



# A New Standard for Soft Tissue Assessment: Objective | Non-Invasive | Reproducible

---

Compremium Quantis ST closes the gap in soft tissue evaluation, giving clinicians reliable data to support critical decisions.



# Table of Contents

Introduction: The Need for Better Soft Tissue Assessment in Musculoskeletal Care	3
From Research to Real-World Impact	5
Objective Metrics at the Core: CP-Value and CP-Quotient Fueling the Compremium Quantis ST	7
Economic Impact of Advanced Soft Tissue Monitoring	9
Supporting Decision-Making and Team Coordination	10
Conclusion: Raising Standards in Soft Tissue Assessment	10
Testimonials	11
References	12
About Compremium	13

## Introduction:

# The Need for Better Soft Tissue Assessment in Musculoskeletal Care

Soft tissue health is crucial to recovery after musculoskeletal injury or surgery, as factors like swelling, blood flow, or delayed healing can mean the difference between a smooth recovery and long-term complications. Yet clinicians currently lack a reliable, non-invasive way to monitor it. Compremium Quantis ST fills this gap by providing objective, quantifiable, real-time data on soft tissue status non-invasively, enabling earlier intervention and reducing procedural risks. This technology enhances clinical decision-making and supports value-based care by improving outcomes, efficiency, and safety for patients.

Clinical decisions in musculoskeletal trauma often hinge on the condition of soft tissue. The current standard relies heavily on subjective palpation or invasive pressure measurements; approaches that can be limited in reliability, reproducibility, and patient comfort, with outcomes frequently affected by the level of clinical experience. In many acute settings, clinical assessments are commonly performed by less experienced healthcare providers such as residents. The gap in today's routine care leads to uncertainty regarding surgical timing, inconsistent management strategies, and an increased risk that interventions may occur too early, resulting in unnecessary procedures like premature fasciotomies, or too late, potentially allowing complications to progress and compromise patient outcomes.

Effective soft tissue management is essential in perioperative care, where tissue condition guides surgical readiness and shapes postoperative outcomes. Injuries such as high-energy tibial plateau fractures often result in significant swelling, blistering, or compromised skin integrity, making temporizing stabilization necessary until tissues improve. The AO Foundation, recognized globally as an authority in orthopedic trauma, emphasizes that "every fracture treatment starts with soft tissue management." This principle reflects their position that careful assessment and care of soft tissue are critical determinants of patient outcomes following musculoskeletal injury. Prioritizing soft tissue management helps reduce infection risk, supports optimal healing, and improves surgical results, setting the foundation for best practices in fracture care (1). Supporting this perspective, Borrelli concluded in his study that "significant soft tissue injuries generally accompany high-energy tibial plateau fractures. The successful management of the soft tissues surrounding the proximal tibia in the pre-, intra-, and postoperative periods is nearly as important as the accurate and thoughtful treatment of

the displaced fracture.” Operating before adequate tissue recovery raises the risk of complications, infection, and poor healing, while unnecessary delays can prolong recovery and increase costs (2).

In a recently published study of 357 patients across five level I trauma centres, the predictive value of seven clinical signs and symptoms associated with acute compartment syndrome (ACS) was evaluated (3).

The ‘seven Ps’ were pain, pallor, paraesthesia, poikilothermia, paralysis, pulselessness, and palpation. Interestingly, pain was the weakest predictor of ACS. Findings on palpation showed strong and consistent predictive value and outperformed the other six signs. Overall, the study supports objective, non-invasive monitoring of swelling and palpation findings over time.

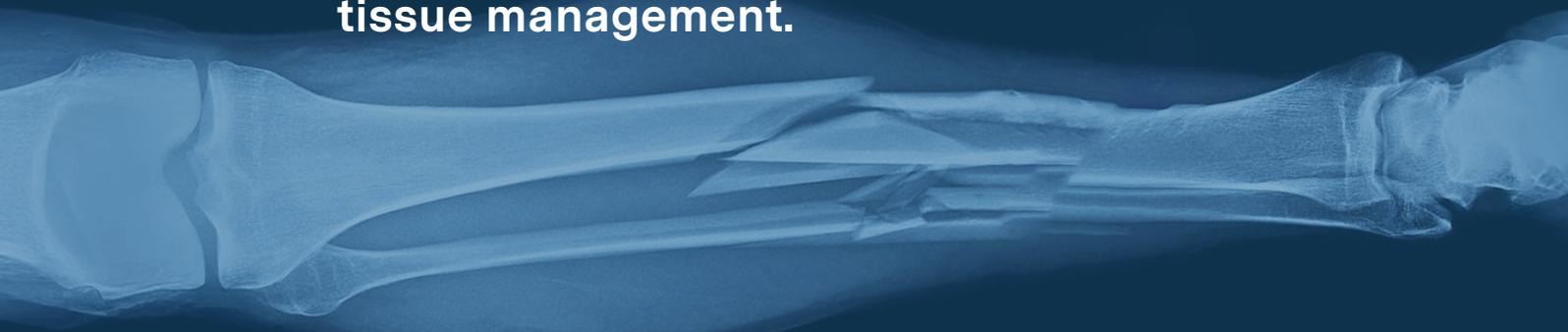
Regulatory and clinical experts agree that accurate and timely assessment of compartment pressures is crucial for patient safety and optimal outcomes in limb compartment conditions. The FDA’s Orthopaedic and Rehabilitation Devices Panel of the Medical Devices Advisory Committee met on September 9, 2020, to evaluate the regulatory classification and safety standards for intracompartmental pressure monitor devices. The

panel emphasized the value of monitoring approaches that minimize procedural risks, reflecting a general trend toward non-invasive solutions in clinical practice. The panel recognized the important role these devices play in helping clinicians detect and manage compartment pressure-related complications in a timely and effective manner, especially among patients with co-morbid conditions and those unable to reliably communicate symptoms (4).

The Compremium Quantis ST (Compremium AG, Switzerland) was developed by doctors, for doctors, to provide a non-invasive, quantitative method for assessing soft tissue compressibility across diverse clinical settings. In this white paper, acute compartment syndrome (ACS) is highlighted as a high-stakes reference condition because it is well-studied and underscores the importance of timely, accurate soft tissue evaluation. While ACS serves as a case example, Compremium Quantis ST’s clinical utility extends to a wide range of perioperative and acute care scenarios where objective assessment of soft tissue compressibility can support earlier recognition of complications, guide intervention timing, and improve patient management.



**The AO Foundation, globally recognized as an authority in orthopedic trauma, emphasizes that every fracture treatment starts with soft tissue management.**



## From Research to Real-World Impact

A decade of rigorous research has laid the foundation to transform a scientific concept into a validated, FDA-cleared solution that delivers objective, non-invasive soft tissue monitoring for clinical use.

The scientific journey began with the recognition that invasive methods for measuring compartment pressures presented limitations, including variability, invasiveness, and patient discomfort. Early work by Large et al. in 2015 highlighted these challenges, noting significant interobserver variability in needle-based techniques (5). This prompted efforts to develop a non-invasive, objective alternative, ultimately leading to Compremium Quantis ST.

Based on a clinical study using Compremium's prototype, Sellei et al. (2015) introduced the concept of soft tissue compressibility as a surrogate marker for pressure. This concept was subsequently validated in a series of follow-up studies, further supporting its reliability and clinical relevance. In cadaveric and in vitro models, they demonstrated a strong inverse correlation between elasticity and pressure, validating reproducibility with

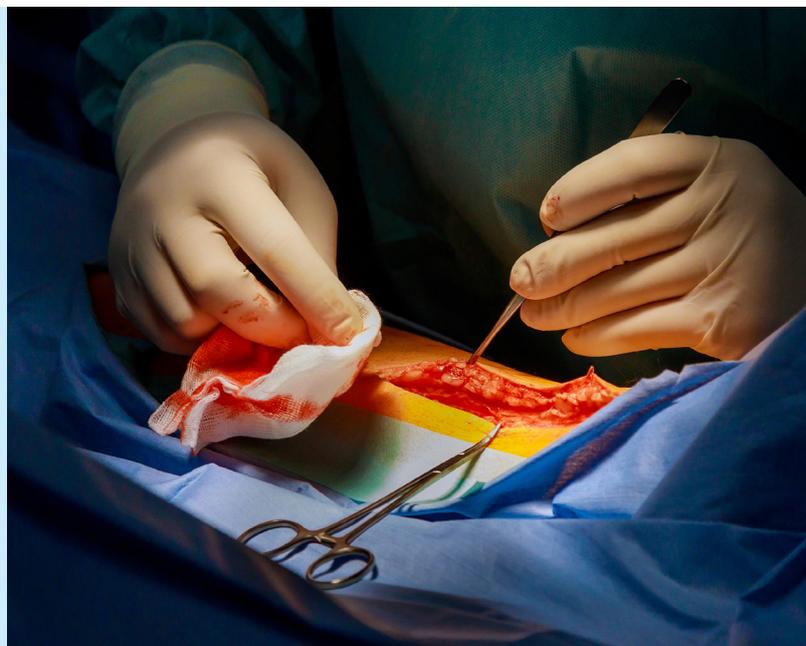
excellent intra- and inter-observer reliability (6, 7). These studies provided key building blocks to the body of knowledge that further informed the development of Compremium Quantis ST. With this evidence as a foundation, Bloch et al. extended the research to animal models and confirmed that compressibility ratios accurately reflect changes in compartment pressure (8), further supporting the technology's clinical relevance. Human studies by Herring et al. demonstrated the feasibility of using dual-sensor probes for non-invasive pressure assessment in controlled environments (9). Marmor et al. built upon this work in a 2021 prospective clinical study involving 52 patients under general anesthesia before surgery. Their research established strong correlations between Compremium Quantis ST measurements and direct intra-compartmental pressures, with high intra- and inter-observer reliability (10, 11).



Since 2014

# 16

clinical studies support the reliability and utility of the Compremium Quantis ST System in musculoskeletal and trauma care.



Further studies extended these findings into trauma settings. Sellei et al. demonstrated that non-invasive compressibility measurements could reliably distinguish affected from unaffected compartments with high sensitivity and specificity. In their study, compressibility was significantly reduced in affected limbs compared to contralateral healthy limbs, showing a strong correlation with elevated invasive compartment pressures, both in clinically suspected ACS and high-pressure states without confirmed ACS. A relative compressibility value below 10.5% indicated a compartment at risk, while values near 5% signified confirmed ACS, with 95.8% sensitivity and 87.5% specificity (12, 13). The method also demonstrated high intra- and inter-observer consistency. Likewise, Anwander et al. validated the reproducibility of Compremium Quantis ST measurements in 60 volunteers, confirming strong agreement between experienced and less experienced observers (14).

In a 2023 prospective study, Sellei et al. used pressure-related ultrasound to evaluate muscle compressibility in 25 pediatric patients with forearm fractures. The study found that even subtle differences in muscle swelling, undetectable by palpation, could be captured using this non-invasive method (15). This work supported the Compremium Quantis ST measurement principles applied in trauma and recovery monitoring in pediatrics. This work helps illustrate Compremium Quantis ST's potential to be used across the full range of age groups.

Reviews by Novak et al. recognized the potential of non-invasive ultrasound-based methods as objective tools for assessing compartment-related conditions, identifying Compremium Quantis ST as the most promising technique currently available (16). These reviews synthesized evidence supporting the measurement principles underlying Compremium Quantis ST. van Heeswijk et al. further demonstrated the relevance of ultrasound-guided compressibility techniques in sports medicine by evaluating 35 healthy volunteers, providing additional support for the scientific foundation of Compremium Quantis ST's technology (17).

# Objective Metrics at the Core: CP-Value and CP-Quotient Fueling Compremium Quantis ST

CP-Value and CP-Quotient provide objective, quantifiable, real-time measurements of soft tissue compressibility. These parameters are intended to assist clinicians in real-time informed decision-making and monitoring soft tissue changes over time.

In daily clinical practice, decisions regarding soft tissue management, such as timing of surgery, monitoring post-injury recovery, and identifying complications, are often based on clinical signs, such as palpation. Those signs are not objectively quantifiable and cannot be accurately documented to which degree they are present. This is where CP-Value and CP-Quotient provide a critical advantage. These proprietary parameters form the foundation of the Compremium Quantis ST system and are designed to give clinicians objective, real-time, quantitative insights into soft tissue compressibility that cannot be obtained through palpation or current device solutions.

## THE CP-VALUE - OR COMPARTMENT COMPRESSIBILITY VALUE

The CP-Value quantifies how much tissue compresses under controlled pressure, providing a standardized and repeatable measurement to guide decision-making. It is a numerical representation of the compressibility of soft tissue, calculated by measuring how much a compartment deforms under a defined external pressure. Using a combination of ultrasound imaging and precision pressure sensors, Compremium Quantis ST captures parameters to inform deformation response. A lower CP-Value indicates stiffer tissue with reduced compressibility, which may be associated with swelling, edema, or elevated compartment pressures. Conversely, a higher CP-Value reflects more elastic and compliant tissue with normal or recovering soft tissue status. This metric serves as an early indicator for changes in tissue condition, helping clinicians to track progression or improvement over time and to make informed, risk-based decisions regarding intervention, surgical timing, and ongoing patient management.

## THE CP-QUOTIENT - OR COMPARTMENT COMPRESSIBILITY QUOTIENT

The CP-Quotient standardizes assessment by comparing the CP-Value of the affected limb with that of the contralateral, uninjured limb. It is calculated as:  $CP\text{-Quotient} = CP\text{-Value (uninjured limb)} \div CP\text{-Value (injured limb)}$ . This ratio offers a personalized, patient-specific reference, enabling clinicians to account for individual variability in tissue properties. In acute situations with one-sided soft tissue injuries, a significantly lower CP-Quotient may indicate increased compartment stiffness and a heightened risk for complications such as compartment syndrome.

Together, the CP-Value and CP-Quotient provide a robust, objective framework for assessing soft tissue health, enhancing the precision of diagnosis, monitoring, and surgical planning throughout the patient care continuum.

While the scientific foundation of CP-Value and CP-Quotient is strong, their clinical

relevance is even more compelling. In a prospective study involving 16 patients at risk for acute compartment syndrome (ACS) (18), the CP-Quotient identified one patient who required fasciotomy and flagged two others as at risk. In one of those cases, the CP-Quotient normalized without intervention, helping avoid unnecessary surgery. This kind of personalized, real-time monitoring would not be possible without objective data. Usability and workflow integration were also evaluated. All clinicians in the study reported confidence using the system, describing it as intuitive and safe. No device-related adverse events or technical issues were observed. For clinicians, this translates into a tool that fits seamlessly into workflow, enhances interdisciplinary communication, and improves documentation quality.

Compremium Quantis ST provides objective measurements to accompany soft tissue assessment. These results are intended to complement other clinical parameters and patient context for comprehensive risk evaluation.

### CP-Value

Relative compressibility of injured limb



### CP-Quotient

CP-Value of control limb / CP-Value of injured limb



#### Figure 1. CP-Value and CP-Quotient as Quantitative Indicators of Soft Tissue Compressibility and Risk Stratification.

CP-Value provides a real-time measurement of tissue compressibility, while CP-Quotient compares readings from the injured and uninjured limbs to establish a personalized baseline. These measurements can be tracked over time to support more informed clinical decisions. The above illustration is for information purposes only.

#### FDA cleared indication for use

Compremium Quantis ST is FDA-cleared for the following indication for use: “The Compartmental Compressibility Monitoring System (CPM#1) is intended for real-time and intermittent monitoring of relative compartment compressibility. The relative compartment compressibility (CP Value) is not meant for trend analysis.” 510(k) Number: K223509.

# Economic Impact of Advanced Soft Tissue Monitoring

In value-based care models, hospitals are increasingly accountable for outcomes tied to complications, delayed diagnoses, and prolonged hospitalizations. Poorly managed soft tissue injuries, particularly those involving swelling and elevated compartment pressures, contribute to increased resource utilization, extended lengths of stay, medico-legal exposure, and higher costs for both providers and payers.

Evidence from literature shows that delays in timely intervention led to longer hospital stays, increased use of healthcare resources, and greater risk of complications. Technologies that enable earlier, objective assessment of soft tissue health, such as Compremium Quantis ST, align with healthcare priorities to reduce avoidable complications, enhance clinical efficiency, and improve both patient outcomes and resource utilization. Soft tissue injuries, especially when complicated by elevated compartment pressures, impose a significant economic burden. Particularly, injuries leading to acute compartment syndrome (ACS) substantially increase hospital costs, length of stay, and the likelihood of additional surgical procedures. Avoidable complications, including medico-legal exposure from delayed or missed ACS recognition, add to direct hospital costs and extended care needs. Objective measurements may help support earlier recognition documentation.

Kantor et al. reported that tibial plateau fractures complicated by ACS were associated with a 2.85-fold increase in total treatment costs compared to fractures without ACS ( $P < 0.001$ ), with ACS emerging as the single largest contributor to increased costs after adjusting for confounding factors ( $r^2 = 0.57$ ) (19). Similarly, Schmidt et al. demonstrated that patients with tibial fractures and ACS had hospital stays three times longer and incurred more than double the charges compared to patients without ACS ( $P < 0.005$  and  $P < 0.00004$ , respectively) (20).

Further economic modeling by Boyers et al. illustrated that missed or delayed diagnoses of ACS, leading to limb salvage procedures or amputations, can cost upwards of USD 53,736 per patient, while prompt diagnosis and intervention average just USD 6,313 (21). These data emphasize the critical financial consequences of delayed recognition and the value of early detection.

## Supporting Decision-Making and Team Coordination

By introducing objective compressibility measurements, Compremium Quantis ST equips clinical teams with a common reference point that improves confidence, communication, and continuity of care.

Beyond cost considerations, Compremium Quantis ST supports rapid decision-making in the time-critical setting of soft tissue injuries, including suspected acute compartment syndrome. In training environments where assessments may be performed by residents with varying experience, objective compressibility measurements provide reproducible data that reduce reliance on subjective palpation. This is especially valuable during night shifts or weekends when more experienced staff may not be available. By enabling on-duty teams to detect early changes, perform intermittent measurements as

indicated, and escalate care using objective data, Compremium Quantis ST promotes timely, confident decisions and ensures continuity of care around the clock.

The Compremium Quantis ST solution also fosters interdisciplinary trust by introducing a shared, objective framework that enhances collaboration across emergency departments, trauma teams, orthopedic services, and perioperative care. Quantitative compressibility data supports more consistent communication and joint decision-making, breaking down silos and enabling aligned action across specialties.

## Conclusion: Raising Standards in Soft Tissue Assessment

Compremium Quantis ST redefines the standard for soft tissue assessment by delivering precision, speed, and confidence. With its objective and non-invasive technology, Compremium Quantis ST transforms clinical decision-making, giving healthcare teams the power to identify risk early, intervene effectively, and protect patient outcomes from uncertainty and complications.

FDA-cleared and already being integrated into US hospitals, Compremium Quantis ST is proving its value in real-world practice. It empowers clinicians with actionable data when timing is critical, shifting soft tissue evaluation from subjective judgment to

objective measurement. Compremium Quantis ST does not replace clinical judgment; it amplifies it, providing robust, quantitative insights to every bedside, every team, and every clinical decision.

For healthcare providers committed to delivering outcome-driven, value-based care, Compremium Quantis ST is the missing link. It closes the diagnostic gap and delivers what medicine demands: reliable answers, timely action, and better patient results.

The future of soft tissue assessment is here. Bring Compremium Quantis ST to your practice and experience the transformation in patient care.

## “ Testimonials



*The Compremium Quantis ST is able to monitor precisely, non-invasively muscle compressibility and tissue pressure. These reliable data are a big step forward in providing the best care for our patients in an urgent medical need.*

---

**Prof. Dr. med. Ulrich Stöckle**

Executive Director, Center of Muskulo-skelatal Surgery, Charité – Universitätsmedizin Berlin  
President of German Society for Trauma Surgery.



*The concept of relative compartment compressibility is intuitively appealing, as it allows us to objectify and quantify what has traditionally been a manual, subjective examination.*

---

**Prof. Dr. med. Richard Sellei**

Prof. Dr. med. Richard Sellei, Chief Physician, Department of Orthopedics and Trauma Surgery, Sana Klinikum Offenbach  
Since 2014, Dr. Sellei and his team have conducted extensive published studies in the field of Acute Compartment Syndrome that validate the potential of Compremium Quantis ST.

## References

1. AO Foundation. Soft tissue loss: principles of management. AO Foundation website. <https://www.aofoundation.org/what-we-do/education/topic-areas/publishing-and-faculty-support-media/ao-principles-of-fracture-management/soft-tissue-loss-principles-of-management>. Accessed August 19, 2025.
2. Borrelli J Jr. Management of soft tissue injuries associated with tibial plateau fractures. *J Knee Surg*. 2014;27(1):5-10. doi:10.1055/s-0033-1363546
3. Bouklouch Y, Agel J, Obrebsky WT, Schmidt AH, Liu K, Westberg JR, et al. Rethinking the Paradigm of Using Ps for Diagnosing Compartment Syndrome. *JBJS Open Access*. 2025;10(2):e24.00065
4. Food and Drug Administration. Orthopaedic and Rehabilitation Devices Panel of the Medical Devices Advisory Committee; Notice of Meeting. September 8-9, 2020. <https://www.fda.gov/advisory-committees/advisory-committee-calendar/september-8-9-2020-orthopaedic-and-rehabilitation-devices-panel-medical-devices-advisory-committee>. Accessed August 19, 2025.
5. Large TM, et al. Interobserver variability in the measurement of compartment pressures using the Stryker device. *J Orthop Trauma*. 2015;29(7):316-321.
6. Sellei RM, et al. Assessment of elevated compartment pressures by compression sonography: A cadaver model. *Eur J Trauma Emerg Surg*. 2015;41(6):639-645.
7. Sellei RM, et al. Measurement of compartment elasticity using pressure-related ultrasound. *Acta Chir Orthop Traumatol Cech*. 2015;82(5):387-392.
8. Bloch A, et al. Compression sonography for non-invasive measurement of compartment pressures in animal models. *Injury*. 2018;49(5):893-898.
9. Herring A, et al. A novel non-invasive method for the detection of compartment syndrome. *J Vis Exp*. 2019;(147). doi:10.3791/59187.
10. Marmor M, et al. Use of standard musculoskeletal ultrasound to assess muscle compartment pressures. *Injury*. 2019;50(5):1039-1044.
11. Marmor M, et al. A dual-sensor ultrasound based method for detecting elevated muscle compartment pressures: A prospective clinical pilot study. *Injury*. 2021;52(8):2166-2172.
12. Sellei RM, et al. Non-invasive measurement of muscle compartment elasticity in lower limbs to determine acute compartment syndrome: Clinical results with pressure-related ultrasound. *Injury*. 2020;51(2):301-306.
13. Sellei RM, et al. Non-invasive and reliable assessment of compartment elasticity by pressure related ultrasound: An in-vitro study. 2021;52(4):724-730.
14. Anwander H, et al. Tibial anterior compartment compressibility in healthy subjects measured using compression sonography. *Injury*. 2022;53(2):719-723.
15. Sellei RM, et al. Non-invasive assessment of muscle compartment pressure by ultrasound in pediatric trauma: A prospective clinical study. *Eur J Med Res*. 2023;28(1):296.
16. Novak D, et al. Extremity compartment syndrome: A review with a focus on non-invasive diagnostics. *Front Bioeng Biotechnol*. 2022;10:961842. doi:10.3389/fbioe.2022.961842.
17. van Heeswijk K, Janssen L, Heijmans MH, Scheltinga MRM. Ultrasound guided compressibility of the lower leg anterior tibial muscle compartment: a feasibility study. *Phys Sportsmed*. 2024 Dec;52(6):561-567. doi: 10.1080/00913847.2024.2340421.
18. ClinicalTrials.gov. Non-invasive monitoring of patients at risk of acute compartment syndrome (ACS) with CPMX1. Identifier NCT06030635. Updated June 4, 2024. Accessed July 19, 2025. <https://www.clinicaltrials.gov/study/NCT06030635>
19. Kantor AH, Clapp I, O'Neill DC, et al. Tibial Plateau Fractures Complicated by Compartment Syndrome Are Associated With a 3 Times Higher Cost of Care. *J Orthop Trauma*. 2023;37(11):568-573.
20. Schmidt AH. The Impact of Compartment Syndrome on Hospital Length of Stay and Charges Among Adult Patients Admitted With a Fracture of the Tibia. *J Orthop Trauma*. 2011;25(6):355-357.
21. Boyers D. Costing report for a new diagnostic test for the detection of acute compartment syndrome. University of Aberdeen; 2012.

## About Compremium

Compremium AG is a Swiss medical technology company developing non-invasive diagnostic solutions for pressure-related physiological conditions. Its technology has been evaluated in more than 40 clinical studies. The company's lead commercial product, Compremium Quantis ST, is FDA-cleared and CE-marked for soft-tissue assessment.

For more information, visit [www.compremium.ch](http://www.compremium.ch).



# Turning Point in Diagnostics



## Compremium AG

Worbstrasse 46  
3074 Muri b. Bern  
Switzerland

[info@compremium.ch](mailto:info@compremium.ch)  
[www.compremium.ch](http://www.compremium.ch)



Use QR code for  
contact information