lynx as well as temperature regulating materials and covers to assist with cooling, but with limited success.

Rafael's positioning has always been a challenge as he requires a very close-fitting seating system to accommodate his postural needs, and to manage breathing and impingement issues when seated. Suzanna Shari (occupational therapist) and Victoria Curling (rehabilitation engineer) saw the clinical need for a wheelAIR (two channels + fan box) which was built into the contoured backrest to help alleviate heat-induced problems. Corien Staels, chief executive officer of WheelAIR, worked with RED and GSTT to integrate the product into the seating.

Rafael mostly sits in 14-degree tilt, so pressure mapping with the current non-adjusted backrest was completed at this angle as well as fully-tilted back. The custom carved backrest was replicated. Two rectangular shapes to fit the channels were carved out. The channels were glued into place and covered with materials to allow for airflow and to help divide pressure equally. Rafael was hoisted back into his wheelchair, and new pressure mapping was completed.

After a two-week trial, it became clear that the wheelAIR had significantly improved Rafael's quality of life. He now needs his clothes changed once a day, and barely shows any signs of sweating.

The recorded results are:

- reduction in changing of T-shirt due to perspiration to 1 x/day
- Rafael's mother no longer has to wipe perspiration from his face
- only 1 fan required to cool him down
- no longer need to change in situ slings
- no towel required behind his back
- Rafael no longer scratches his head and knees
- reduction of redness to his back

Discussion

After the successful trial, it became clear that ventilation for a patient prone to overheating is both a relief and a welcome boost to the quality of life. But another – maybe even more important – question arose from the trial: can ventilation also improve posture?

Previously, Rafael's posture correction through his seating was, to a certain extent, limited because of the risk of overheating. Considering his level of learning and communication difficulties, could the only way he knew to escape a too hot backrest – and the only movement he could manage – be by rotating his shoulder forward to gain desperately needed ventilation? We can be wary of designing very intimate postural support into the seating to avoid over-heating.

As the wheelAIR system can be incorporated without interfering with the shape or pressure of the system, the patient's seat could now be perfectly fitted for optimal support without the worry of causing excess heat. In conclusion... can ventilation improve posture?

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