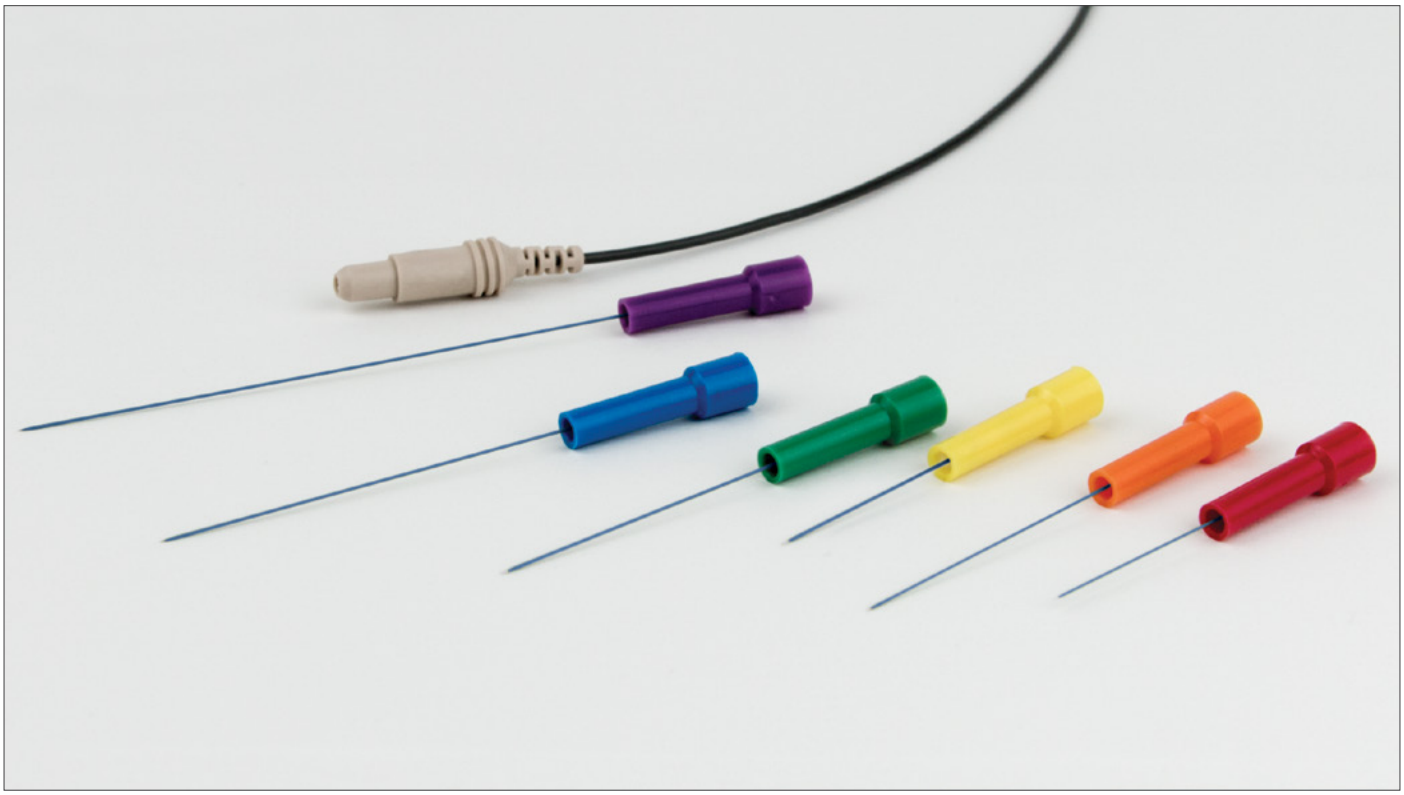
WHITE PAPER

Advancing Monopolar Needle EMG Design to Reduce Frictional Force



Needle electromyography (EMG) is a critical tool in Neurodiagnostics, primarily used to evaluate the health of muscles and the nerve cells that control them. By inserting a thin needle electrode directly into the muscle, needle EMG tests measure electrical activity in response to nerve stimulation and during muscle contraction.

Needle EMG exams provide detailed information about the presence, location, and extent of neuromuscular abnormalities, helping clinicians develop targeted treatment plans and monitor disease progression. The test is indispensable for diagnosing disorders that disrupt muscle function or nerve-to-muscle signaling, such as muscular dystrophy, motor neuron diseases, or peripheral neuropathies.

natus®

Monopolar needles for EMG

Monopolar needles are usually more affordable and cause less discomfort due to their smaller diameter and coated shaft. As a result, many neurologists and other neurodiagnostic professionals prefer monopolar needles for their improved ease of insertion and smoother repositioning during exams. Compared to concentric needles, monopolar needles are also capable of detecting activity from a broader array of muscle fibers. Consequently, the amplitude of potentials captured by monopolar needles tends to be greater than that obtained with concentric needles.

Monopolar EMG needles are distinguished by their design around a single electrode. The needles are composed of coated stainless steel, except at the tip, to guarantee precise signal detection and reduce interference to a minimum. Their shape enables greater depth of penetration and more accurate positioning, crucial for identifying neuromuscular problems during needle EMG tests. Most monopolar needles are pre-sterilized for single use and come in varying lengths and diameters to fit different muscle sizes and diagnostic requirements.

Continued improvements in monopolar needle technology have focused on improving signal quality, reducing tissue trauma, and enhancing patient comfort. These innovations include refined needle designs with thinner shafts and sharper tips to facilitate smoother insertion and minimize tissue disruption.

The most important advancements of late have been the development of better coating materials for monopolar needles. A primary driver of this work has been a desire to reduce frictional force during needle EMG exams to improve diagnostic accuracy and simultaneously reduce patient discomfort.

Reducing frictional force during needle EMG exams

"Reducing frictional force decreases pain and helps obtain high quality artifact-free EMG signals that are essential for proper interpretation and diagnosis."

— Sanjeev Nandedkar, Ph.D.

In the context of needle EMG testing, frictional force refers to the resistance the needle encounters when it penetrates and moves through muscle tissue. Frictional force can greatly impact the ease of insertion, the ability to reposition the needle, EMG exams, and patient comfort. For those reasons, frictional force is a critical success factor for obtaining the most accurate results possible from needle EMG procedures.

Frictional force is affected by two primary factors:

- Surface Coating. Monopolar needle coatings are standard to reduce friction. Coatings containing polytetrafluoroethylene (PTFE), known for its low friction coefficients, allow the needle to move more easily through the tissue.
- Needle Tip Design. The design of the needle tip can impact how it interacts with tissue. A sharper, well-designed 3-point pyramidal tip requires less force to penetrate tissue, reducing the frictional force necessary for insertion.

Reducing frictional force is beneficial for the patient, as it minimizes discomfort and tissue trauma. For the clinician, the benefits are even greater. Lower frictional force results in easier insertion, allowing for more accurate placement and stable EMG recordings. If adjustment is required during the needle EMG test, less frictional force helps clinicians reposition the needle electrode more easily with less discomfort for the patient.

Frictional force market comparisons

Natus has introduced a new PTFE blue coating for its TECA® Disposable (S) and (TP) monopolar needles. The new coating is designed to further reduce friction during insertion and facilitate easier needle repositioning during procedures. As with its other monopolar needles, Natus' new PTFE blue coating ensures a low-friction surface, allowing the needle to glide even more smoothly through muscle tissues.

Recently, a Natus team of product managers and engineers conducted internal studies to compare the average frictional force of five different needle groups and their associated diameters and lengths. Three competitive needle products (Ambu, Technomed, and Rhythmlink) were evaluated alongside two versions of Natus monopolar needles, the first with its traditional PTFE green coating and the second with the newly introduced PTFE blue coating.

"The TECA® Disposable Monopolar Needles with blue coating greatly improved our experience when inserting into the patients' skin and into the patients' muscle. The needle entered skin with less resistance, was comfortable for patients and was smoother overall."

— Clinician feedback after testing of new blue coating on TECA® Disposable Monopolar Needles from Natus

Evaluation methodology

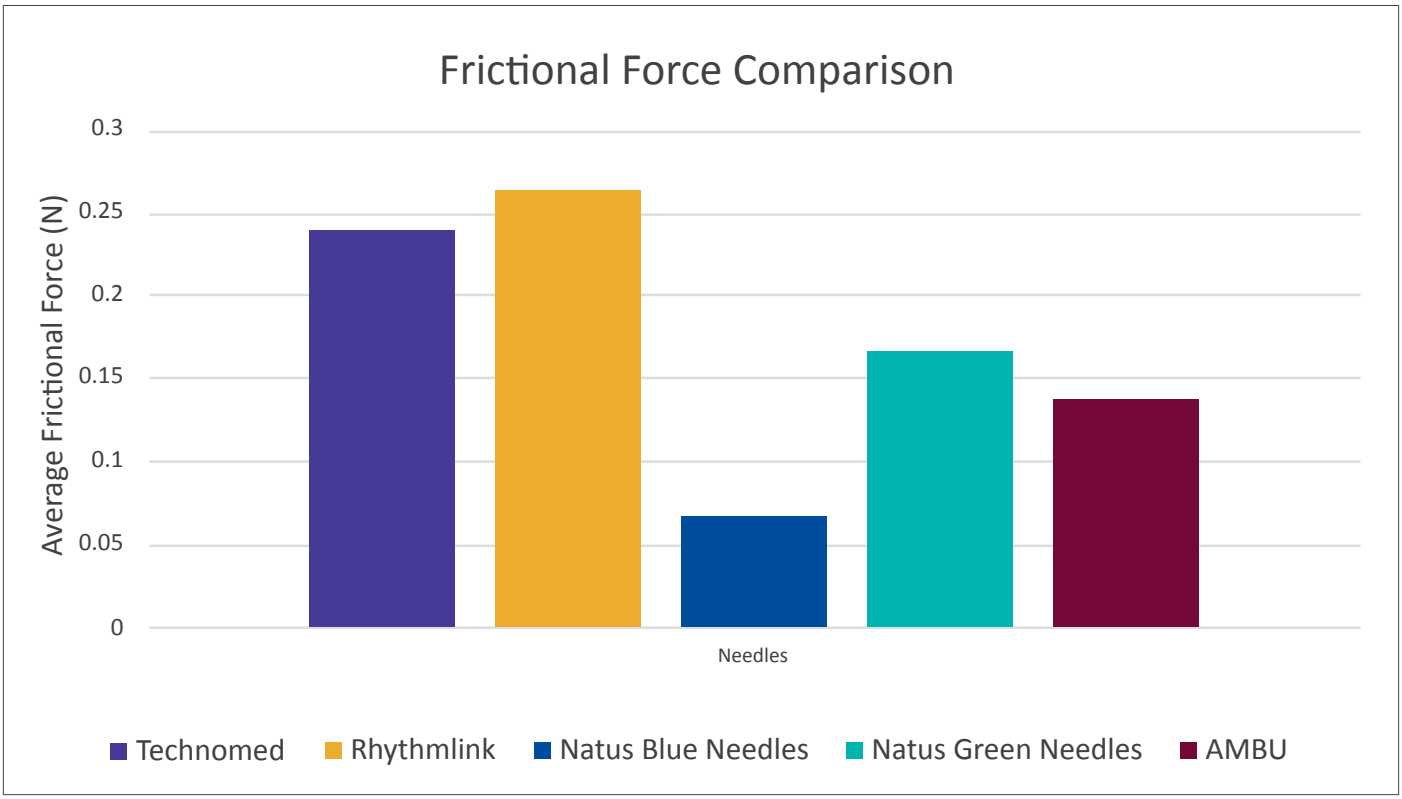
The methodology for collecting frictional force was defined as the average force obtained from a representative portion of the force profile after a minimum of 80% of the needle body was inserted in the tissue surface or substrate. A new substrate was introduced for each penetration test, and student t-testing was used to demonstrate the presence of statistical significance. Comparisons were then obtained based on the average frictional force required by each needle type.

As seen below, data from the frictional force analysis showed significantly lower average frictional force levels for the Natus monopolar needles using the new PTFE blue coating when compared to other needle groups in the study.

Findings from Natus' internal tests consistently indicate that TECA Disposable Monopolar Needles with advanced blue PTFE coating exhibit the lowest average frictional forces based on the comparison with other products in this category. For more detailed information on Natus' Monopolar Needle Comparison studies, contact your Natus representative at neurology.customerservice@natus.com.

"The TECA® Elite and TP Disposable Monopolar Needle Electrodes with the advanced blue PTFE coating offer significant advantages in terms of reduced frictional force. For neurologists seeking the clearest needle EMG results without sacrificing patient comfort, this is a product to be considered."

— Vaibhav Landge, M.B.A., M.S., Bioengineering and Biomedical Engineering, Natus EMG Product Manager



*Similar needles from each company evaluated, graph shows result averages.

More benefits of Natus TECA® disposable (S) and (TP) monopolar needles

Natus TECA® Disposable (S) and (TP) Monopolar Needles combine these advanced coating materials with its standard array of impressive product features:

- Natus is the only company that offers two types of monopolar needles, the TECA® Elite (S) and (TP). The difference between the two needles is the tip profile. S-type needles are convenient for patients because of the sharper tip. Natus (TP) needles have been designed with conical tips to reduce risk in cases where bleeding may be a potential issue.
- Natus TECA® Monopolar Needle Electrodes are designed to deliver consistently low impedance levels, ensuring accurate recordings of EMG and nerve conduction signals. This type of precision is indispensable for the correct interpretation of the body's signals and for making better informed clinical decisions.
- Each needle is color-coded according to size, simplifying identification, and streamlining the workflow for clinic administrators.
- Needle electrodes are pre-sterilized using gamma irradiation, affirming their safety and readiness for use, with a guaranteed shelf life of three years.
- Environmentally conscious, Natus TECA Elite & TP Disposable Monopolar Needle Electrodes are RoHS compliant and do not contain natural rubber latex, catering to a broader range of patient sensitivities.
- Natus manufacturing facilities are based in Europe, and it is the only product in this category that adheres to rigorous MDR standards.

Summary

Findings from Natus internal studies demonstrate clearly that Natus TECA® Elite Disposable (S) and (TP) Monopolar Needle Electrodes offer the lowest frictional force currently available on the market. In addition, the reliability of the TECA brand is supported by consistent positive feedback from clinical use that highlights marked improvements in patient comfort and EMG diagnostic accuracy.

An ultra-sharp 3-point pyramidal tip, combined with Natus' unique PTFE coating, is part of an advanced needle design that substantially decreases patient discomfort during EMG procedures and improves neurodiagnostic outcomes. By selecting Natus TECA Elite & TP Disposable Monopolar Needles, clinicians are choosing to elevate their standard of patient care, improve the accuracy of needle EMG diagnostics, and enhance clinical outcomes.

Sources

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Making sense of the body's signals