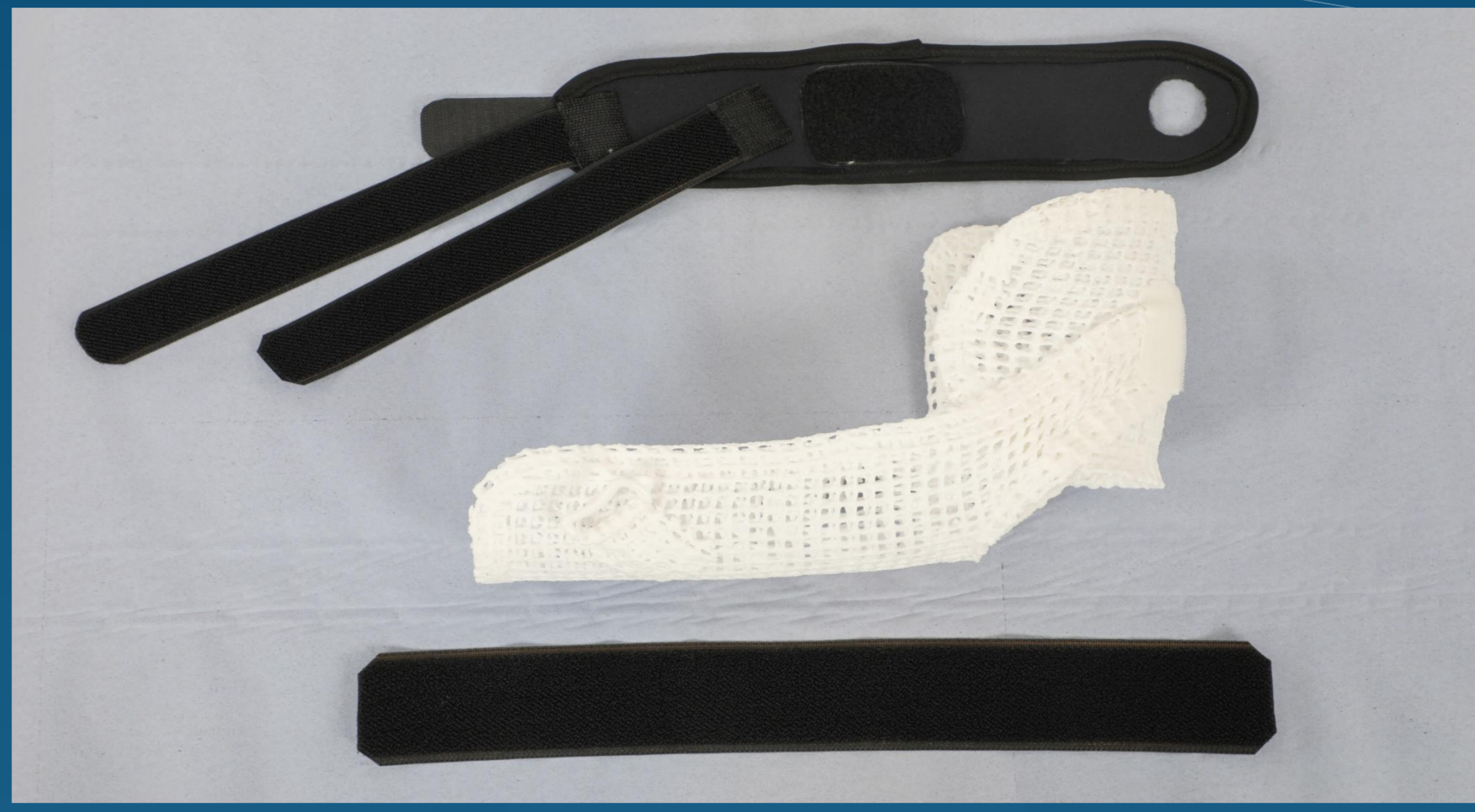


## Introduction

- The ability to pronate and supinate the forearm significantly enhances hand function.
- Recovery of rotation post injury is vital to prevent compensatory postural patterns of movement which can lead to further musculoskeletal issues.
- An internet search was completed into various designs and functions of prefabricated and bespoke pro/supination splints. The author's design combines the rigidity of a thermoplastic material for strength with the comfort of a neoprene wrist wrap to avoid pressure areas, reduce discomfort and encourage compliance.
- The purpose of this work is to investigate whether this bespoke thermoplastic and neoprene exercise splint can enhance the home exercise programmes of the 4 patients in the trial.
- The aim of the splint is to facilitate a sustained passive supination stretch, in a true plane of movement with ease.
- By wearing the splint, total end range time is optimised therefore allowing the muscle and connective tissue to lengthen due to their respective plastic and viscoelastic properties.<sup>1</sup>
- The patient is in full control of the force applied, in order to minimise pain, maximise tolerance and encourage compliance.<sup>2</sup>



## Method

- The splint was trialled with 4 patients with reduced supination causing functional deficit.
- This was as a direct result of distal radioulnar joint stiffness post distal radius fracture, or as a result of stiffness secondary to radial nerve palsy.
- Permission was granted by the service manager to trial this splint and consent was gained from the patients.
- The patients selected had not made significant progress at least 4 weeks after initial assessment with a standard home exercise programme, or had reached a plateau at a later stage of treatment.
- The splint was made from the same pattern for each patient with the thermoplastic element custom moulded to the individual to ensure optimum fit and comfort.
- Patients were advised to wear the splint for periods of up to 1 hour, 3 times per day as tolerated.
- The material cost for the splint is estimated to be £33, and can be made in approximately 20 minutes, depending on the experience of the clinician, and on the basis that the components are pre-fabricated.
- Supination was recorded using the well documented distal forearm method of goniometry.<sup>3,4</sup>
- Measurements were taken prior to the use of the splint and reviewed at regular intervals during follow up face to face therapy sessions. These intervals varied due to COVID-19 related restrictions to service provision.

## A presentation of 4 case studies demonstrating how a bespoke supination splint can enhance a home exercise programme, and promote recovery of range of movement.

Patient A	Patient B	Patient C	Patient D
<ul style="list-style-type: none"> <li>• 79 year old gentleman; enjoys shooting &amp; fishing.</li> <li>• Left midshaft humerus fracture with associated radial nerve palsy.</li> <li>• Global hand stiffness at initial assessment and passive supination midline only.</li> <li>• Supination splint not made initially as patient had significant pain and very limited tolerance to PROM.</li> <li>• 12/52 post referral - pain settling, visible signs of nerve recovery &amp; passive supination 30°. Splint provided.</li> <li>• 2/52 later - active supination of 56°, passively 60°</li> <li>• 3/52 later - active supination remained at 56°, however 70° achieved passively.</li> <li>• 3/52 later 62° active supination..</li> <li>• Splint use ongoing</li> </ul> <p><b>Summary:</b> splint provided 12/52 into treatment, by which time only 30° of passive movement had been regained. Within 5/52 of using the splint, another 40° of passive movement, &amp; 56° AROM was regained.</p>	<ul style="list-style-type: none"> <li>• 34 year old male teacher</li> <li>• Left ORIF distal radius.</li> <li>• Global hand stiffness at initial assessment; active supination 15°</li> <li>• Steady progress made initially into supination.</li> <li>• 4/52 post referral - had achieved 60° however plateaued here for 4/52</li> <li>• Patient reported significant functional deficit due to decreased ROM in this plane.</li> <li>• Splint provided</li> <li>• 5/52 later - 75° active supination.</li> <li>• Patient reported that the increase in supination made a significant difference to functional use of the affected hand.</li> </ul> <p><b>Summary:</b> reached a plateau after good initial progress, despite AROM and PROM exercises within home programme. After use of splint for 5/52, patient regained a further 15° and a functional ROM.</p>	<ul style="list-style-type: none"> <li>• 64 year old male; office based employment.</li> <li>• ORIF to left distal radius fracture with associated ulna styloid process fracture.</li> <li>• Supination at initial assessment 25°</li> <li>• 4/52 later - 50° active supination, however achieved only 3° more over next 4/52.</li> <li>• Standard PROM exercises difficult for patient to complete due to right scaphoid injury &amp; extended time in cast.</li> <li>• Splint provided.</li> <li>• 5/52 later - patient had achieved 73° active supination &amp; reported significant improvement in functional use.</li> <li>• Patient continued splint use for a further 5/52 &amp; achieved 85° active supination.</li> </ul> <p><b>Summary:</b> reached a plateau after good initial progress. Standard PROM difficult due to bilateral wrist injuries. After use of splint for 5/52, patient regained a further 20° &amp; a functional ROM. Patient continued splint use to achieve 85°.</p>	<ul style="list-style-type: none"> <li>• 57 year old female; support worker.</li> <li>• ORIF to left distal radius fracture with associated ulna styloid process fracture.</li> <li>• Supination at initial assessment midline only.</li> <li>• 5/52 later - active supination -35°.</li> <li>• Patient anxious re. home exercise programme due to significant pain, &amp; feared injuring herself further.</li> <li>• Global hand &amp; wrist stiffness; wrist extension (serial splinting) prioritised.</li> <li>• 5/52 later - only midline could be achieved; splint provided.</li> <li>• 4/52 later - 5°supination had been achieved however patient then fell; sustained fracture to left humerus.</li> <li>• Continued with exercise only, no splint, for 3 months and achieved 20° supination.</li> <li>• 3/52 after recommencing splint use, achieved 44°. Treatment ongoing.</li> </ul> <p><b>Summary:</b> 4/52 after initial provision of splint had gained 5°, however use stopped for 3 months due to humerus fracture. Within this time patient gained 20° through exercise alone. 3/52 after restarting use of splint, active supination increased to 44°.</p>

### Patient feedback

"The splint has enabled me to turn my hand over. I use it 3 to 4 times each day. After half an hour it becomes a little uncomfortable but the results have been worth it".

"It is a convenient device as it allows you to sit and watch TV whilst the splint does the work".

"It has improved the rotation enormously and has now achieved 80°. I feel it has now done it's job and the wrist has pretty much reached it's full rotation".

"When the splint was adjusted and the straps were tensioned, it applied a good rotational force to the wrist".

### Conclusion

The information gained from this series of case studies, does support the potential for the use of this orthosis by patients as part of their home exercise programme. For these 4 patients, supination improved after use of splint where they had otherwise struggled to progress. It is acknowledged that it is preliminary work, and that further research should be done to include a larger sample to allow for an in depth analysis of results. Further investigation could also be conducted in to the suitability of the specific patient to trial the splint; for impact of ulna variance post distal radius fracture.

### References

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