

Wharton's Jelly Tissue Allograft for Myelin Sheath Defects of Nerves in the Tarsal Tunnel: A Retrospective Case Series

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Background

Tarsal Tunnel syndrome is an entrapment neuropathy of the posterior tibial nerve and potentially its terminal branches under the flexor retinaculum and behind the medial malleolus of the ankle (Kalçık Ünan 2021). While the occurrence of nerve damage in the tarsal tunnel is unclear and thought to be underdiagnosed, it has been found to have a higher incidence in females and can be witnessed at any age (Kiel 2022). Contributing factors to the incidence of tarsal tunnel syndrome include trauma, tight-fitting shoes, abnormal biomechanics, and systemic diseases, which may induce nerve or surrounding tissue inflammation (Dreyer, 2023). Left untreated, posterior tibial nerve compression can cause permanent nerve damage and atrophy (Kiel 2022). Conservative management includes activity modification, physical rehabilitation, corticosteroid injections, and non-steroidal anti-inflammatory drugs (NSAIDs) (Rodríguez-Merchán, 2021). When symptoms persist, surgical decompression may be required.

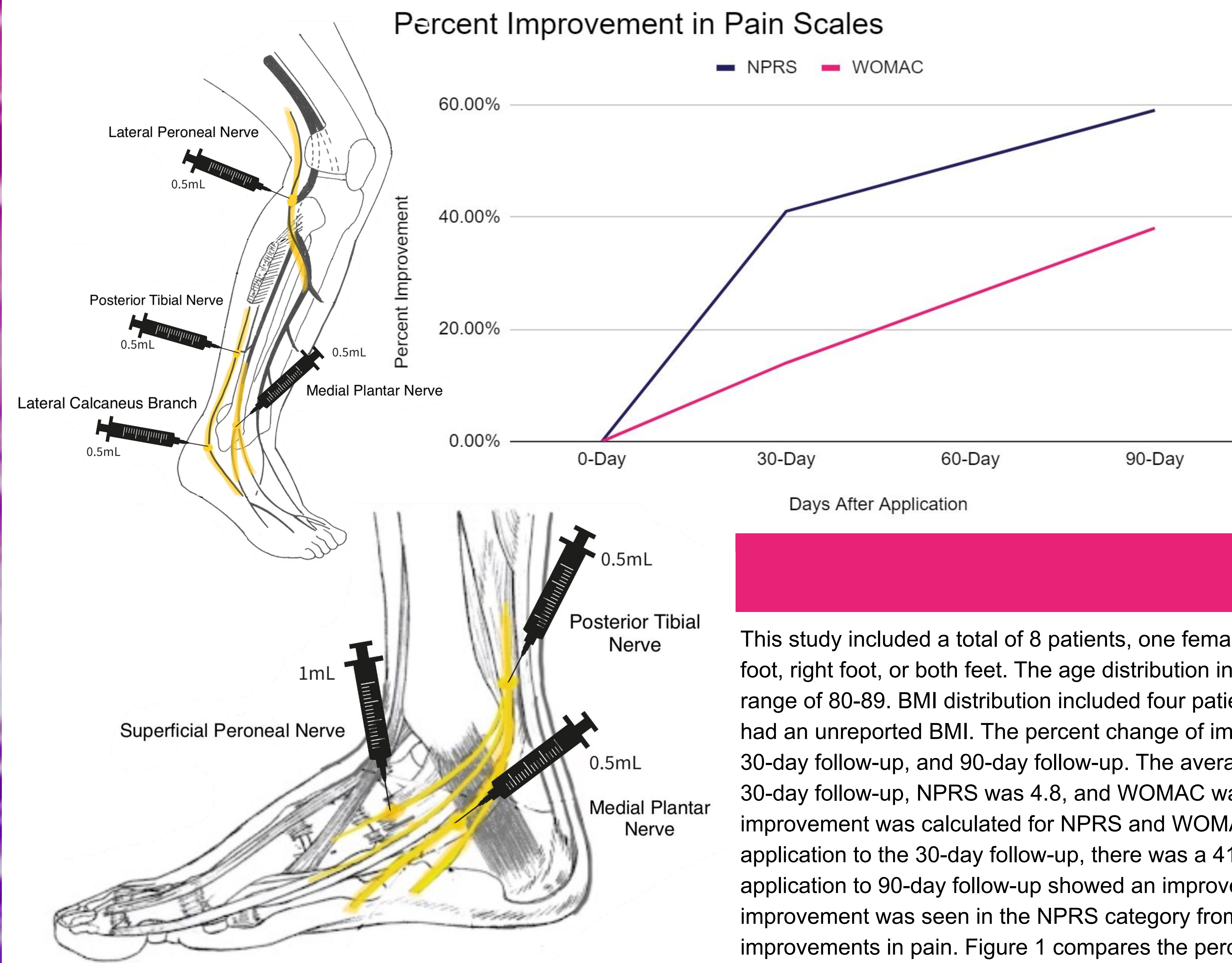
Novel alternative interventions are necessary for refractory nerve damage as surgery does not guarantee improvement, with surgical success rates varying from 44% to 96% (Rodríguez-Merchán, 2021). Wharton's jelly is a loose connective tissue found in the umbilical cord that cushions and protects the vessels within the cord from external forces and stretching. It contains collagen types I and III, hyaluronic acid, proteoglycans, growth factors, and cytokines. Hydrodissection of a compressed nerve with Wharton's jelly can supplement the damaged protective coating and provide additional cushioning to the nerve, promoting proper function. The retrospective repository used in this study is facilitated by Regenerative Labs, containing data on over 180+ beneficial homologous uses for Wharton's jelly tissue allografts, including musculoskeletal defects. This case series presents data from patient-reported pain scales in the retrospective repository of eight patients who received one application of Wharton's jelly to refractory nerve damage and compression within the tarsal tunnel.

Resources

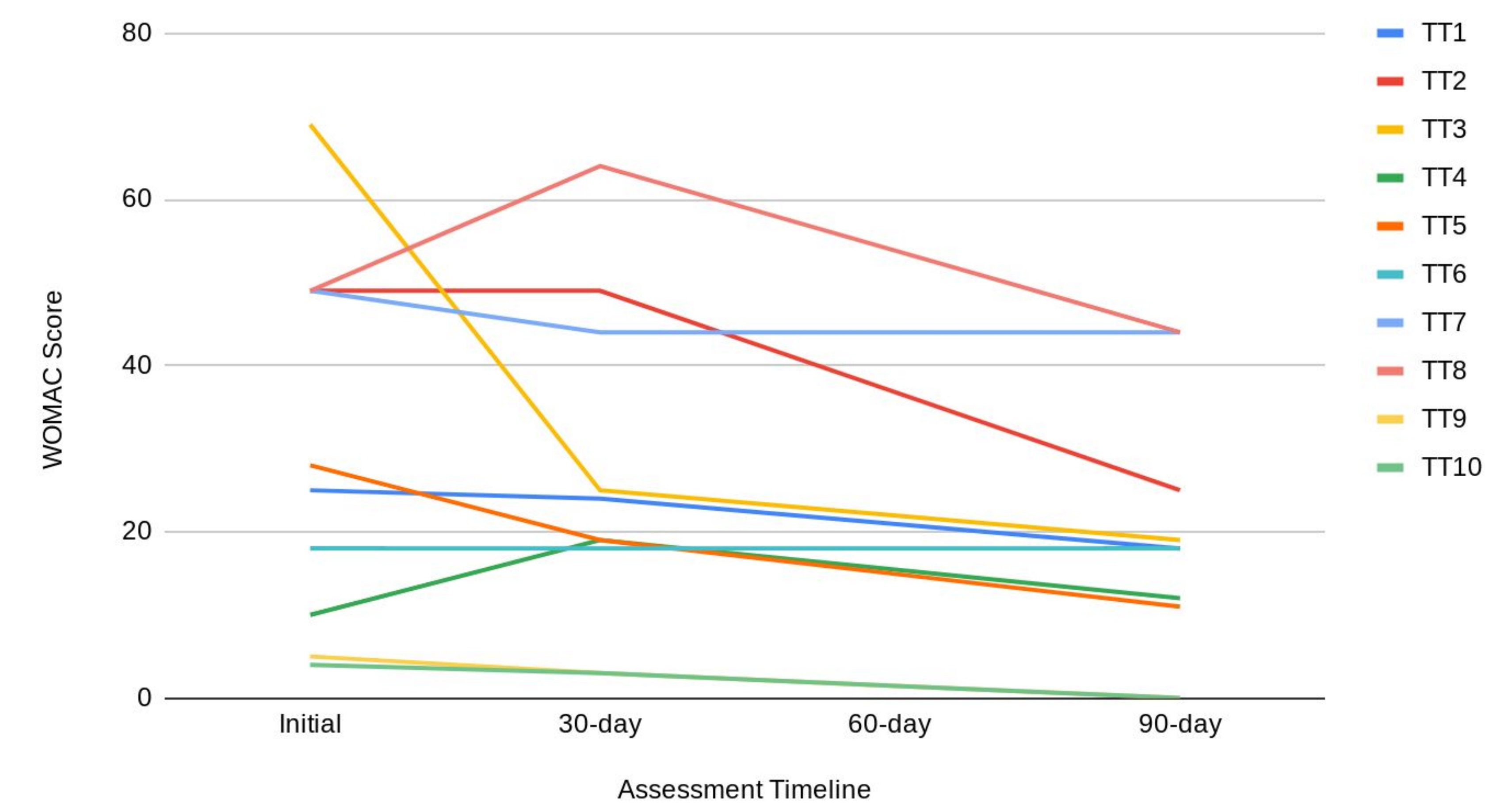
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Methods

This retrospective case study pulled patients from the Regenerative Labs repository that had complete data sets (pain scales recorded at initial, 30-day, 90-day visits), documented tarsal tunnel nerve defects, and received only one 2mL application of the 150mg Wharton's jelly tissue allograft, also known as ProText. This resulted in eight patients from four clinics with nerve damage on one or both legs. Data sets were completed for each extremity separately. The severity of neuropathy among the participants in this study was determined at each clinic through tests that assess the different nerve senses. The purpose of these tests is to provide a baseline of sensory loss. If the results of the sensory test show that sensory loss is only in the feet, then a specific amount of Wharton's jelly was applied in specific anatomical sites of the foot. A 25-gauge needle was used in the application. The application was not a guided entry. If sensory loss was present only in the foot, 0.5 cc of WJ was injected into the posterior tibial nerve, 0.5 cc was injected at the medial plantar nerve, and one cc was injected in the superficial peroneal nerve on the dorsal side of the foot. If the neuropathy extended upwards towards the patella, then a total of 2 mL WJ was applied in four different injection sites. 0.5 cc was into the lateral calcaneus branch, 0.5 cc to the lateral peroneal nerve just below the patella, 0.5 cc to the medial plantar nerve, and 0.5 cc to the posterior tibial nerve. Post-application, some providers recommended that the patient receive high-powered laser therapy, red-light therapy, and vibration therapy at home daily.



Tarsal Tunnel: Individual Data Set WOMAC



Results

This study included a total of 8 patients, one female and seven males, who presented with nerve defects in the tarsal tunnel in either their left foot, right foot, or both feet. The age distribution included one patient in the range of 40-49, six in the range of 70-79, and one patient in the range of 80-89. BMI distribution included four patients who were categorically overweight, two patients who were obese, and two patients who had an unreported BMI. The percent change of improvement in patient pain scales was calculated with the cohort averages at initial application, 30-day follow-up, and 90-day follow-up. The average NPRS score was 6.7 at the initial application appointment, and WOMAC was 30.6. At the 30-day follow-up, NPRS was 4.8, and WOMAC was 26.8. At the 90-day follow-up, NPRS was 2.75, and WOMAC was 19.1. Percent improvement was calculated for NPRS and WOMAC from initial to 30-day and 90-day follow-ups post-initial application. From the initial application to the 30-day follow-up, there was a 41.20% improvement in NPRS and a 14.18% improvement in WOMAC. Finally, the initial application to 90-day follow-up showed an improvement of 59.43% in NPRS and 37.58% improvement in WOMAC. Overall, the greatest improvement was seen in the NPRS category from the initial application to the 90-day follow-up, but all patients experienced significant improvements in pain. Figure 1 compares the percent improvement in the NPRS and WOMAC scales, whereas Figure 2 illustrates individual Tarsal Tunnel data sets for the WOMAC scale. It is important to recognize that a higher WOMAC score correlates to increased pain.

Conclusion

Given the reported pain improvements on various pain rating scales, this study provides evidence that WJ allograft applications are safe, minimally invasive, and efficacious for patients who have failed standard care treatments for nerve tissue defects associated with the Tarsal Tunnel. Of the patients in this study, no adverse reactions or increased pain were reported. The results of this study warrant further research to confirm the efficacy of Wharton's jelly added to conservative care protocols. Additional studies may clarify the optimal dose, protocol, and durability of WJ allograft application. Limitations of this study include its small cohort size and non-blinded trial design. However, the effect of the study being non-blinded is minimized by the use of patient-reported scales of NPRS and WOMAC, which quantize patient pain, functionality, and stiffness based on an array of questions. Future research may include a study including a larger and more diverse cohort and a blinded control group. The positive results presented in this retrospective case series align with current literature on human tissue defects associated with knee osteoarthritis (Davis 2022), articular cartilage defects affiliated with the sacroiliac joint (Lai 2023), degenerative tissue in sacral decubitus ulcers (Lavor 2023), and more. Of these studies, no adverse reactions were reported, and significant pain improvement was seen in each study, making WJ allografts a promising alternative intervention for musculoskeletal and tissue defects.

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