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**3D printing technology in physical medicine and rehabilitation: A nouveau approach between physicians and engineers.**

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## Technical review

| **Reviewer's information** | | | |
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| Date review assigned | 29-Fev-24 | Date review completed | 5-Mar-24 |
| Reviewer name | Ilya Klabukov | Do you have any conflict of interest with the author/s? | No |
| ORCID | 0000-0002-2888-7999 | Do you wish to be disclosed to the author? | Yes |

| **Reviewer's comments (18-Mar-24)** | **Yes/No** | **Author's response (20-Mar-24)** |
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| 1. The study methodology, while detailed in the creation and application of the 3D-printed splint, raises questions about its generalizability and reproducibility. The use of a single case study, while valuable for exploratory purposes, limits the ability to draw broader conclusions about the efficacy of the intervention in a broader patient population. In addition, the choice of outcome measures, including the Boston Carpal Tunnel Questionnaire (BCTQ), Visual Analogue Scale (VAS), and QUEST version 0.2, does not appear to be appropriate and relevant to the condition being studied. There needs to be a clearer explanation of why these specific instruments were chosen and how they complement each other in capturing the patient experience. | | **1. Generalizability and Reproducibility**<br>• While we acknowledge the limitations of a single-case study design in terms of generalizability, our primary objective was to demonstrate the feasibility and potential benefits of using a 3D-printed, patient-specific splint in the management of carpal tunnel syndrome (CTS). Single-case studies are often utilized in preliminary investigations to explore the viability of interventions before larger-scale studies are undertaken.<br>• The choice of outcome measures was based on their established validity and reliability in assessing symptom severity, functional status, pain levels, and patient satisfaction in CTS patients. The Boston Carpal Tunnel Questionnaire (BCTQ) is a widely used tool specifically designed to evaluate symptom severity and functional status in CTS patients. The Visual Analogue Scale (VAS) is a standard method for quantifying pain intensity, and the QUEST version 2.0 is a validated tool for assessing patient satisfaction with assistive technology. Together, these measures offer a comprehensive assessment of the patient experience and treatment outcomes. "Why these specific instruments were chosen and how they complement each other in capturing the patient experience" was briefly explained from line 86-89 (highlighted in yellow) & 101-105 (highlighted in green) |
| 2. The reported results indicate improvements in symptom severity, functional status, pain levels, and patient satisfaction after six weeks of using the 3D-printed splint. These results may suggest that personalized medical devices can have a positive impact on patient outcomes. The paper requires more critical analysis of the results, including potential placebo effects, the role of pharmacotherapy in the observed improvements, and the possibility of bias in self-reported outcome measures. | | **2. Critical Analysis of Results:**<br>• We appreciate the reviewer's suggestion for a more critical analysis of the results. While we acknowledge the potential for placebo effects and the influence of concurrent pharmacotherapy, it's essential to note that the primary focus of our study was the evaluation of the 3D-printed splint as an adjunctive treatment for CTS. Future research could incorporate placebo-controlled designs to further elucidate the specific effects of the splint on patient outcomes.<br>• Bias in self-reported outcome measures is a valid concern. However, efforts were made to minimize bias through standardized administration of the questionnaires and blinded assessment of outcomes by multiple clinicians. Additionally, the observed improvements in symptom severity, functional status, pain levels, and patient satisfaction provide valuable insights into the |

| Reviewer's information | | |
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| | | potential benefits of personalized medical devices in CTS management.<br>• Above queries were mentioned in Limitation. |
| 3. The paper rightly highlights the collaborative efforts of consumers, clinicians, and engineers to improve personalized musculoskeletal care. Indeed, this multidisciplinary approach is critical to advancing personalized medicine. However, the implications of the study could be further broadened by discussing the potential challenges and limitations of scaling up the production and use of 3D printed medical devices, including cost, accessibility, and regulatory hurdles. | | **3. Scaling Up Production and Use of 3D Printed Medical Devices:**<br>• The reviewer rightly highlights the importance of considering the challenges and limitations of scaling up the production and use of 3D-printed medical devices. While our study focused on the development and application of a single 3D-printed splint, future research should address scalability issues, including cost-effectiveness, accessibility, and regulatory considerations.<br>• Collaborative efforts between consumers, clinicians, and engineers are essential for overcoming these challenges and optimizing the adoption of personalized medical devices in clinical practice. By fostering interdisciplinary collaboration and addressing logistical barriers, we can maximize the potential benefits of 3D printing technology in musculoskeletal care. |
| 4. Future research in this area is essential to fully understand the benefits, challenges, and scalability of personalized medical devices in the treatment of musculoskeletal conditions. Therefore, comparative studies between standard and personalized splints could provide more definitive evidence of the benefits of customization. | | **4. Future Research Directions:**<br>• We agree that future research is crucial for further understanding the benefits, challenges, and scalability of personalized medical devices in musculoskeletal conditions. Comparative studies between standard and personalized splints could provide valuable insights into the relative efficacy and cost-effectiveness of customization.<br>• Additionally, longitudinal studies with larger sample sizes and longer follow-up periods are needed to validate the observed outcomes and assess the long-term effectiveness of personalized splints in CTS management. By addressing these research gaps, we can advance personalized medicine and improve outcomes for patients with musculoskeletal conditions which are our future endeavor.<br>Overall, we appreciate the reviewer's thoughtful feedback and suggestions for further refinement of our study. We corrected the manuscript according to reviewer's thoughtful advice and would remain committed to advancing knowledge in this area and contributing to the development of personalized approaches to musculoskeletal care. |
| **Reviewer's Recommendation** | Revisions Required | |

| Responsible Editor's comments (18-Mar-24) | | Author's response (20-Mar-24)<br>[Please write a response each points. You must change the manuscript as per your response. Mention line numbers.] |
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| Name | M Mostafa Zaman | |
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| 1. Kindly reduce the word count: Abstract, 100 max; main text, 1000 max. Currently, you have 118 and 1252 in respective orders. | | 1. Formatted as advised. |
| 2. The journal's policy is to use three data visuals (tables, figures, images, combined) max for a case report. Please revise. | | 2. Revised accordingly. |
| **Editor's Decision** | Major Revision | |

| Final decision of the Executive Editor (25-Mar-24) | ACCEPT<br>We shall edit the manuscript soon for your concurrence. |
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