The Case for Naturopathic Prescribing

Marianne Trevorrow,[1] MA, ND

This summer and fall, negotiations are underway for prescription access in several regulated provinces, and discussions about lifting restrictions or adding prescribed items to naturopathic scope are ongoing projects for 2 of 3 provinces that already have prescriptive authority (BC and Ontario). After many frustrating years of little to no progress for the profession, it appears that more provincial governments are becoming receptive to the idea of adding these important Restricted Acts to the professional scope of naturopathic doctors (NDs) in Canada.

However, for those who are advocating for a broader role for NDs as primary care prescribers, the fact remains that we are still either mostly limited or completely locked out when it comes to prescriptive access in 9 of 10 provinces and 2 of our 3 territories. By extension, this means that we are usually overlooked in the ongoing discussions (both provincially and nationally) about solutions to the primary care crisis in Canada, such as the models promoted by Jane Philpott in her recent book advocating for universal primary care "homes."[1] This is a very frustrating fact for many naturopathic leaders, who are seeing other regulated health professions (e.g., pharmacists, nurse practitioners, midwives) make the progress that until now has eluded us.

Still, despite the obstacles of navigating bureaucracies that often see us as a minor player in the healthcare landscape, and political leaders who may be more or less approachable for partisan reasons, the associations that are now seeking the addition of prescribing rights are starting to see some (modest) progress in their efforts. At the *CAND Journal*, we look forward to a time when prescriptive scope parity between regulated provinces and territories can move from the "nice to have" column to a realistic possibility for NDs in all the regulated provinces and territories and, eventually, across Canada.

At the same time, we recognize that there are many people in the profession who worry that, in the push to add more conventional therapeutics to naturopathic practice, we will lose the traditional knowledge and practices embodied in the Naturopathic Principles and Therapeutic Order. In particular, they worry that, as we move into the primary care space, we will be increasingly subject to "standard (conventional) care" models that seem to prioritize medication therapies over preventive, whole-patient strategies or more complementary approaches.

These are valid concerns; all of the leaders I've consulted recently see the importance of maintaining our broad range of naturopathic therapies within a continuum that prioritizes our unique patient-centred model and support for traditional (particularly Indigenous) knowledge and practices. Additionally, being able to demonstrate that we can take on more routine primary care safely will show that we are serious about providing solutions to healthcare access issues, especially for patients who lack trust in conventional care. Furthermore, with each province or territory that adds prescriptive authority to our Restricted Acts, the likelihood increases that other governments (as well as third-party payers) see NDs as a viable solution to public pressure for more primary care points of access.

We have two important commentaries for this edition. The first, by Greg Nasmith consulting for the Canadian College of Naturopathic Medicine (CCNM), is on the newly concluded National Team Primary Care project. This national initiative involved a number of health professions and sought improvements to delivery of primary care through interprofessional collaboration and training and by using a more community-focused, less hierarchical approach. As he points out, CCNM and the CAND being invited to the table for these projects represents a potential transformation in how the profession is viewed by conventional health care, and we have an opportunity to expand our reach in discussions of primary care delivery in ways that would have been difficult to picture in the past. At the same time, he urges us to develop approaches that focus on how we deliver care using evidence-informed methods (even within the diversity of modalities that NDs use) and mutual respect for other professions.

Our second commentary is more focused on development within the profession, fostering cultural diversity, and supporting underrepresented groups through transformational leadership and mentorship in our educational and professional environments. A current Canadian faculty member of Bastyr at San Diego, Baljit

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Khamba, points out the lack of representation of many historically marginalized groups in naturopathic medicine and argues for a framework to address these disparities using the principles of transformational leadership that embrace cultural diversity, critical race theory, and understanding models of community cultural wealth. As she argues, our rapidly diversifying population in North America requires us to develop a more diverse and culturally supportive ND workforce that will help us in turn deliver improved long-term health outcomes to many populations who have often been marginalized and/or discriminated against in conventional health care.

Closely following the Baljit commentary, we have a report from community health researchers Bevilacqua and Copeman addressing screening for mercury exposure in at-risk populations. This is particularly a concern for many Indigenous populations living near remote areas of resource development (notably mining) in our northern provinces and territories, underscored by recent reports about toxic cyanide water contamination downstream from the Yukon Eagle gold mine[2] and ongoing problems with mercury contamination of water at Grassy Narrows First Nation in Northern Ontario.[3]

For NDs working with populations who regularly consume fish, or who live near mines or other areas of industrial pollution, the authors discuss how to screen for these toxins in potentially at-risk groups and propose a framework for how to discuss exposure mitigation in patients to prevent significant health risks caused by high levels of toxic mercury.

Finally, we have a report from Clarke at CCNM-Boucher on combining several non-pharmaceutical interventions in a case of traumatic peripheral nerve injury, showing positive resolution of symptoms 8 weeks post-treatment. Although this is a protocol that deserves further study, we believe that reports like this serve to highlight how often less invasive naturopathic treatments can achieve beneficial, cost-effective outcomes for acute injury causing neurological issues in many patients.

As always, we encourage colleagues and researchers interested in contributing to the *CAND Journal* to consider submitting reports, original research, reviews and commentaries to our publication.

AUTHOR AFFILIATION

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Defining Naturopathic Medicine in the Context of Comprehensive Team Primary Care

Greg Nasmith,[1] MA, ND (Inactive)

I recently played a consulting role for the involvement of naturopathic medicine organizations in a national initiative to advance team-based primary care in Canada. The Team Primary Care Training for Transformation (TPC) project, led by the College of Family Physicians of Canada and the Canadian Health Workforce Network, aimed to advance team-based primary care through innovation in interprofessional training.[1] The Canadian College of Naturopathic Medicine and the Canadian Association of Naturopathic Doctors were invited, along with two dozen other primary care professions, to define the scope, education, and regulation of our profession and how it can contribute to domains of primary care in a team context. To be clear, I do not speak on behalf of any of the above organizations. I do, however, have personal insights about the prospect of greater interprofessional collaboration for naturopathic medicine.

The TPC project materialized at a critical time for primary care in Canada, when an increasing percentage of the population does not have access to a family physician or primary care provider. The crisis has renewed calls for primary care reform, from health education[2] to practice models.[3] As members of our profession have aptly argued, while naturopathic doctors (NDs) have the expertise to manage a wide range of complex health concerns using evidence-informed, patient-centered, and wholistic approaches, we are underutilized in the health system. Although many NDs in Canada collaborate to some degree with other health providers, and some have developed strong interprofessional relationships, there have been few opportunities to advance a systematic framework for integrating NDs into comprehensive primary care teams.

Naturopathic medicine's involvement in the TPC project may present a starting point for such an opportunity. Clearly defining NDs' roles and identifying their value within a comprehensive team is crucial for interprofessional collaboration[4] and requires language and concepts that other providers can understand. Given the breadth and diversity of the profession, I suspect that many or most health providers do not understand what naturopathic medicine is.

To effectively communicate our added value to a primary care team, I think NDs need to articulate the areas of overlap where we can lessen the clinical burden on other providers while highlighting our unique approaches and expertise. These dialogues need to be rooted in evidence-informed practice. Otherwise, I fear we risk losing our audience and missing an extraordinary chance to raise the profile and, more importantly, the reach of the profession.

The prospect of narrowing our professional identity to better integrate into primary care teams will surely raise concerns. However, tailoring our roles to comprehensive team care does not mean eliminating hard-won areas for our scope or even losing our distinctly plural nature; these can co-exist. It does, nevertheless, require a willingness to espouse humility, self-reflection, and mutual respect—qualities that have too often been lacking in public discourse surrounding this topic.

The dominant health paradigm is far from perfect, and some in the profession may be reticent to become more closely entwined with it. I would argue that naturopathic medicine has a great deal to offer a system seeking transformation and support, and that we can only do so through more significant integration. To contribute more substantially towards a better healthcare future for all, we need to see ourselves as part of a constellation of care providers rather than an island of opposition.

Although funding for the TPC project ended earlier this year, there was a shared sense of optimism at its final meeting that the diverse primary care providers involved were moving towards a new vision of team-based care, one that is more collaborative, less hierarchical, and more responsive to community needs. There is space for NDs in this vision, but it is up to us to make a case that other providers and policymakers can understand and endorse.

In addition to defining the initial roles and activities of NDs in comprehensive team-based care, there are a few ways we can advance this agenda: integrate interprofessional competencies more robustly into both pre- and post-licensure education; create more interprofessional opportunities for our learners; continue to advocate for an expanded scope and role in primary care; and continue to cultivate productive relationships with other providers.

No doubt there are barriers to NDs integrating into primary care teams, not least of which is the current funding model. Our profession has faced adamant opposition from critics who may never change their minds. Nevertheless, countless NDs have accomplished tremendous achievements on which we can continue to

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build in this endeavour. Moreover, in my own recent experiences, I have noted a positive shift in the perception of naturopathic medicine among primary care providers. Now is the time to act, and act accordingly.

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Promoting Diversity in Naturopathic Medicine through Mentorship and Transformational Leadership

Baljit Kaur Khamba,[1] ND, Ed.D, MPH

INTRODUCTION

In today's rapidly evolving healthcare landscape, the importance of mentorship and transformational leadership cannot be overstated, especially within the field of naturopathic medicine. These concepts are instrumental in fostering cultural diversity, supporting underrepresented groups, and driving positive change in educational and professional environments.

THE ROLE OF MENTORSHIP

Mentorship involves a relationship wherein a more experienced mentor provides guidance, support, and knowledge to a mentee. This relationship is particularly vital in naturopathic medicine, where it can help aspiring practitioners navigate the complexities of their education and career. Effective mentorship fosters personal and professional growth, enhances confidence, and provides a sense of belonging, which is crucial for underrepresented groups.

IMPORTANCE OF CULTURAL DIVERSITY

Cultural diversity enriches naturopathic medicine by introducing varied perspectives and approaches, ultimately leading to better healthcare outcomes. Embracing diversity helps address health disparities and ensures that healthcare providers can offer culturally competent care. However, there is a significant lack of representation of marginalized groups in naturopathic medicine, which perpetuates these disparities.

DEMOGRAPHICS OF UNDERREPRESENTED GROUPS

Historically marginalized groups, including Indigenous peoples, Asians, African Americans, and Latin communities, represent a substantial portion of the population. Despite this, they remain underrepresented in healthcare professions. Increasing diversity within naturopathic medicine is essential to reflect the demographics of the communities served and to provide equitable care.

EDUCATIONAL STRUCTURE AND ITS IMPACT

The current educational system in naturopathic medicine often aligns with individualistic cultural values, which may not resonate with students from collectivist backgrounds. These students might feel alienated or unsupported, which could affect their academic performance and overall experience. To address this, educational practices must integrate cultural competence, recognize diverse cultural values, and support community-oriented values.

SOCIAL JUSTICE AND CRITICAL RACE THEORY

Critical race theory (CRT) is an analytical framework that examines the presence and impact of race and racism within societal structures, including education and health care. CRT posits that racism is not an aberration but a normalized and ingrained feature of society, influencing laws, policies, and practices. CRT allows us to identify systemic inequities by uncovering how institutional practices and policies perpetuate racial inequalities. Further, we can challenge dominant narratives by questioning and reframing those narratives that marginalize underrepresented groups. In addition, we can promote social justice, as CRT advocates for a proactive approach to eliminating racial disparities by transforming societal structures. Lastly, we can empower marginalized voices by emphasizing the importance of elevating the experiences and perspectives of underrepresented communities to inform more equitable policies and practices. Therefore, applying CRT in naturopathic medicine involves critically examining how educational and professional practices may disadvantage underrepresented groups and implement changes to promote inclusivity and equity. Transformational leadership, which emphasizes collaboration, a shared vision, and ethical behaviour, aligns well with the principles of CRT.

TRANSFORMATIONAL LEADERSHIP

Transformational leadership involves inspiring and motivating others to achieve their full potential and work towards a shared vision. Key behaviours of transformational leaders include

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idealized influence, whereby a leader acts as a role model who exemplifies high ethical standards, integrity, and commitment. Inspirational motivation involves communicating a clear, compelling vision that motivates and inspires others to pursue shared goals. Next, intellectual stimulation involves encouraging innovation, creativity, and critical thinking by challenging the status quo. Lastly, individualized consideration involves providing personalized support, mentorship, and attention to the unique needs and aspirations of each person. Inspirational motivation, intellectual stimulation, and individualized consideration: by embracing these behaviours, transformational leaders can create an environment that supports growth, innovation, and inclusivity within naturopathic medicine.

MODEL OF COMMUNITY CULTURAL WEALTH

The Model of Community Cultural Wealth, developed by Tara Yosso[1], provides a framework for understanding the various forms of capital that underrepresented groups possess. This model identifies six forms of capital that contribute to community cultural wealth. First, aspirational capital is the ability to maintain hopes and dreams for the future even in the face of real and perceived barriers. Second, linguistic capital is the intellectual and social skills attained through communication experiences in more than one language and/or style. Third, familial capital is the cultural knowledges nurtured among family that carry a sense of community history, memory, and cultural intuition. Fourth, social capital represents networks of people and community resources that provide instrumental and emotional support. Fifth, navigational capital utilizes skills of maneuvering through social institutions, including educational spaces. Lastly, resistant capital involves the knowledge and skills fostered through oppositional behaviours that challenge inequality. Understanding and leveraging these forms of capital can transform how we support students from underrepresented groups in naturopathic medicine. By recognizing and valuing the cultural wealth they bring, we can create a more inclusive and equitable educational environment

CONCLUSION

Emphasizing mentorship, transformational leadership, and cultural diversity in naturopathic medicine is crucial for creating a more inclusive and supportive environment. By recognizing the unique strengths and contributions of underrepresented groups, we can improve healthcare outcomes and build a stronger, more diverse profession.

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Mercury Screening for At-Risk Populations

Miranda Bevilacqua,[1] PhD, and **Rylan Copeman,**[1] BScN

ABSTRACT

This article discusses the risks associated with mercury exposure, particularly focusing on at-risk populations in Canada, such as those living in remote areas, individuals living near toxic spills, and those who rely on fish consumption year-round. It underlines the detrimental health effects of mercury exposure, including liver and kidney damage, neurological changes, and developmental issues. The lack of awareness and screening for elevated mercury levels is identified as a significant issue along with the need for greater education regarding possible exposures to mercury. A screening pathway is proposed to aid primary care providers in identifying individuals at risk of elevated mercury levels, with the aim of preventing long-term health complications. Overall, the paper highlights the importance of proactive measures to mitigate mercury exposure and safeguard public health.

Key Words Mercury exposure, mercury poisoning, screening for mercury

Specific populations across Canada have a higher risk of being exposed to mercury depending on where they live.[1] Some at-risk populations may include individuals who rely on fish as a main food source and live near mines or areas with high industrial pollution.[2] Mercury is a naturally occurring toxin that bioaccumulates and biomagnifies within its host.[3] In the context of toxicity to humans, we are looking at organic mercury, specifically methyl mercury, which is a result of the transformation of inorganic mercury by aquatic life.[3] Mercury emissions can be transported through land and water processes, which significantly impacts the level of exposure populations may have.[2] High mercury levels are becoming more prevalent in Canada, specifically in remote areas due to the increase in industrialization and the growing release of mercury from anthropogenic sources.[1,2] Elevated mercury levels have consequential health impacts, including liver and kidney damage if exposed over the long term.[3] In Canada, Indigenous populations have higher rates of chronic kidney disease and kidney failure, which can be further exacerbated by mercury exposure.[4] Elevated levels of mercury can also cause neurological changes, such as neuromuscular alterations, memory loss, and thyroid disorders.[5] Many individuals with mercury exposure have suffered from Minamata's disease evidenced by auditory and vision changes, numbness, and weakness.[3] In Japan, there was a mercury poisoning incident where exposed individuals suffered from Minamata's disease, long-term psychiatric symptoms including impaired mood and behavioural issues, as well as fetuses that presented with cerebral palsy–like symptoms.[2] Chronically elevated mercury levels, even moderately elevated, can significantly impair one's mental health.[6] Elevated mercury during pregnancy is also detrimental and has been associated with microcephaly, blindness, and other physical disabilities in fetuses.[5]

Health Canada directed a biomonitoring screening program with Indigenous populations which showed significantly high levels of mercury.[7] Obtaining more information on mercury levels in Canadians was recommended to serve as an indication of potential exposure, as well as surveying demographics and socioeconomic information regarding fish consumption.[8] Health Canada[1] also reviewed mercury levels in the general public in 2016, which showed less than the acceptable levels of mercury. The participation of the general public creates a gap in knowledge surrounding those who may be more prone to elevated levels, such as those who live around mercury-polluted sites or those who consume fish year-round. Not only is there a lack of recent data on mercury levels in Canadians, but primary care providers (PCPs) are often not familiar with screening and testing for elevated mercury. In a study conducted in 2023, 82% of PCPs never ordered blood work on mercury levels.[9] Another significant result from this study is that no healthcare provider who participated in the survey is confident with analyzing elevated mercury levels.[9] The purpose of this paper is to provide insight into the importance of screening for potentially elevated mercury in the population that may be at risk.

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SIGNIFICANCE

A news article about the situation in Grassy Narrows First Nation sheds light on the severe repercussions of mercury exposure.[10] The Grassy Narrows incident involved Indigenous individuals from Grassy Narrows and Wabaseemoong First Nations who were exposed to mercury waste dumped into the surrounding river system.[10] Many individuals affected by these exposures exhibited symptoms consistent with Minamata's disease, including weakness, numbness, and sensory impairments.[3] Tragically, in the aftermath of this crisis, there was a notable surge in suicides among adolescents and children in subsequent years.[11] A study conducted by Mergler and colleagues[11] delved into three generations—grandmothers, mothers, and children—to investigate potential links between mercury exposure and suicide. The findings of this study indicated a correlation between maternal, prenatal, and childhood mercury exposure and psychological distress. Furthermore, maternal fish consumption during pregnancy was identified as a significant contributor to behavioural patterns in children.[11] This emphasizes the enduring impact of mercury exposure across generations and underscores the urgent need for comprehensive measures to address its devastating consequences on mental health and well-being. In May 2024, a news article showed that mercury poisoning near Grassy Narrows is being further exacerbated by current industrial pollution.[12] Sulfate and organic matter from industrial waste have been found in the English-Wabigoon River.[12] Sulphate specifically worsens methyl mercury levels that are already present by feeding the bacteria that produce methyl mercury from inorganic forms in the environment.[12] This process displays secondary re-emission processes which involve redistributing mercury through environmental mechanisms.[2]

Many people residing in the Northern Ontario (NO) region regularly incorporate fish into their diets, with some considering it a fundamental aspect of their lifestyle.[1] Mercury, a toxic metal, accumulates within organisms over time, underlining the importance of considering the duration of fish consumption.[3,12] There is a growing concern regarding the potential risks associated with prolonged or habitual exposure to mercury through fish consumption, particularly for fetal development.[14] This concern is amplified in regions like NO, where many inhabitants rely heavily on fish as a primary food source throughout the year.[15] The prevalence of elevated mercury levels is increasing across Canada, particularly in remote areas such as NO.[1]

According to Health Canada,[8] there is a recognized need for more comprehensive data on mercury levels in the Canadian population, which could serve as an indicator of potential exposure. This entails gathering demographic and socioeconomic information regarding fish consumption patterns. These recommendations underscore the importance of monitoring potentially elevated mercury levels, particularly among pregnant and breastfeeding individuals in NO. While various guidelines on fish consumption are accessible through reputable sources such as Canadian government websites, Food Guide Ontario, and the Guide to Eating Ontario Fish, it is crucial to acknowledge the variability of mercury levels in fish across different lakes and species.[16] There is therefore a need for continued research and vigilance in monitoring and regulating fish consumption to mitigate potential health risks, particularly in vulnerable populations like those in NO.

Health Canada has developed an equation for assessing exposure and determining acceptable fish intake. However, the primary sources of fish and data used for these calculations often do not encompass the popular fish species found in the inland lakes of NO.[16] Mercury levels vary from lake to lake and among different fish species,[1] rendering reliance on generic fish consumption guidelines challenging. For instance, certain guidelines may present conflicting information regarding mercury levels in specific fish, depending on their geographical origin.

The mercury content in particular fish species from the Great Lakes may diverge from those in smaller lakes, even within the same species.[16] While resources such as the Guide to Eating Ontario Fish[1] offer valuable insights, data gaps exist, particularly for lakes where information is not readily available. Several factors contribute to this data deficiency, including the vast number of lakes in Ontario, the financial constraints associated with surveying each lake, the logistical challenges of reaching remote locations, and the availability of qualified scientists. According to Health Canada,[1] a safe level of mercury within the human body is less than 20 μg/mL and for pregnant populations and those under 18 years of age, under 8 μg/mL is recommended. In New York, the health department suggests that a safe mercury level is under 5 μg/mL, and anything above must be reported to the health authorities.[17] Expecting clinicians to possess expertise in the specific mercury levels of various lakes and fish species is unrealistic. Consequently, the onus of ensuring safe fish consumption falls upon the individuals consuming these sources. However, this task becomes exceedingly arduous when individuals lack access to resources for determining safety or when data on specific lakes or fish species is absent. Considering the myriad health benefits associated with consuming fish,[5] and the cultural significance of fish consumption in certain communities, the healthcare system must prioritize measures for preventing high mercury exposure and supporting vulnerable populations in making informed dietary choices.

Mercury exposure, stemming from various sources including fish consumption, traditional subsistence living, and pollution, poses a significant risk to individuals, particularly in northern regions such as those inhabited by Canada's Indigenous populations.[3] Factors contributing to heightened vulnerability in northern communities include their higher latitudinal positioning, heavy reliance on fish as a primary nutritional source, contamination of water bodies, and interconnected ecosystems.[3] Prolonged mercury exposure can lead to detrimental effects on vital organs, as previously mentioned.[3] This is particularly concerning for NO given the elevated risk factors for chronic kidney disease (CKD), diabetes, metabolic syndromes, mental health issues, and immune-mediated kidney diseases among Canadian Indigenous populations.[4]

Of notable concern is the rising incidence of kidney failure requiring dialysis among rural Indigenous populations, which correlates with the damaging impact of mercury exposure on

renal health.[4] In pregnant individuals, mercury readily crosses the placenta, resulting in fetal exposure levels surpassing those of the mother.[5] Excessive fetal mercury exposure has been linked to severe consequences[13] such as microcephaly, blindness, and other physical disabilities.[5] These findings underscore the critical need for proactive measures to mitigate mercury exposure in vulnerable populations, particularly in the antenatal and postpartum periods, to safeguard both maternal and fetal health.

A study conducted in 2023 revealed that a significant portion of healthcare professionals lacked familiarity with the Guide to Eating Ontario Fish, which is the sole guide to relevant mercury levels in fish in Ontario.[9] Only 8% of respondents reported being very familiar with this resource. Another notable finding is that a significant majority of PCPs (82%) never ordered blood work for mercury levels. Interestingly, 86% of respondents never request mercury blood tests, with a mere 3.5% occasionally doing so. Moreover, 79% of PCPs admitted to having no confidence whatsoever in reading and interpreting mercury levels, while only three expressed some level of confidence. None of the surveyed PCPs reported feeling confident in analyzing elevated mercury levels. These PCPs clearly require more support, resources, and education.[9]

Several barriers were identified that hinder PCPs from ordering blood work for mercury levels, including uncertainty about when to order such tests and how to interpret the results, limited access to resources for blood drawing, concerns about exceeding their scope of practice, and the absence of recommendations prompting them to do so. An interesting observation from the data is that a common barrier to mercury screening is the lack of discussion surrounding the topic. Notably, the Ontario Perinatal Record features an extensive medical history questionnaire that includes a section on nutrition but does not specifically address fish consumption.[18] In the 2023 survey, participants were asked to suggest educational resources that would aid in screening for and identifying elevated mercury levels. Recommendations included in-service training, lunch-and-learn sessions, handouts, the development of screening pathways or guidelines, medical directives for ordering mercury-level blood work, and webinars. These suggestions point to the need for enhanced education and awareness regarding mercury testing. Overall, while participants acknowledged the importance of mercury testing, they emphasized the necessity for greater education and awareness in this area. It must be noted that naturopathic doctors were not involved in this study, and further studies including them are warranted. Having said that, alongside midwives, physicians, and nurse practitioners, naturopathic doctors' laboratory requisitions are now covered through non-insured benefit plans.[19] This concept is critical for the general public to be aware of, especially since many naturopathic doctors are the sole PCPs in rural locations.[20]

The study conducted by the researchers in 2023 resulted in the creation of a pathway (Figure 1) for PCPs to use when screening for mercury levels in their perinatal population.[9,21] It should be noted that safe fish consumption guides vary from province to province and are generally in English or French and in electronic format.[1] This causes more barriers for users who do not have access to the Internet, or who do not speak English or French, again disengaging

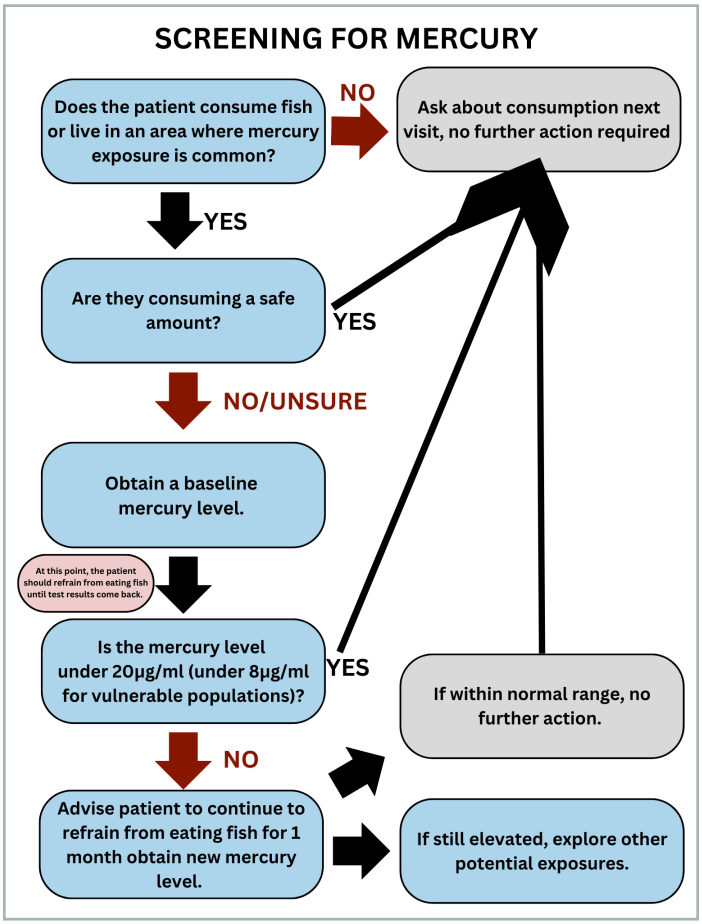

FIGURE 1 Mercury screening pathway.[21]

rural Indigenous communities. This puts pressure on PCPs to screen and educate their patients appropriately. Individuals should not be deterred from eating fish, as there are substantial benefits,[5] especially in certain cultures. The healthcare system must therefore prioritize the prevention of high mercury levels and actively promote awareness to assist vulnerable individuals. In addition to this, advisories such as mercury-polluted waters or watersheds must be readily shared with those who live off the land or interact with such bodies of water. Lastly, the notion of randomly testing large numbers of people for mercury is unrealistic. Proper screening of individuals should be conducted, which can be done with a few questions as reiterated in the pathway (see Figure 1).[21]

CONCLUSION

Heightened mercury levels pose significant and enduring health risks to individuals. PCPs play a crucial role in monitoring and screening for this toxin, yet identified barriers hinder their effectiveness in doing so. The implementation of a screening pathway along with education can prevent long-term complications related to high exposure to mercury.

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The Combination of Proteolytic Enzyme Supplementation, Acupuncture, and Osseous Manipulation for the Treatment of Traumatic Peripheral Nerve Injury: A Case Report

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ABSTRACT

This report describes the treatment of peripheral nerve injury in a 43-year-old woman using a combination of proteolytic enzymes, acupuncture, and osseous manipulation as alternatives to conventional care. Her presenting symptoms include complete loss of sensation in the superolateral left thigh and a mass of fibrotic scar tissue in the area of injury. A holistic treatment plan was created to address the underlying mechanisms of the injury. Plant-based proteolytic enzymes, bromelain and papain, were used to address tissue inflammation and reduce scar tissue formation around the nerve, acupuncture was used to regenerate the superficial nerves, and osseous manipulations were provided for structural re-alignment. After 8 weeks of treatment, the patient reported significant reduction in the size of the fibrotic mass and complete resolution of sensory loss. The fibrotic mass of tissue reduced from 6 cm to 1 cm during the treatment course. Proteolytic enzymes have wide-ranging indications; however, they have not been well studied for peripheral nerve injury, which makes this a novel indication for this natural health product. This case report found the use of proteolytic enzymes, and acupuncture, effective in treating peripheral nerve injury and provides grounds for research to treat nerve-related injuries.

Key Words Bromelain/papain, inflammation, anti-inflammatory, anti-fibrinolytic, trauma

INTRODUCTION

Peripheral nerve injuries (PNI) are common conditions with wide-ranging presenting symptoms. Although much is known about the mechanism of injury, very few reliable treatments have been shown to provide full functional recovery. In many cases, nerve and soft tissue damage can cause debilitating symptoms weeks to months after the initial trauma. Untreated tissue damage can lead to chronic pain, loss of nerve function, and other long-term complications, such as compartment syndrome and avascular necrosis. Prompt diagnosis and effective treatment can reduce the risk of complications and improve patient outcomes.[1]

Seddon and Sunderland created a universal language for the classification of peripheral nerve injury.[2,3] They classified the severity of nerve injury into Stages I through V based on the extent of axonal and connective tissue damage. Grade I, also known as neurapraxia, is defined as focal demyelination with limited damage to the axons and connective tissues.[4] Clinical symptoms of neurapraxic injuries include paresthesia but with preservation of autonomic function.[4] Grades II-IV are known as axonotmesis and are defined as direct damage to axons and focal demyelination with continuity of the nerve connective tissue sheath.[5] This stage can present with paresthesia, neuropathic pain, advancing Tinel's sign, and dry skin with loss of sweating due to vasomotor and autonomic dysfunction.[4] Grade V, also called neurotmesis, is the most severe form of PNI. This stage involves complete transection of the axon and connective tissue layers, resulting in discontinuity of the nerve.[5] This stage often presents with severe neuropathic pain, paralysis, anesthesia, and loss of vasomotor and autonomic function.[4] The Seddon and Sunderland classification grades of nerve injury are outlined in Table 1, with Seddon contributing the electrophysiologic diagnosis and Sunderland contributing surgical treatment standards. The gold standard diagnostic techniques to accurately classify PNI include neurophysiology studies of electromyography (EMG) and nerve conduction study (NCS).[4]

PNI can have various etiologies. Traumatic peripheral nerve injuries (TPNIs) can arise from falls, crush injuries, stretching or compression in sports, and as a complication of orthopedic surgery.[4,5] TPNI differs from other forms of neuropathy in

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TABLE 1 Seddon and Sunderland Classification of Nerve Injury[1,2,3]

Stage	Pathology	Clinical signs	Neurophysiologic Findings	Prognosis
I **Neurapraxia**	Only conduction block	Paresthesia Autonomic function preserved	NCS: CMAP and SNAP show focal conduction block at site of lesion EMG: may show fibrillation, reduced motor unit action potential	Full, spontaneous recovery takes about 3 months
II–IV **Axonotmesis**	Division of axons with Wallerian degeneration Connective tissue remains intact	Paresthesia Neuropathic pain Worsening Tinel's sign Dry skin, loss of sweating due to autonomic dysfunction	NCS: loss of CMAP and SNAP within 2 weeks EMG: fibrillations	May be a good prognosis, dependent on severity Average spontaneous nerve recovery at rate of 0–3 mm/day May require surgery if severe
V **Neurotmesis**	Complete transection of nerve	Paralysis Neuropathic pain Anesthesia Dry, red skin with loss of sweating due to complete autonomic dysfunction	NCS: loss of CMAP and SNAP within 2 weeks EMG: fibrillations	Poor prognosis without surgical intervention Surgery required

NCS = nerve conduction studies; EMG = electromyography, CMAP = compound muscle action potential, SNAP = sensory nerve action potential. Table adapted from: Bage T, Power DM. [1]Seddon HJ, Three types of nerve injury, *Brain.* 1943;66(4):237-88, https://doi.org/10.1093/brain/66.4.237; [2]Sunderland S. *Nerves and nerve injuries*. Edinburgh: E & S Livingstone Ltd.; 1968; [3]Bage T, Power DM. Iatrogenic peripheral nerve injury: a guide to management for the orthopaedic limb surgeon. *EFORT Open Rev*. 2021;6(8):607-617. doi: 10.1302/2058-5241.6.200123.

the sudden nature of the event, and recovery is closely associated with the type and severity of injury.[5] Functional recovery is often unsatisfactory, and limited treatment options are available.[5] Therefore, there is an unmet need for alternative non-surgical strategies to promote functional recovery in patients affected by this injury.

Conventional medical approaches to PNI include watchful waiting, pharmacological, electrical, cell-based, and surgical strategies. Surgery is reserved for moderate to severe cases and includes end-to-end neurorrhaphy, nerve grafting, nerve transfer, and conduit repair. However, surgical repair entails several risks, including slow rate of nerve regeneration and sub-optimal functional outcome, as well as being an invasive procedure. Aside from surgery, other evidence-based treatment strategies include physical therapy, electrical stimulation, low level laser therapy, and pharmaceuticals such as corticosteroids and erythropoietin.[5,6]

Many conventional treatments for PNI primarily address the pain aspect of injury, and limited treatments are available when pain is absent, such as in this case. In addition, there are few non-surgical treatment options to treat milder stages of peripheral nerve injury and its sequelae. The accessibility of these options is also limited.[5] Naturopathic medicine has the potential to provide effective, non-invasive treatment options using a root-cause approach.

Acupuncture has been used for centuries to heal a wide variety of diseases. It has become more widely accepted as a means of reducing chronic pain and improving peripheral neuropathies associated with diabetes, Bell's palsy, and carpal tunnel syndrome.[7] Although the use of acupuncture in nerve injury is supported by the literature, there is less quality evidence for the use of proteolytic enzymes in PNI.[8] Plant-based enzymes have not been found to directly regenerate nerves; however, they have been shown to reduce inflammation in soft tissues, which provides a supportive environment for nerve healing.[9] Therefore, the use of proteolytic enzymes as an adjunctive therapy in nerve injury is novel. The purpose of this case report is to document the impact of proteolytic enzymes with acupuncture in a case of peripheral nerve injury.

CASE PRESENTATION

This report describes the case of a 43-year-old female presenting with loss of sensation and a mass of fibrotic scar tissue over the superolateral left thigh. Onset of pain, numbness, and the formation of a hematoma began as the direct result of a fall to the lateral left thigh on March 15, 2023. The patient had slipped on the front steps of her house, lost her balance, and her left leg took the brunt of the impact with other minor injuries to the left elbow and left ankle. Due to the magnitude of the bruising and pain, she presented to the emergency department a few days after the injury. X-rays of the left leg, left elbow, and left ankle were taken; no fractures were identified. No treatment options were provided, and she was told that the injury would resolve without intervention. Pain and bruising resolved on their own. However, the numbness and fibrotic scar tissue remained without improvement. She sought naturopathic care for the lack of sensation in her left leg due to concerns of permanent nerve damage.

A physical exam was performed to assess the severity of her nerve damage. Findings revealed absent sensation of the dermatome innervated by the lateral femoral cutaneous nerve. Two-point discrimination test revealed an area of 12 cm in length and 5 cm in width on the left leg with no sensation. An oval-shaped nodule of soft fibrotic tissue was palpated beneath the left buttock measuring at 6 cm in length and 3 cm in width. The borders were well-demarcated, the skin was slightly elevated and dome-shaped, and the texture was smooth. Muscle function of her left leg was conserved at strength 5/5 in hip flexion, extension, abduction, and adduction movements, and pain was absent. This case report complies with the *CAND Journal* policies on Research Ethics and Informed

Consent. The patient provided full, informed, and written consent for this case report.

Medical History, Medications, Natural Health Products

The patient reported having no current medical diagnoses. She had been successfully working with her general practitioner (GP) on weight loss for the past 6 months towards her goal weight. Her GP had prescribed semaglutide, a long-acting GLP-1 agonist medication, administered subcutaneously once per week. She reported only minor side effects from the medication, including a smaller appetite and mild constipation on the day of the injection. The patient had a history of clinical depression in 2004 that had since resolved. She reported a few minor motor vehicle accidents in childhood that left her with no long-term injuries. She reported no significant musculoskeletal injuries in the past.

Family history revealed her father had passed from amyotrophic lateral sclerosis (ALS) in 2021, her sister was diagnosed with rheumatoid arthritis, and her brother and paternal grandfather had been diagnosed with diabetes mellitus type 2 (T2DM). Her current supplement regimen included self-prescribed vitamin D (1000 IU daily), a broad-spectrum probiotic (15 billion CFU, 1 cap daily), iron (21 mg daily), B-Complex (1 cap daily), magnesium (100 mg daily) and fish oils (375 mg EPA and 250 mg DHA daily).

Biopsychosocial Determinants of Health

The patient reported having a healthy support system, including her husband, two children, close family and friends. She works 5 days per week at a desk job that she finds enjoyable. She has a highly active lifestyle; she attends spin class twice per week, does strength training twice per week, goes for walks three to five times per week, and either attends an aquafit class or free swims once per week. In her spare time, she enjoys gardening, traveling, hiking, walking her dogs, cooking, and spending time with her husband and children. She reported 8 to 10 hours per night of quality sleep. Her stress was well managed with a positive mindset, exercise, and taking time for the activities she enjoyed.

Diagnosis

A definitive diagnosis could not be made due to the lack of GP referral for a nerve conduction study and/or electromyography. However, a working diagnosis of traumatic peripheral nerve injury was made. Based on clinical history, the paresthesia presented in a dermatomal distribution, which suggested PNI of the left lateral femoral cutaneous nerve. The history of hematoma and remaining tissue mass at the site of injury led to the conclusion that there was scar tissue forming as a result of soft tissue damage. Radiographic findings ruled out fracture and avascular necrosis, which allowed us to be more confident in our working diagnosis. In addition, lack of significant cramping pain and pressure in the leg ruled out compartment syndrome, and lack of tingling and shooting pain ruled out sciatica.[10,11] Using the Seddon and Sunderland Classification of Nerve Injury, we concluded that this injury was a mixed neurapraxic and axonotmesis peripheral nerve injury.[12] She experienced a biphasic recovery, where there was immediate spontaneous resolution of pain and bruising, suggesting a neurapraxic component, and a slower recovery of the axon, suggesting an axonotmesis component.[13] Classification of peripheral nerve injury is described in Table 1.

Therapeutic Management

A holistic treatment plan was created to address the root cause of her presenting symptoms. Based on her peripheral nerve injury, we wanted to reduce the inflammation around the nerve, improve blood flow to the local area of injury to promote healing, and ensure surrounding skeletal structures were in alignment following her fall. A combination of targeted supplementation, acupuncture, and osseous manipulations were utilized.

Natural Health Products

On the first visit, a proteolytic enzyme supplement containing plant-derived bromelain and papain was prescribed, 1 capsule twice daily taken at least 30 minutes before or after meals until symptoms resolved. Each capsule contained 9,450,000 food chemical codex (FCC) of protease activity and only contained the enzymes derived from *Carica papaya* (papaya seeds) and *Ananas comosus* (pineapple stem). Proteolytic enzymes, thiol endopeptidases from pineapple stem and chymopapain from papaya, cleave peptide bonds between amino acids through hydrolysis, and are used by the body to break down ingested protein when taken orally.[8] The targeted outcome of using this supplement was to break down the mass of fibrotic scar tissue and reduce connective tissue inflammation around the nerve, hence the indication to take on an empty stomach to avoid the enzymes breaking down food.

Physical Medicine

Weekly acupuncture sessions were recommended, with points chosen to improve blood flow and enhance nerve regeneration. The points were chosen based on a combination of traditional Chinese medicine (TCM) and western medical styles of acupuncture. Specifically, points on the gallbladder (GB) meridian as they benefit sensory deficits in the leg based on TCM theory.[14] In addition, three a-shi points were chosen based on palpation and patient feedback of the area of greatest sensory deficit. A-shi points do not follow a particular TCM meridian. Six 0.25 × 25 mm needles were inserted into GB 30, GB 31, GB 32 acupuncture point locations and a-shi points on the left leg to a depth of 1 cun (about 1 inch or 2.5 cm). The acupuncture points were manually stimulated for 2 to 5 seconds upon insertion, then left in their respective locations for an average of 15 minutes per session. Four acupuncture sessions were completed at an interval of 1 to 3 weeks, based on the patient's availability. Clean needle technique was used.

To provide structural re-alignment, osseous manipulations were utilized. Based on an assessment of the sacroiliac (SI) joint using the long-sit test, observation of a posterior-inferior sacroiliac joint dysfunction of the left hip was made.[15] One high-velocity, low-amplitude osseous manipulation was performed to the left SI joint using a posterior to anterior force vector. The patient had also reported that her left leg and foot were more laterally rotated

compared with her right leg since the fall. To correct this dysfunction, three attempts of a left subtalar adjustment using a superior to inferior force vector and two attempts of an internal rotation acetabular adjustment using an anterior to posterior force vector were performed. She found little to no benefit from the osseous manipulations and therefore we will not comment on their significance in this case.

The primary outcome measure was the distance between points using a two-point discrimination test for sensation. The secondary outcome measure was the size of the fibrotic tissue mass. Due to clinician oversight, no standardized questionnaires or validated measures were used. Lack of access to a nerve conduction study and electromyography meant we had to assume the patient's condition was improving based on our measurements and her reported symptoms, despite not being able to accurately assess changes in nerve morphology and remyelination.

RESULTS AND PATIENT OUTCOMES

On August 11, 2023, after about 1 month of taking the proteolytic enzymes twice daily and one acupuncture session, she reported indigestion and acid reflux after taking the enzymes immediately before a spin cycle class. She was advised to continue the supplement and to avoid doing vigorous exercise within 30 minutes of taking the capsule. Her adverse reaction completely resolved and did not reoccur. Gastrointestinal upset is a known side effect of proteolytic enzymes if taken on an empty stomach and followed by exercise.[8] The patient was adherent to taking this supplement for the duration of her treatment, as assessed by clinical inquiry each visit.

On August 18, 2023, the patient reported improvement in her sensation on the left thigh. A physical exam revealed the distance on the two-point discrimination test had decreased to 9 cm from 12 cm in length measured on the initial appointment on July 14, 2023. On September 15, she reported further improvement in sensation, and the distance between the two points was 4 cm in length.

On September 8, 2023, she reported the fibrotic tissue mass had decreased in size. It measured 3 cm in diameter, down from 6 cm in diameter on the initial appointment.

On October 13, 2023, she reported complete resolution of the loss of sensation on her left leg and the fibrotic tissue mass had decreased in size to 1 cm. She reported being very happy with the results of her treatment. A complete timeline of her treatments can be found in Table 2.

TABLE 2 Treatment Timeline

Date of Visit	Recommended NHPs/Treatments	Physical Medicine Treatment	Patient-Reported Outcomes
July 14, 2023	Plant-derived bromelain and papain, proteolytic enzymes, 1 cap twice daily 30 min away from meals until symptoms resolved	—	—
July 21, 2023	—	Acupuncture: GB 30, GB 31, GB 32 on left side only	Difficulty finding time to take enzymes twice per day away from meals
Aug 11, 2023	—	Acupuncture: GB 30, GB 31, GB 32, 2 a-shi points based on palpation of sensory loss on left side only Osseous manipulation: left posterior-inferior ilium adjustment (posterior to anterior vector)	No change in sensation on thigh Left SI joint pain since the injury Indigestion and acid reflux after taking proteolytic enzymes and attending spin class immediately afterwards. Recommended to avoid vigorous exercise within 30 minutes of taking supplement
Aug 18, 2023	—	Acupuncture: GB 30, GB 31, GB 32, 3 a-shi points based on palpation of sensory loss on left side only Osseous manipulation: left subtalar adjustment (superior to inferior vector), left hip internal rotation adjustment (anterior to posterior vector)	Improved sensation on thigh Mild tolerable pain in left hip post-adjustment lasting for 1 day, resolved spontaneously.
Sept 8, 2023	—	Osseous manipulation: left posterior-inferior ilium adjustment (posterior to anterior vector)	Significant decrease in size of fibrotic tissue mass as observed by the patient
Sept 15, 2023	Recommended Figure-4 stretch, 45 sec hold per side twice daily, to improve hip mobility	Acupuncture: GB 30, GB 31, GB 32, 3 a-shi points based on palpation of sensory loss on left side only Recommended performing lunges to strengthen gluteus muscle group and stabilize SI joint, 10 reps × 2 sets per day	Improved sensation on thigh No noticeable difference in hip joint mobility post-adjustment
Sept 29, 2023	Continue treatments as stated above	—	Improved sensation on thigh noticed while doing aquafit training No change in hip mobility since last hip adjustment
Oct 13, 2023	—	—	Full resolution of lost sensation on left thigh Fibrotic tissue mass decreased in size

NHP = natural health product; GB = gall bladder meridian; SI = sacroiliac.

DISCUSSION

Although peripheral nerve injuries are not life-threatening, they can have a significant effect on a patient's quality of life. This case report describes the use of alternative, non-surgical treatment modalities to address the underlying mechanisms of peripheral nerve injury. In particular, we describe the use of acupuncture and proteolytic enzymes to treat this condition.

Acupuncture has been studied as an effective alternative treatment for peripheral neuropathy.[7] It involves inserting fine needles in particular points to specified depth and angles along meridians to promote healing from disease. Several studies have demonstrated a high density of peripheral nerve endings along acupuncture point meridians, suggesting that acupuncture acts directly on the nervous system.[16] The mechanism by which acupuncture effectively restores PNI-induced neurological deficits involves remodelling of the nervous system via neural regeneration and promotion of axon sprouting through the release of nerve growth factor (NGF), brain-derived neurotrophic factor (BDNF), and glial cell-derived neurotrophic factor (GDNF).[16] In addition, acupuncture has been shown to increase blood vessel number, which could increase blood flow and address the tissue ischemia component of PNI.[16]

In addition to the nerve injury in TPNI, muscles and surrounding connective tissue are frequently affected. Muscles have limited capacity for regeneration after injury, and therefore part of the healing results in scar tissue formation. Clinical signs of soft tissue injury include hematoma, edema, and post-traumatic fibrosis.[1] Conventional treatment for this type of injury involves anti-inflammatory techniques using ice, compression, and non-steroidal anti-inflammatory drugs (NSAIDs). However, some research has suggested that NSAIDs may in fact delay the healing of muscle injury.[1]

Proteolytic enzymes may act as a natural alternative to NSAIDs for treating soft tissue inflammation after TPNI. Found naturally in the body as well as in some foods, proteolytic enzymes act to break down protein. Common plant-derived proteolytic enzymes include bromelain and papain. Bromelain is derived from pineapple stalk and has been studied widely in plastic and dental surgery. It was found to be effective in reducing facial swelling and pain following third molar extraction.[9] Papain and chymopapain from papaya seed have been shown to resolve pain and accelerate wound healing in perineal episiotomies.[17] These enzymes can be used for a variety of therapeutic purposes, including as a digestive aid, to reduce blood viscosity, enhance circulation, and reduce swelling and inflammation. This case report identified their use as an anti-inflammatory for traumatic soft tissue injury. The mechanism by which these enzymes work on soft tissue edema and inflammation is largely unknown; however, the theory is that the enzymes denature proteins in the soft tissue resulting in increased permeability of the inflamed tissue, allowing drainage and tissue repair.[8]

Another therapeutic mechanism of proteolytic enzymes is their anti-fibrinolytic activity. Although they have not been studied specifically in PNI, they have been highly effective for wound debridement and in preventing blood clotting.[17] The clotting cascade involves two key mechanisms, platelet aggregation and fibrin formation, to promote wound healing.[18] This was the basis for our decision to use these enzymes in this case. We proposed that the proteolytic enzymes could act to break down the fibrin in the scar tissue and prevent further necrotic debris from accumulating.

LIMITATIONS

This case report has several limitations. One limitation was the prognosis for this patient. Mixed neurapraxic and neurotmesis injuries tend to have a relatively good prognosis. In general, recovery can occur within 3 months for milder injuries and up to 12 months in more severe injuries.[4] Our patient experienced significant improvement in sensation in 2 months of treatment, with treatment being 4 months post-trauma. It is difficult to say whether the patient would have recovered in the same timeframe without intervention based on the natural history of her condition. Second, we did not have access to a nerve conduction study or electromyography to be able to diagnose the injury and monitor treatment effectively and accurately. This limitation forced our reliance on our clinical diagnostic tests to track her treatment progress. In hindsight, we could have used a validated questionnaire or quality-of-life scale, such as the QOLS to better assess patient outcomes over the course of her treatment.[19] Some speculate that oral proteolytic enzymes are destroyed in the highly acidic environment of the stomach. Since we cannot easily assess the extent to which these enzymes reached the target tissue, we assumed that they were playing a part in reducing inflammation and breaking up scar tissue in this patient. Lastly, a major limitation to this report was the small population size associated with a single case report. Therefore, the strength, reliability, and applicability of our results are limited.

FUTURE RESEARCH

Current articles on PNI focus on the mechanism, complications, and limited conventional treatments. There is an evidence gap in research on alternative treatments for TPNI. Future research should focus on higher-quality whole-systems-based treatments, including nutrition, physical rehabilitation, nutraceuticals, and botanical therapies. Such studies would create a more robust research base for our current line of treatment to manage PNI. Furthermore, a validated set of clinical criteria to accurately assess and diagnose PNI should be created in future research.

CONCLUSION

This report demonstrated that alternative treatments for the management of PNI can be effective when they address the underlying mechanisms of injury. Within 8 weeks of treatment with proteolytic enzyme supplementation, acupuncture, and osseous manipulations, complete resolution of sensory loss and significant reduction in the size of the patient's scar tissue was achieved,

although osseous manipulation had no noticeable benefit. This case highlights the importance of addressing nerve degeneration, soft tissue inflammation, and microvasculature compromise in a holistic approach to treating traumatic PNIs. Using a combination of complementary modalities and addressing the root cause of this condition, we can better address this complex form of nerve injury.

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CONFLICTS OF INTEREST DISCLOSURE

We have read and understood the *CAND Journal*'s policy on conflicts of interest and declare that we have none.

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