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ABSTRACT BOOK

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A foam dressing is considerably advantageous over a hydrocolloid for prophylaxis of noninvasive ventilation mask-related-pressure ulcers

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Introduction: Prolonged use of continuous positive airway pressure (CPAP) masks, as often required for noninvasive ventilation during the COVID pandemic time, imposes a risk to facial soft tissue integrity and viability, as these tissues are subjected to sustained deformations caused by tightening of the stiff mask surfaces to the head. The risk of developing CPAP-related pressure ulcers/injuries (CPAP-related-PU) can be reduced through suitable cushioning materials placed at the skin-mask interface, to spread the localised contact forces and disperse the surface and internal tissue stresses.

Methods: Using an integrated experimental-computational approach, we compared the biomechanical protective performance of a popular foam dressing material to that of a market-lead hydrocolloid dressing when applied to protect the facial skin under a CPAP mask. We measured the compressive stiffness properties of both dressing materials, and then fed those to an anatomically-realistic finite element model of the head, with an applied (simulated) CPAP mask. Through this process, we calculated the protective efficacy index (PEI) of the above materials in preventing CPAP-related-PU, which indicates the relative contribution of the dressing type to alleviating the facial soft tissue loads with respect to the no-dressing case.

Results: We found that the greatest facial tissue stresses occur at the bridge of the nose and the cheeks, followed by the chin, which is in excellent agreement with reported clinical-epidemiological data concerning facial anatomical sites at-risk for CPAP-related-PU. The difference in PEIs between the two material types was dramatic at the cheeks, with PEI=64% for the foam dressing with respect to a poor PEI=9% for the hydrocolloid. At the bridge of the nose that difference was lower, but still substantial, PEI=86% for the foam versus PEI=60% for the hydrocolloid. The mean PEI for the entire face was 70% for the foam dressing, and just 23% for the hydrocolloid, indicating that the foam dressing is considerably advantageous over the hydrocolloid for prophylaxis of CPAP-related-PU.

Conclusions: The tested foam dressing demonstrated high protective efficacy at all the studied facial sites, and was considerably superior to a hydrocolloid dressing for prevention of CPAP-related PU.

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