



marc

THE MOTION ANALYSIS RESEARCH CENTER
at Samuel Merritt University (SMU) in Oakland,
California, is one of the nation's only multi-disciplinary
research laboratories designed for students and faculty
to collaborate on clinical biomechanics research related
to human motion.

“The gait analysis studies done at the MARC have provided key information to my daughter’s therapy team. They were able to use this information when creating her therapy plan.”

—KARLA FIELDS, MOTHER OF PEDIATRIC CLIENT



Snapshot: Recent Student and Faculty Collaborations

OCCUPATIONAL THERAPY GROUP RESEARCH: Each year students in SMU’s Doctor of Occupational Therapy (OTD) program conduct a large-scale group research project to gain insights that will improve the recovery and rehabilitation of patients. In the 2013–2016 cohort, students investigated the impact of hands-on exposure to sophisticated balance testing on how occupational therapists interact with patients with balance impairments.

GYMNASTICS STUDY: Two Doctor of Podiatric Medicine students questioned what impact intensive gymnastics training has on the growth and development of young gymnasts’ feet. With the assistance of the MARC faculty, the students established a relationship with a local gymnastics facility to find volunteer participants and space to collect the data.

ADJUSTABLE ORTHOTIC STUDY: Invented by a Southern California podiatrist, the innovative orthotic allows for quick adjustments without needing to remanufacture one in the orthotics lab. The MARC replicated the initial master’s thesis study of the orthotic, collaborating with faculty at UC Fullerton, and expanded it to include both legs and 16 channels of EMG.

Opened in 2013, the state-of-the-art facility known as the MARC reflects SMU's academic mission to prepare its future healthcare professionals from the University's five degree programs — physical therapy, occupational therapy, podiatric medicine, physician assistant, and nursing — in immersive, interprofessional settings.

Thanks to generous donations from alumni and community partners to establish the site, the MARC now has the capacity to host major research initiatives, provide dynamic learning experiences for students and faculty across several disciplines, and advance the scholarship of human movement to improve health outcomes.

“We want to make important discoveries that will improve the human condition,” said Drew Smith, director of the MARC. “Our lab allows students to develop an idea, challenge assumptions and the teachings in their textbooks, and then conduct hands-on research alongside faculty experts to see if their idea works. Those findings will benefit not just patients, but all of us.”

“We want to make important discoveries that will improve the human condition.”

—DREW SMITH, DIRECTOR OF THE MARC

KEY ACCOMPLISHMENTS

- Provides an “open lab” environment for students and faculty to partner on human motion research in support of evidence-based clinical practice.
- Staffed by two full-time, PhD-trained researchers to facilitate ongoing learning experiences for students and faculty.
- Collaborates with colleagues at other universities and industry partners to design and host innovative human movement studies and clinical research.
- Opens doors to underserved youth via community-based partners to promote the study of human movement and future careers in healthcare.





A participant makes a bed in a study that examined the body movements of hotel workers.

“We are extremely fortunate as an active community here in the Bay Area to have an amazing, state-of-the-art resource such as MARC. As an orthopedic surgeon, I am excited to extend the technology and services available at MARC to my patients.”

—DAVID S. CHANG, M.D., CHAIR,
DEPARTMENT OF ORTHOPEDIC
SURGERY, ALTA BATES SUMMIT
MEDICAL CENTER

KEY STUDIES

Healthcare practitioners across several fields use the MARC to study biomechanics, gait, upper and lower body movement, and the effect of treatment modalities and assistive devices to apply what they learn for the benefit of patients. The MARC is also a venue for clinical trials of new products and interventions designed to treat movement disorders.

- **HOTEL ROOM CLEANERS AND PHYSICAL DEMANDS:** The MARC’s first externally funded study was led by Dr. Carisa Harris-Adamson, an SMU Physical Therapy faculty researcher and current director of the UCSF Ergonomics Graduate Training Program. Dr. Harris-Adamson, in collaboration with the MARC and physical therapy student assistants, collected biomechanical and ergonomic data from 17 Bay Area hotel workers as they performed the strenuous and repetitive task of making beds. The study offers valuable insight into the physical demands on the workers, and examines whether hand tools could alleviate their physical exposure.
- **AGING ADULTS AND FALL PREVENTION:** Collaborating with experts in SMU’s Occupational Therapy and Physical Therapy programs and Alta Bates Summit Medical Center, the MARC will monitor 60 adults ages 65–85 to determine the most effective fall prevention assessment, education, and exercise interventions. The study will help healthcare professionals gain a deeper understanding of successful interventions for older adults, and which methods are most likely to prevent future falls.
- **THE EFFECT OF CUSTOM-MADE FOOT ORTHOTICS ON ANTERIOR CRUCIATE LIGAMENT OF THE KNEE:** Non-contact rupture of the anterior cruciate ligament (ACL) of the knee is a serious and prevalent injury in young athletes. In collaboration with Dr. Mark Razzante, faculty researcher at SMU’s California School of Podiatric Medicine (CSPM), the study examines how custom orthotics influence lower leg movement, reducing stress on the ACL. First initiated by an SMU alumni, the study of 30 youths is now underway.
- **MAXIMALIST RUNNING SHOES:** Led by Dr. Cherri Choate, CSPM faculty, students are testing the popular “maximalist” long-distance footwear with high cushioning midsoles in comparison to “neutral cushioning” running shoes to measure pressure, motion, and force changes experienced in the runner’s lower body.
- **TORSO-WEIGHTING:** To study torso-weighting using the “BalanceWear” method for people living with multiple sclerosis (MS), SMU’s Dr. Gail Widener and Dr. Diane Allen from the University of California, San Francisco, along with physical therapy students from both universities, are conducting quantitative balance and gait assessments to examine how people with MS respond to this novel therapeutic intervention.



HARDWARE

The MARC is an innovative lab that updates technology frequently.

- **QUALISYS 9-CAMERA MOTION CAPTURE SYSTEM** featuring Qualisys Tracking Manager software: The mounted camera system that surrounds the 2,100 square foot laboratory allows researchers to track full body movement and joint forces in 3-D images on computer screens in real time.
- **AMTI FORCE PLATFORMS:** The six force platforms mounted in the floor of the lab permit investigators to digitally capture the precise force and pressure created by clients while in contact with the plates.
- **PROTOKINETICS ZENO GAIT WALKWAY:** The 26-foot long walkway detects and collects pressure data during static and dynamic balance and gait assessment without placing any instruments on the participant. Footfalls are automatically processed, yielding a wealth of spatio-temporal gait parameters.
- **DELSYS TRIGNO WIRELESS ELECTROMYOGRAPHY (EMG) SYSTEM:** Allows researchers to monitor muscle activity of up to 16 muscles, plus 3D accelerometers.

Additional Hardware:

- Cosmed K5 Wearable Metabolic Testing System
- Natus Smart Equitest Balance Manager platform
- APDM Mobility Lab Comprehensive Gait & Balance Analysis
- novel electronics inc. EMED Pressure Mapping System
- Tekscan F-Scan in-shoe pressure mapping system
- Biodex isokinetic dynamometer
- AMTI instrumented treadmill
- NexGen Ergonomics industrial Lumbar Motion Monitor (iLMM3)
- Aretech Zero-G Passive safety harness ceiling track



KEY PARTNERSHIPS

- > **ALTA BATES SUMMIT MEDICAL CENTER DEPARTMENT OF ORTHOPEDICS:** Working with Sutter Health, Northern California's largest healthcare provider, to develop a gait analysis service model for orthopedic surgeons and rehabilitation services that will improve patient recovery.
- > **UCSF/UC BERKELEY ERGONOMICS RESEARCH & GRADUATE TRAINING PROGRAM:** Collaborating with local academics and students to expand research capabilities in occupational and environmental health.
- > **UCSF BENIOFF CHILDREN'S HOSPITAL WALNUT CREEK:** Developing a clinical and research relationship with pediatric orthopedics and physical therapy.



“The MARC is a unique facility where faculty researchers can work side-by-side with our students to conduct evidence-based research and provide real, hands-on learning experiences.”

—DR. GAIL WIDENER, ASSOCIATE PROFESSOR, SMU

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