

The Science of ROHO® combines HISTORY and EVIDENCE

durable

adjustable

adaptable

ROHO®

permobil

History and evidence are the foundation of every ROHO® product.

First, the history.



For more than 45 years, ROHO has dedicated its efforts to research, science, engineering and manufacturing of air-cell based cushions, making ROHO the industry standard in skin and soft tissue protection.



Engineering principles were incorporated into the cushion design, providing the mechanisms that resulted in decades of successful clinical outcomes.



ROHO's proof of performance is clear in over 90 studies. Superior protection and healing are documented in case studies, clinical trials, laboratory studies, and engineering analyses.



Our quality, design, manufacturing systems and processes are certified to ISO 13485. This standard ensures the highest level of reliability with state-of-the-art scientific, engineering, and process control practices.

Expanding knowledge in the 21st century.



Academic research throughout the world over the last 15 years proves that tissue and cell deformations are the primary mechanisms of deep tissue injury.



ROHO's Clinical Education is in international demand as the highest and most current source of industry knowledge for PTs, OTs, nurses, and physicians. We continue to study, consult, and learn the state of the science to teach and improve clinical outcomes.



ROHO pioneered industry-academic partnerships in the wheelchair cushion industry, breaking new ground in scientific discoveries with the first Scientific Advisory Board. Our internationally acclaimed researchers and clinical board members are recognized leaders in advancing the science of pressure injury prevention, setting international guidelines, and influencing public policy.

Immerse.

Envelop.

Adapt.

Protect.



The ROHO® Scientific Advisory Board: Dr. David Brienza (University of Pittsburgh); Dr. Cees Oomens (Eindhoven University); Dr. Amit Gefen (Tel Aviv University), Board Chair; Dr. Joyce Black (University of Nebraska); Dr. Dan Bader (University of Southampton, UK)



ROHO

Then, the evidence.

ROHO advances the highest level of scientific study. No other manufacturer equals this.

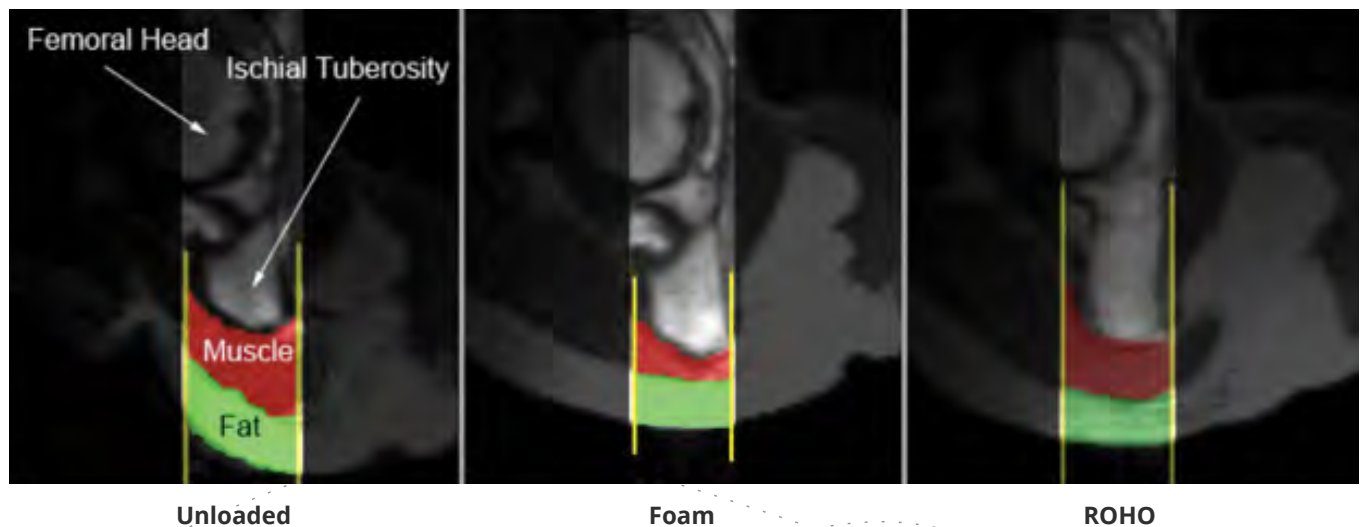
Randomized Clinical Trial (RCT)

One of the largest and most robust cushion assessment RCTs provided real-world injury outcomes on real people. Dr. David Brienza (University of Pittsburgh) studied the effect of cushions on preventing pressure injuries. Foam, foam with gel, viscous fluid, and ROHO air-cell cushions were used in the trial across multiple long-term care facilities. Up to 23% of the patients on non-ROHO cushions developed pressure injuries, compared to less than 3% on a ROHO cushion. Of 152 geriatric patients with kyphosis, NONE developed pressure injuries on a ROHO cushion. Dr. Brienza observed a correlation between immersion depth (via adjustability) and successful pressure injury outcomes.

Medical Imaging

A seated MRI provided the world's first look inside. Dr. Stephen Sprigle and Dr. Sharon Sonenblum (Georgia Institute of Technology) captured a never-before-seen look at what happens when someone sits on a ROHO compared to foam. These images make it clear that through immersion and envelopment, the ROHO cushion drastically minimizes the deformation of soft tissues.

Coronal Slices. Images provided by Dr. Stephen Sprigle and Dr. Sharon Sonenblum of the Rehabilitation Engineering and Applied Research (REAR) Lab at the Georgia Institute of Technology



MRIs reveal how well ROHO maintains the shape of the body through immersion and envelopment which protects muscle, fat and skin.

ROHO's data has advanced the understanding of the critical need for cushions that are adjustable, adaptable, and durable to immerse, envelop, and protect the individual throughout the day and over time.

Engineering models build upon MRI evidence.

The world's first biomechanical cushion analysis.

ROHO's Scientific Board Chair and chief research collaborator, Dr. Amit Gefen (Tel Aviv University), leads the advancement of biomechanical computer modeling, to better understand how pressure injuries occur. His work reveals the never-before-analyzed internal stresses and strains in the body that result from sitting. This data shows how the ROHO cushion minimizes these stresses to prevent deep tissue injury. He is sought after worldwide to present his findings.

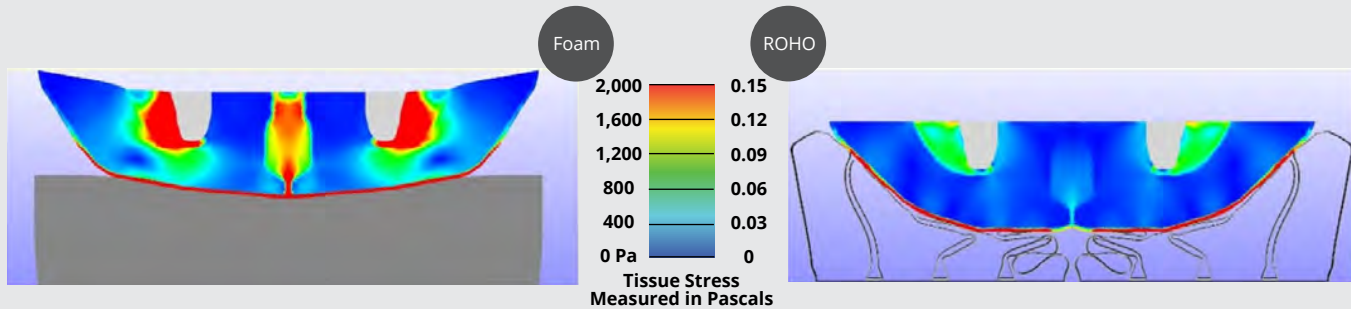
Risk factors are revealed.

The world's first biomechanical assessments of risks.

The finite element models developed at Tel Aviv University analyzed a wide range of body conditions to demonstrate their unique risks. These models show how the ROHO cushion can minimize risk by being adjustable and adaptable to immerse, envelop and protect individuals with the following:

- Obesity
- Diabetes
- Scars, both internal and external
- Muscle spasms
- Weight loss
- Muscle atrophy
- Bone adaptations
- Fat infiltration into muscles

Importance of Immersion and Envelopment



Every body is different — and every body changes.

Immersion and envelopment happen when the cushion is adjustable to the body, today and every day, and over time.

Scientific evidence increases safe sitting time. By combining MRIs, computer models, tissue properties and the latest understanding of cell death, Dr. Gefen's analyses demonstrate that safe sitting time can be increased through immersion and envelopment as well as adjustability and adaptability.

After nearly half a century, science, technology and computing power have caught up to the ROHO design, proving why and how it is incredibly effective.

ROHO's data has advanced the understanding of the critical need for cushions that are adjustable, adaptable and durable to immerse, envelop and protect the individual throughout the day and over time.



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History and evidence speak for the work
and the products created by ROHO.

Find out even more by visiting our website, ROHO.com.

*Citations for peer-reviewed articles and research.

Brienza, D. (2016). *Analysis of Data from a Clinical Trial on Wheelchair Seat Cushions*. Presentation at the European Seating Symposium workshop Improving Patient Outcomes: Bridging the Gap Between Science and Efficacy; Dublin, Ireland.

Brienza, D., et al. (2010). A randomized clinical trial on preventing pressure ulcers with wheelchair seat cushions. *Journal of the American Geriatrics Society*, 58(12), 2308-2314.

Gefen, A. (2014). *Tissue changes in patients following spinal cord injury and implications for wheelchair cushions and tissue loading: A Literature Review*. *Ostomy Wound Management*, 60(2), 34-45.

ISO 16840-6:2015 *Wheelchair seating -- Part 6: Simulated use and determination of the changes in properties of seat cushions*.

ISO/TS 16840-12 *Wheelchair seating -- Part 12: Apparatus and method for cushion envelopment testing*.

Levy, A., Kopplin, K., & Gefen, A. (2016). Device-related pressure ulcers from a biomechanical perspective. *Journal of Tissue Viability*. doi: 10.1016/j.jtv.2016.02.002

Levy A., Kopplin K., Gefen, A. (2016). A computer modeling study to evaluate the potential effect of air cell-based cushions on the tissues of bariatric and diabetic patients. *Ostomy Wound Management*, 62(1), 22-30.

Levy A., Kopplin K., Gefen A. (2015). Adjustability and adaptability are critical characteristics of pediatric Support Surfaces. *Advances in Wound Care*, 4(10), 615-622.

Levy A., Kopplin K., Gefen A. (2014). Computer simulations of the efficacy of air-cell-based cushions in protecting against re-occurrence of pressure ulcers. *Journal of Rehabilitation Research and Development*, 51(8), 1297-1310.

Levy A., Kopplin K., Gefen A. (2014). An air-cell-based cushion for pressure ulcer protection remarkably reduces tissue stresses in the seated buttocks with respect to foams: Finite element studies. *Journal Tissue Viability*, 23(1), 13-23.

Levy A., Kopplin K., Gefen A. (2013). Simulations of skin and subcutaneous tissue loading in the buttocks while regaining weight-bearing after a push-up in wheelchair users. *Journal of Mech Behav Biomed Mater*, 28(1), 436-47.

Shoham, N., Levy, A., Kopplin, K., & Gefen, A. (2015). Contoured foam cushions cannot provide long-term protection against pressure-ulcers for individuals with a spinal cord injury: Modeling studies. *Advances in Skin & Wound Care*, 28(7), 303-316.