

Combat Wounded Veteran Challenge

Kilimanjaro Research Expedition – 2013

Explorers Club Flag #93

The Impact of High Altitude Mountaineering on Lower Limb Amputees, PTSD and Traumatic Brain Injury Patients



Front Row (L to R): SSG Dan Swank, Maj Brett Huchthins, SFC Michael Rodriguez, SSG Billy Costello, Ted Graves, Arlene Gillis, Idee Belau
Back Row (L to R): CAPT Dave Olson, Colby Coombs, Tim Hewette, Tom Barnhill, SSG Vic Thibeault, AOCM Will Wilson, SSG Pete Quintanilla (Mt. Kilimanjaro in background)

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Acknowledgements



Since our founding in the spring of 2010, the Combat Wounded Veteran Challenge (CWVC) has been dedicated to improving the quality of life of returning American military service veterans who have been wounded or injured while in the service of their country. No one has cared more deeply for these Combat Wounded and Injured veterans than **Mrs. Carol Martin**, Founder of the Combat Wounded Veteran Challenge. Mrs. Martin's dedication, love, kindness, and persistence will forever have a very positive impact on their lives. We thank you, Mrs. Carol Martin, for all of your continued heartfelt support, for without you, none of this would be possible. We each care very deeply for you, we are inspired by your selfless support, and could not be more appreciative. God Bless You.

We are also thankful to the many other people and organizations that have come together to share in our collective purpose of demonstrating to other Combat Wounded and Injured veterans that, despite their injuries, they too can overcome seemingly insurmountable personal challenges. We are dependent and sincerely grateful for their generosity and their support of our troops:

Colby Coombs, Caitlin Palmer, Tim Hewette and the entire staff of the Alaska Mountaineering School (AMS), Talkeetna, Alaska, for planning all of the logistics of the expedition as well as serving as our professional mountaineering guides on Kilimanjaro; **Nardo Msuya**, Keys Hotel (Uru Road), Moshi, Tanzania; **Dr. Ed Coleman, MD**, for his proposed Kilimanjaro Case Study on *Pulmonary Vascular Response and Nitric Oxide Levels in a Double Lung Transplant Individual at High Altitude*; **Eric Kennedy**, website and social media support; **Worley and Denise** for all of their tremendous support of the team during their training in Tampa; **Stella Himonetos**; **Peter Ristorecelli**; **Jon Johonson**, website host support; **LtCol Reid Carlock**, USMC (Ret); **Col John and Charla Tempone**, USMC (Ret); **Jim and Teresa Ronayne**; **Elisabeth and John Bucci**, media technical support; **CAPT Bob Silah**, Operation Helping Hand; **Mark Van Trees**, Support the Troops; **Paul and Margot Toomey**, Geographic Solutions; **Dr. Steven Scott**, Medical Director, Polytrauma Rehabilitation Center, James A. Haley Veterans Administration Hospital; **Dr. William Law Jr.**, President, St. Petersburg College J.E. Hanger College of Orthotics and Prosthetics, St. Petersburg College; **Dr. Karena Neri, MD**; **Dr. David Zaas, MD**, Medical Director, Lung Transplant Program,

Duke University; **VADM Bob Harward**, Deputy Commander, U.S. Central Command; **Congressman Mike & Gus Bilirakis** family; **Catherine Kingsford**, Impedimed; **Dr. George Panagakos, MD**; **Steven Springer**, Case Nurse, Walter Reed National Military Medical Center; **Bill Hoskins, Bruce Parks, Sandra Forrest**, National Geospatial Agency; **Pete Conzollo, Thomas May, Ron Parfit, Rick Eparvier, Mike Marconi and Pedro Freire**, and all the Execujet family; **Dr. Dan Kobal**, The Explorers Club; **Steve Hlas**, Derby Lanes; SCUBAnauts International, **Ben (CEO) and Laurie Hayes, John and Sonya Liston, Brian and Alina Hamm, Dr's Chris and Elizabeth Moses, Jim Cassick and Jim Alaniz**; for their support. The Kilimanjaro Team also would like to thank the following Combat Wounded and Injured veterans and support staff who have participated in previous *Challenges* in support of our training and preparation for this expedition: **LCDR Gerard Coleman, SSG Tyler Hall, Cpt Nic Massie, SSG Roland Vaughan, SSG Chris Corbin, Cpl Dave Warden, III, USMC**. Most importantly, thanks go out to each of our spouses and family members, especially **Teresa, Gannie, Deanna, Melaney, Suzanne, Kelly, Angela, Jennifer, and Mike**.



Front Row (L-R): Danny Swank, Brett Hutchins, "Rod" Rodriguez, Billy Costello, Ted Graves, Arlene Gillis, Idee Belau
Back Row (L-R): Dave Olson, Colby Coombs, Tim Hewette, Tom Barnhill, Vic "Yeti" Thibeault, Will Wilson, Pete Quintanilla

A Dedication – Vulneror non Vincor

The Combat Wounded Veteran Challenge – Kilimanjaro Research Expedition Team-2013, dedicated this climb to three members of previous *Challenges*: **LT Justin Legg, Navy SEAL, (Ret)** and **TSGT Jeremy Maddamma, USAF, Pararescueman, and Navy Chief Holly Crabtree (Ret)**. Their

courage and patriotism served as an inspiration for us all.



LT Justin Legg was originally scheduled to participate in the Kilimanjaro research *Challenge*, but was hospitalized just three weeks prior to our departure to Tanzania with complications involving his double-lung transplant that was undertaken in 2010. **Dr. David Zaas, MD**, Chief Medical Officer at Duke University, was to conduct research of pulmonary vascular response to the high-altitudes of Kilimanjaro encountered by LT Legg, a double-lung transplant mountaineer, using fellow team members as a comparison.

Justin successfully participated in a previous

Combat Wounded Veteran Challenge research expedition in June of 2011, *“Taking Lung Transplant Physiology and Leg Prosthesis Research to Denali”*.



TSGT Jeremy Maddamma, USAF, was injured in combat while conducting a medical evacuation mission in Afghanistan during late summer of 2012. Jeremy was assigned to the 212th Rescue Squadron, 176th Wing, Alaska Air National Guard. He was a key member of the storied Alaska Pararescue Team and provided mountaineering support during the Combat Wounded Veteran Challenge research expedition to

Denali in June of 2011. Today, Jeremy is fighting to save his left leg after suffering from a bullet wound and continues his physical rehabilitation at the Center for the Intrepid in San Antonio, Texas.



Navy Chief Holly Crabtree, while in the performance of her military duties as a Combat Medic and, while on patrol with a Navy SEAL team in Iraq, was shot in the head, the round piercing her military helmet, by an enemy sniper. Normally providing life-saving medical attention to American soldiers during firefights, she herself, became a victim of our adversaries aim.

During two years in the Veterans Administration hospital system, Holly was in a fight for her life. She was reminded daily of the frustrating paralysis and severe physical and mental limitations that were sure to challenge her during the remainder of her life. Holly willingly made a great and

life-long sacrifice in the service of her country and now realizes her new mission of conducting inspirational visits to other servicemen most in need. Holly continues to participate in *Challenges* tailored to supporting TBI research, improving orthotics and is scheduled to conduct mountaineering training in Alaska the summer of 2013.

Combat Wounded Veteran Challenge

Founded in 2010, the Combat Wounded Veteran Challenge (CWVC) is a Florida non-profit charitable organization committed to improving the lives of our wounded and injured Veterans through rehabilitative high-adventure and therapeutic outdoor challenges while furthering medical sciences associated with their injuries. The Combat Wounded Veteran Challenge team consists of professional medical research volunteers, volunteer support staff and Combat Wounded and Injured veterans, all of whom are willing to participate in medical research studies during each of many different “Challenges” that are held annually. The team also conducts regular visits to local Veterans Administration hospitals to meet with other servicemen and servicewomen to provide inspiration and hope to those in need. ***Challenge-Research-Inspire*** are the three central pillars of the program. ***Vulneror non Vincor, Wounded – not Conquered***, is the team motto.

SUMMARY

On January 21, 2013, a group of 14 Combat Wounded and Injured military veterans and their support staff embarked on a courageous and inspirational expedition to summit the highest mountain on the African Continent, Mount Kilimanjaro. Their objective: to find medical solutions to further improve the science impacting the advancement of their prosthetics, Post Traumatic Stress (PTSD) and Traumatic Brain Injury (TBI) treatments. U.S. mountaineering guides who accompanied the Team included the founder of the Alaska Mountaineering School (AMS), Colby Coombs, and AMS senior guide Tim Hewette, both of whom are uniquely familiar with the members of the team, experienced and prepared to deal with the challenging conditions encountered by the veterans. Tanzanian mountaineering guides included Dawson, Thomas Meela, Danford, Hubert, Waziri and Roman. The expedition was the team’s second Explorers Club Expedition. Explorers Club Flag #93 was carried by the Kilimanjaro team. Flag 93 was first carried in 1939.

Carrying the Explorers Club Flag

The Explorers Club (EC) flag is awarded for expeditions intended to further the cause of exploration and field science. The flag has been carried on hundreds of expeditions since 1918: to both poles, to the highest peaks of the greatest mountain ranges, traveled to the depths of the ocean, to the lunar surface, and outer space. The Combat Wounded Veteran Challenge was approved to carry Flag Number 93 on the Kilimanjaro research expedition. In 2011, the Combat Wounded Veteran Challenge team carried

Explorers Club Flag Number 61 during their Denali research expedition, ***“Taking Lung Transplant Physiology and Leg Prosthesis Research to Denali”***.
<http://www.explorers.org/>

Prosthetics

The J.E. Hanger College of Orthotics and Prosthetics, St. Petersburg College in St. Petersburg, Florida, partnered with the Combat Wounded Veteran Challenge to provide clinical support for amputee climbers during their expedition. In addition to the clinical support Certified Prosthetist and Program Director Arlene Gillis provided, the school allowed O&P student Ted Graves to accompany the Combat Wounded Veterans to document his own case study. His case study followed each amputee’s reaction to the environmental stresses of Mount Kilimanjaro, specifically, residual limb fluctuation in traumatic amputees during periods of increased activity at high altitudes. The main objective of the prosthetic case study was to note ways to improve and expand prospects for amputee service members who wish to return to active duty, specifically focusing on controlling and adapting volume changes inside the prosthetic socket during extended periods of high activity.

St. Petersburg College J.E. Hanger College of Orthotics and Prosthetics Mrs. Arlene Gillis, CP, LPO, M. Ed, Program Director

Saint Petersburg College (SPC) is one of less than a dozen colleges in the United States to offer a degree program in Orthotics and Prosthetics.

St. Petersburg College (SPC) and Florida State University (FSU) have entered into a consortium to offer a graduate program of study leading to a master’s of science in industrial engineering with specialization in engineering management of orthotics and prosthetics (MSIE-EMOP). Through this consortium, students earn a bachelor of applied science (BAS) in orthotics and prosthetics from SPC and then apply to matriculate at FSU to earn their master’s degree. http://www.eng.fsu.edu/ime/graduate/msie_emop.html

Saint Petersburg College’s J.E. Hanger College of Orthotics and Prosthetics partnered with the Combat Wounded Veteran Challenge to give back, by means of support, to Combat Wounded Servicemen and women. Certified Prosthetist and Program Director Arlene Gillis and student Ted Graves participated in the expedition by conducting initial evaluations of each amputee climber and securing any needed prosthetic equipment

before the journey began. In Africa, each amputee's residual limb was inspected daily to ensure the climber's safety. Orthotic and Prosthetic student Ted Graves was also given the opportunity to document a prosthetic case study throughout the expedition.

In the case study, three Combat Wounded amputee participants were measured for volume changes twice a day. During each data collection, a measurement of total body volume was taken along with segmented measurements of the residual limb. For data collection, **bioimpedance spectroscopy** was used. This method was utilized due to its proven accuracy when compared to other known volume measuring devices. It proved to be the best and most rugged tool for accurate measurements during the ascent of Mt. Kilimanjaro. Bioimpedance spectroscopy uses low current electrical pulses that flow through the body tissues at different frequencies. The device analyzes and converts these frequencies into usable data. The fact that this device can read the different frequencies is of high value in this study because it was required to analyze the difference between the amounts of volume that is inside the cells during that moment compared to that outside the cells. This data will aid in providing us with some answers as to what exactly is going on in the limb during activity.

We hypothesized that the changes and differences of the fluid inside the cells, also known as intracellular fluid, and the fluid outside of the cells, extracellular fluid, will be patterned according to the participant's activity level. The results of the entire case study can be found in TAB [A].

Bioelectrical Impedance Analysis (BIA)

Bioelectrical impedance analysis (BIA) measures the impedance or opposition to the flow of an electric current through the body fluids contained mainly in the lean and fat tissue. In practice, a small constant current is passed between electrodes spanning the body and the voltage drop between electrodes provides a measure of impedance. Using the Bioimpedance Analyzer (BIA) for a total body measurement consists of placing a total of four electrodes on the wrist and ankle and logging the data point in the BIA. The segmented body measurement consists of placing the four electrodes on the residual limb followed by the same process to log the data point in the BIA. The objective will be to correlate short-term physiologic changes with extracellular fluids volumetric changes and long-term physiologic changes with intracellular fluid's volumetric changes. Bioimpedance measurements will be taken at key intervals throughout the day while logging environmental conditions to include, but not limited to: participant's daily hydration, time of day, humidity, altitude, ambient temperature, and activity level.

Each data collection will consist of a total body composition measurement and a segmented body composition measurement of their residual limb. These two measurements allow us to log the total fluid in the participant's body and track how much of that fluid is retained in their residual limb. The aim of this case study is to better understand how extreme environmental conditions affect socket fit, suspension, and its resulting adverse effects on the residual limb.

Traumatic Brain Injury

The first ever concentrated study at altitude concerning the effects of elevation, decreased atmospheric pressure and O2 Saturation on Traumatic Brain Injury was conducted and authored by Combat Wounded veteran SFC Michael Rodriguez during



TBI researcher, SFC Rod Rodriguez chose not to wear his corrective lenses during the summit of Mt. Kilimanjaro in order to accurately conduct his self-study research. Tanzanian guides remained close to protect him while climbing among the most rugged volcanic boulders.

this expedition. SFC Rodriguez is an active duty United States Army Special Forces Green Beret with a history of multiple Traumatic Brain Injuries (TBIs) sustained from blast and blunt force. SFC Rodriguez still exhibits strong residual neurological symptoms from these events. SFC Rodriguez's desired end-state is to document and find more effective ways to differentiate between altitude sickness diagnosis and progression versus residual TBI symptoms, ultimately learning how to prepare for

and cope with these symptoms. His hope is that the data he collected will increase the survivability of service members operating in high altitude

environments by delineating possible duty limitations for those with a history of TBI or even provide a safe means for an individual with neurological injuries or deficiencies to take on the challenges that increases in elevation can offer. SFC Rodriguez' Case Study can be found at TAB [B].

Post-Traumatic Stress

Mr. Tom Barnhill, PTSD counselor, conducted in-field psychological research assessing veterans with PTSD demonstrating that a positively aimed team-based adventure activity, which challenges veterans both mentally and physically, best supports quality of life and a lasting reduction in PTSD symptoms.



Tom Barnhill (L) planning the route with Danny Swank and Yeti

Tom assembled a unique survey placing together validated scales, isolating some clinical dimensions of combat stress but also focusing on functioning in life. This allowed Tom to capture those without PTSD and to focus on quality of life gains while also noting clinical dimensions such as avoidance behaviors and depression. “It’s all

relevant data for PTSD research”, he indicates, “specifically as well as for those without a formal diagnosis but with wounds from combat whether they be PTSD, amputations or TBI”. The results of Tom’s Case Study are forthcoming in six months after further post-event interviews.

Training

Prior to undertaking this research expedition, the 14-man team completed rigorous mountaineering training with the Alaska Mountaineering School in the Alaska Range. Some of the members of the Kilimanjaro team also completed a successful Explorers Club Flag research expedition (Flag #61) at Alaska's Mt. McKinley (Denali) July, 2011: ***Taking Lung Transplant Physiology and Leg Prosthesis Research to Denali,***

http://www.explorers.org/index.php/expeditions/into_the_field/flag_reports/category/year_2011.

Regarding the biomedical support aspects of this Kilimanjaro research expedition, students Ted Graves and Caitlin Collins conducted preliminary assessments on the amputee's residual limbs prior to the team's departure to Kilimanjaro to gather the baseline data to determine their gait, balance and volume measurements. **GAITRite® Mats** were used to record gait and balance readings. The majority of this preliminary work was completed during the preceeding week of the expedition at Mrs. Carol Martin's home in Tarpon Springs, Florida.

About the Mountain



Mount Kilimanjaro, at 19,341 ft/5,895 meters, is the tallest free-standing mountain in the world and is regarded as the "roof of Africa". The entire mountain area is 2,485 miles/4,000 kilometers of the earth surface, *"as wide as all the world, great, high and unbelievably white,"* according to Earnest Hemingway

(<http://www.eturbonews.com/26401/myths-and-mysteries-mount-kilimanjaro>) .

Mt. Kilimanjaro is located in Tanzania some 200 miles south of Equator, giving a towering view hundreds of miles away. It is a volcano with three peaks, Shira in the west (12,999 ft); Mawenzi in the east (16,893 ft); and Kibo in the center (19,341 ft). It is now a United Nations Educational, Scientific and Cultural Organization (UNESCO) World

Heritage Site, and secured a position as one of the Seven Natural Wonders of Africa, declared on February 11, 2013 in Arusha, Tanzania.



View of Mt. Kilimanjaro on the second day

Formed some 750,000 years through volcanic eruptions, Mount Kilimanjaro took several geological changes for 250,000 years. Present features were formed during the past 500,000 years after a number of upheavals and

tremors took place to cause formation of 250 volcanic hills and crater lakes including the magnificent Lake Chala down its slopes.

The last volcanic activity occurred about 200 years ago and created a symmetrical cone of ash around Kibo peak, and since then, Mt. Kilimanjaro was at peace until today, but people who were living on the slopes and observed volcanic eruptions connected this natural phenomenon to punishment from God.

Our Tanzanian guides related to us that earlier occupants of its slopes took the mountain as a place not to go to in fear of reprisal from God because it was his almighty seat. Locals today see the dwindling snow as a punishment from God because too many humans attempted to climb it. Tourist deaths on the mountain are still connected to this wrath from God by some.

The Maasai people on the very lower slopes never gave a name to this awe-inspiring mountain but the Wakamba people on the Kenyan side named it "Kilima Jeu" and "Kayolaa."

It is also believed that the present name of the mountain was derived from the Swahili people from Mombasa and other coastal towns who called it "Kilima Njaro," or mountain of caravans, because they used the mountain as the symbol to determine directions

from far away, as their compass. To many, the chance to climb this mountain is an adventure of a lifetime.

[Segments of this section partially derived from <http://climbmountkilimanjaro.com/about-the-mountain.html>]

Participants

The CWVC EC Flag expedition was led by CAPT David Olson, Explorers Club FN'11, Co-Founder of the Combat Wounded Veteran Challenge, and guided by Alaska Mountaineering School (AMS) mountaineering guides, Colby Coombs and Tim Hewette. The Tanzanian mountaineering guides were Dawson, Thomas Meela, Danford, Hubert, Waziri and Roman. David was responsible for assembling the team, including the orthotists & prosthetists, planning, financing, and contracting Alaska Mountaineering School for guiding the expedition. Caitlin Palmer, Alaska Mountaineering School, was responsible for planning all arrangements and details relating to lodging, guiding and movement while in Tanzania.

Alaska Mountaineering School




The Alaska Mountaineering School (AMS) has been the guiding company of the CWVC since our very first mountaineering course in 2010. Their very professional mountaineering instructors tailor skills training to meet the *Challenge* requirements of our amputees and other Combat Wounded and Injured veterans. AMS teaches instructional courses and leads guided climbs in the Alaska Range, Talkeetna Mountains, and Chugach Mountains. Colby Coombs and Caitlin Palmer own and operate Alaska Mountaineering School, LLC in Talkeetna, Alaska, 50 miles south of Denali National Park & Preserve. <http://www.climbalaska.org/>

The Combat Wounded and Injured military participants who comprised the Kilimanjaro Research Expedition team were selected by a committee of their peers and participating professional medical researchers and providers. Their selection was based upon the nature of their specific injury sustained in military combat or during military service as well as their intense desire and commitment to participate in medical research and improve upon the functionality of their condition, ultimately inspiring other wounded veterans to do the same.

Arlene Gillis, CP, and student Ted Graves, J.E. Hanger College of Orthotics and Prosthetics, St. Petersburg College, volunteered as the prosthetic clinical team who

monitored the amputee participant's safety and status during the expedition. Ted Graves also collected data and monitored the veteran's anatomical reactions to the changes in environment during the climb. Specialized equipment and measurement tools such as bioimpedance spectroscopy, supporting computers and batteries were necessary to accompany the research team.

The Combat Wounded & Injured Kilimanjaro expedition team, excluding Tanzanian mountaineering guides, consisted of the following persons:

NAME	INJURY/FUNCTION	PROFESSION
 David Olson	CWVC Head of expedition	Co-Founder & Executive Director, CWVC, CAPT, U.S. Navy (Ret)
 Will Wilson	Unilateral Right Amputee (BKA) & evaluator	Deputy Director AOCM, U.S. Navy (Ret)
 Michael "Rod" Rodriguez	TBI evaluator; Self-Study	SFC, U.S. Army Special Forces (Green Beret)
 "Billy" Costello	Unilateral Right Amputee (AKA) & evaluator	SSG, U.S. Army Special Forces (Green Beret)

 <p>Pete Quintanilla</p>	<p>Unilateral Left Amputee (BKA) & evaluator</p>	<p>SSG, U.S. Army Special Forces (Ret)</p>
 <p>Vic "Yeti" Thibeault</p>	<p>Partial hand and multiple finger amputee - Support</p>	<p>SSG, U.S. Army (Ret)</p>
 <p>*Danny Swank</p>	<p>Unilateral Right Amputee (BKA) & evaluator</p>	<p>SSG, U.S. Army (Ret)</p>
 <p>Brett Hutchins</p>	<p>Support</p>	<p>Major, U.S. Air Force (Ret)</p>
 <p>Ted Graves</p>	<p>Orthotics and prosthetics support team</p>	<p>Student, J.E. Hanger College of Orthotics and Prosthetics</p>

 <p>Arlene Gillis</p>	<p>Orthotics and prosthetics support team</p>	<p>CP, LPO, M.Ed Certified Prosthetist, Program Director at J.E. Hanger College of Orthotics and Prosthetics</p>
 <p>Tom Barnhill</p>	<p>Mountaineer, PTSD and TBI evaluator</p>	<p>PTSD Counselor</p>
 <p>Colby Coombs</p>	<p>Lead Mountaineering Guide</p>	<p>Alaska Mountaineering School</p>
 <p>Tim Hewette</p>	<p>Mountaineering Guide</p>	<p>Alaska Mountaineering School</p>
 <p>Idee Belau</p>	<p>Team Photographer</p>	
 <p>Mrs. Carol Martin</p>	<p>Base Camp Ground Support</p>	<p>Founder, Combat Wounded Veteran Challenge</p>

**Russ Gratz	Base Camp Ground Support	MSGT, U.S. Air Force (Ret)
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*Due to potential increased damage to SSG Danny Swank's residual limb, SSG Swank was unable to complete the study.

**Photo not available

Objectives

Our objectives were to collect valuable information and medical data during this "Challenge Expedition" to contribute to the science of human performance, rehabilitation and recreation under extreme conditions. The unique information gathered is being prepared for dissemination to relevant groups including cardiopulmonary and rehabilitation professionals who will find it useful to 1) advance the state of science and, 2) inform the rehabilitative care of others with similar needs, specifically:

(1) Use of **bioimpedance spectroscopy** to analyze amputee residual limb volume and tissue composition changes throughout the 19,000 ft climb to further the development of an advanced prosthetic socket that better manages these volumetric changes and pressures while providing active cooling and temperature control;

(2) the first ever concentrated study at altitude concerning **the effects of elevation, decreased atmospheric pressure and O2 Saturation on Traumatic Brain Injury** (conducted and authored by SFC Michael Rodriguez who has severe TBI);

(3) **In-Field psychological research assessing veterans with PTSD** demonstrating that a positively aimed team-based adventure activity, which challenges veterans both mentally and physically, will support quality of life and a lasting reduction in PTSD symptoms.

Findings

TAB A: ***Using Bioimpedance Spectroscopy to Analyze Residual Limb Volume Fluctuations During High Altitude Activity***, Theodore Graves, Student, Orthotics and Prosthetics, J.E. Hanger College of Orthotics and Prosthetics

TAB B: ***The Effects of Atmospheric Pressure and Elevation on Traumatic Brain Injury, a Self Study***, SFC Michael R Rodriguez, US ARMY Special Forces, Green Beret

Research-Data Collection Equipment

PROSTHETICS – Ted Graves:



- Impedimed SFB7 Bioimpedance Spectroscopy (BIS) for volume measurements
- Garmin GPS for distance and altitude measurements
- Laptop for backup and analyzing BIS data
- Pen and Write in the Rain notepads
- Digital Camera
- HD Hero Video Camera

TRAUMATIC BRAIN INJURY (TBI) - SFC Michael Rodriguez:

- Nonin finger pulse oximeter
- Suunto watch with barometer
- 72" piece of 550 parachute cord incrementally marked with centimeter measurements from 25 cm to 120 cm in 10 cm
- Kindle Fire utilizing program called Brain Lab created by SIXDEAD Entertainment.

- Lake Louise checklist
- Write in the Rain notepad
- Headache (HA) journal utilizing OPQRST technique
- Notepad to record number of falls and Sleep journal

Kindle Fire

The Kindle Fire is a mini tablet computer version of Amazon.com's Kindle e-book reader. Announced on September 28, 2011, the Kindle Fire has a color 7-inch multi-touch display with IPS technology and runs a forked version of Google's Android operating system. SFC Rodriguez borrowed his young son's Kindle and loaded it with the Brain Lab application to help him conduct his self-study.

Brain Lab

Brain Lab is a Brain and Puzzle game designed to improve your short-term memory, logic, calculation and visual skills. SFC Rodriguez utilized Brain Lab as part of his TBI tests at different altitudes to measure his brain power based on his game performance on memory, logic, calculation and visual.

POST TRAUMATIC STRESS (PTSD) - Tom Barnhill:

- **PTSD Checklist (PCL)** -- The standard, quick-hit PTSD evaluation tool. Has questions focused on each of the 17 qualifying symptoms.
- **World Health Quality of Life Scale (WHOQOL)** -- A well-validated scale with questions about quality of life.
- **Beck Depression Scale (Beck-D)/ truncated version** -- The standard for depression assessment
- **Multi-dimensional Acceptance of Loss Scale (MALS)** -- Questioning regarding functioning in the face of a disability.
- **Connor-David Resilience Scale (CD-RISC)** -- This is a unique scale, almost tailored for us, that tests resilience/attitude.
- **Cognitive Behavioral Avoidance Scale (CBAS)** -- This tests for avoidant behaviors which are one of the prime identifiers/problems in PTSD.

General

The Combat Wounded Veteran Challenge Kilimanjaro Research expedition was dedicated to the full recovery of LT Justin Legg, U.S. Navy (SEAL), TSGT Jeremy Maddamma, U.S. Air Force Pararescueman, and Chief Holly Crabtree, U.S. Navy Combat Medic.

The mission of this expedition originally included an additional study of ***Pulmonary Vascular Response and Nitric Oxide Levels in a Double Lung Transplant Individual at High Altitude*** (LT Justin Legg) as prepared by **Dr. Edward J. Coleman, MD**, with control group. **Dr. David Zaas, MD**, former Medical Director of the Lung Transplantation Program at Duke University Health System was scheduled to accompany LT Legg on this expedition to conduct this research but **LT Legg's** worsening condition as a double-lung transplant patient and hospitalization at Duke University Medical Center very near to the expedition date precluded their participation.

The U.S. Guides

The Combat Wounded Veterans Kilimanjaro Challenge Team was guided by the co-owner and operator of the Alaska Mountaineering School (AMS), **Mr. Colby Coombs**, himself a world class alpinist, guide and published author on mountaineering. Colby was assisted by **Mr. Tim Hewitte**, owner of Remote Endeavors, LLC, who has scaled peaks world- wide, focusing on Alaskan and Antarctic ranges year round.

The Tanzanian Guides and Porters

Most Kilimanjaro guides and porters are predominantly members of the local Chagga tribe, who live in the towns of Moshi, Arusha and surrounding villages at the base of Kilimanjaro. With an estimated 200,000 climbers attempting to climb Kilimanjaro each year, tourism has become a primary source of income for the Chagga.

The Keys Hotel served as our local tour-guide company and arranged for the employ of local porters to carry our equipment and supplies up and down the mountain. There was a standard ratio of 3



Our Tanzanian Guides. Lead guide, Dawson, in center.

porters for every climber in our group; approximately 35 porters assisted our team during the expedition.

Porters were assigned to carry all of our gear, up to 35 lbs each, and included food and medical research equipment stuffed in large sacks that were balanced on their heads. Each climber also was required to carry up to 35 lbs of their personal gear. Each porter



Tanzanian guides and porters gather at the final basecamp for closing "tipping" ceremony

was extremely respectful and alert to our every request. They briskly broke camp every morning, packed all gear, balanced their packs upon their heads, and made their way up the mountain in a single line greeting us with "Jambo, Jambo" as they each passed, well ahead of us, in time to make camp and have a hot meal prepared for us upon arrival. Our porters were paid a total of \$6 per

day for their work, in addition to tip, for which they were very enthusiastic. For many Chagga, carrying heavy luggage up the mountain is their only way of life as unemployment hovers around 80%.

Some of our local guides and porters have climbed the mountain over 100 times, although not all of them reach the summit. Many of them continue to work together throughout the year, guiding each and every month. Although Kilimanjaro has a reputation as being an "easy" big peak to climb, an average of 10 people die on the mountain each year, many of them porters. Oftentimes, porters are at greater risk than their client climbers because they lack the proper equipment and clothing. We were sure to take care of our porters and many of our team left behind some quality gear for some of them that they would find of benefit for future climbs.



Kilimanjaro guides all receive a license to work on Kilimanjaro from the National Park. Additionally, they are trained in Wilderness & Emergency Rescue First Aid. Without this certification they are unable to operate as guides. Our Tanzanian mountaineering guides were exceptionally professional and demonstrated great skill: Dawson, Thomas Meela, Danford, Hubert, Waziri and Roman.

The Climbing Team

The U.S. mountaineering expedition climbing team, excluding the U.S. guides, totaled 12:

- 6 Combat Wounded and Injured (amputee, PTSD, and TBI volunteers)
- 3 Research staff (Prosthetist, Graduate Student and PTSD Counselor)
- 3 Support Staff (Expedition Leader, Photographer, Support)

MSGT Russ Gratz and Mrs. Carol Martin provided ground support for the climbers and remained on call at the Keys Hotel in Moshi by Satellite Phone due to the active duty status of some of our military and civilian team.

Colby Coombs was the lead U.S. Mountaineering guide and was assisted by **Tim Hewette**. During the first two legs of the expedition, the entire team maintained close integrity, sharing pre-planned breaks. By the third day, however, the group broke into two separate teams, one led by Colby and one led by Tim.



Danny Swank encountered major issues with sweat in his prosthetic socket

SSG Danny Swank required additional stops due to the very painful abrasions that were developing on his scarred residual limb. **Arlene Gillis and Ted Graves**, prosthetists, were strategically placed within the second group to better monitor SSG Swank's condition and assist him when required. Our Tanzanian mountaineering guides ensured that the prosthetist's equipment and tools remained within reach to assist SSG Swank and other amputees.

SFC Michael "Rod" Rodriguez quickly established great stability with his trekking poles in the early stages of the ascent as described in his journal entries that follow in the below. Despite the occasional stumble or fall, he consistently inspired the climbers of the first group with his strength. One of the Tanzanian guides, along with a U.S. climber, usually was close at hand on either

side of Rod, however, during the steeper and rockier ascent legs in the event Rod may go head first into the sharp volcanic rock.

The Rongai Route

There are six established routes to climb Mount Kilimanjaro - Marangu, Machame, Lemosho, Shira, Rongai and Umbwe. For this expedition, the team chose the Rongai Route, the only route that approaches Kilimanjaro from the north, close to the Kenyan border. The Marangu, Machame, and Umbwe routes all approach from the south of the mountain (Mweka is used only for descent). The Lemosho and Shira routes approach from the west. The illustration below depicts a three-dimensional view of Kilimanjaro's climbing routes.



The Rongai Route was the preferred route for this research expedition



The Rongai Route begins in attractive farmland and delightful forest, with the opportunity for viewing black and white colobus monkeys, and passes through five different climate zones.

Although the scenery is not as varied as the western routes, Rongai makes up for this by passing through

true wilderness areas for days before joining the Marangu route at Kibo camp. This route descends down the Marangu route.

We couldn't complain when it came to ready-made hot meals. Our long caravan of porters carried the teams cooking equipment and supplies up the mountain, including live chickens, an effort that's reflected in the daily fare: eggs, porridge and toast for breakfast, popcorn and homemade potato chips as snacks before dinner and fresh grilled chicken for dinner.



Tumaini Protas Mtui ensured that our team had hot food & tea as soon as we arrived at each camp

The Expedition Log– Kilimanjaro Challenge

22 – 29 January 2013

Date: 22 January (Tuesday, Day One)

Location: Rongai Trail Head to Simba Camp (8,530 ft/2600m)

Bag drop outside of the Keys Hotel was 0800 hrs. At approximately 0900 hrs, the team departed in two vans to the Marangu National Park to obtain our permits. After driving through the bushland, we arrived at the entrance to Kilimanjaro National Park and its Rainforest zone, the second of five distinct climate zones on Kilimanjaro. After completing the necessary registration formalities at Marangu National Park gate, we transferred again by bus



Enroute from the Keys Hotel for the 2-hour bus ride to Marangu National Park

to Rongai.

This first leg of the expedition began from the wooden village of Nale Moru (6,398 ft) and wound through forest, maize, potato farmlands and pine plantations. It was only a half-day walk, approximately 4-hours along a consistent but gentle climb through dense forest populated by a variety of wildlife. We reached our first overnight stop by 1800 hrs located on the edge of the moorland zone at approximately 8,530-ft.

When we arrived at camp, the porters had already set up camp for us, including a dining tent and latrine. Hot water, popcorn and peanuts were served by Tumaini, our assigned waiter. Immediately upon arrival to camp, Ted Graves, Arlene Gillis and SFC Rodriguez immediately began conducting their research involving Bioimpedence Spectroscopy on our amputees residual limbs. Ted took measurements on all amputees as planned while SFC Rodriguez conducted his tests nearby the tent area with Tim Hewette and

Tom Barnhill as his control subjects. Master Chief Wilson and his tent-mate SSG Billy Costello retired early.



Master Chief Will Wilson (BKA):

Final staging at Keys Hotel in Tanzania, 0900 departure, the bus ride consisted of 2 legs equaling about 3 hours to the trail head to sign in for the climb. Approximately 1230, packs on headed up to about 2800 ft ASL., arriving at camp at 1815. Hot today.....big surprise there! Staying very aware of sweating and fluid replacement ratio so I don't lose too much volume in my limb, as we arrive in camp after a fairly long initial hike at a pretty good/fast pace for us old guys, it's time to get fluid measurements taken by Ted graves of St Pete College of Prosthetics. A few sticky pads and some horizontal time to equalize the fluid within our bodies the test begins, just hoping that all this sweat does not short out the electrodes and I jump up with a hairdo like the Bride of Frankenstein! Nice to have the first day under our belts and working out the



Master Chief Wilson leads the team followed by Tom Barnhill and Ted Graves

bugs of being on the trail once again and out in the badlands. Dan Swank is already having issues with his limb due to the nature of his injury and sensitivity due to extensive skin graphs. 123 Points of internal fluid noted by Ted on my scan, we will see how steady this goes during the trip. Billy and I are a bit whipped due to the first day's exertion and choose not to go to the chow tent, the guides bring us some Cucumber soup and some of the best spaghetti I had ever tasted, did not think I was hungry till I tasted the food and realized I needed it more than I wanted it. The plan is to move out tomorrow for a 900m gain, we will see how the hydration goes, it's sure to be AFRICA HOT again in the AM!



Arlene Gillis, team prosthetist:

All of the guys look out for each other like brothers. It is clear Yeti and Dan have a very special bond.

Dan had problems with his socket. He struggled with heat. We kept a log of all the stops he had to make to wipe the sweat off his residual limb. At one point he added a sock and ended up with a blister on the lateral side of his limb. Beyond that, he needed several rest stops because he would not slow his pace. Dan is determined to summit and I

hope his residual limb allows him to complete the climb alongside Yeti. During today's climb he walked on his tiptoes and his heart rate got up to 167bpm at one point. I let them know he may have skin breakdown and we will need to evaluate its severity. Again, I realize more and more how amazing this team is the more I get to know them and interact with each of them.



Danny Swank (L) and Yeti Thibeault (R)



SSG Billy Costello:

This morning we started our trek to the base of Kilimanjaro. Just about everyone woke up hours before first call. I think everyone was as anxious as I was to start the climb. At 0800, our guides and porters loaded our gear and by 0900 we were on the road. We passed through many villages, passed many schools, past an enormous Catholic Church, many



Billy Costello is followed by Pete Quintanilla

banana and sunflower fields to the gates of Kilimanjaro National Park. There, our guides purchased our permits. Once we unloaded to stretch our legs, we were bombarded with Tanzanians selling Kilimanjaro Booni Caps and bracelets. I didn't bring any money, but I wish I did so I could have purchased a bracelet for each of my boys. I will attempt to barter my multi-cam hat for a bracelet for Wes and Ty.

We hiked to our first camp. I saw a black and white monkey (Colobus). The rest of the time, I was concentrating on the trail. I avoid conversation when I march because it detracts from performance,, and on this trip I am here to perform. I still have many things I need to prove to myself. 5,860-ft elevation. Racked out as soon as we made it to camp. Dave made sure me and Will got some dinner. I had a bowl of cucumber soup and some bread. It was hard to get the motivation to put the leg back on after I took it off for the scientific measurements and analysis.



SFC Rodriguez, TBI Self-Study:

Today started off well, had a restless sleep last night though. I rode in front of the bus on the way to Kilimanjaro to avoid motion sickness. Pressure increased for HA as we drove, unsure if due to driving or increase in elevation. Once we hit the trail I had a few stumbles and fell twice. It is very frustrating to try to stay on your feet but unable to. I like glacier travel more, crampons, snowshoes tend to provide more stability. If I focus on every step I think I may do better tomorrow. I had a slight bit of pressure right in my throat but it subsided once I started to concentrate on breathing techniques more. Today's tests showed little change from yesterday's baseline.



AMS Guide Tim Hewette (L) served as Rod's control subject during the TBI tests



Theodore Graves, Student, Orthotics and Prosthetics:

We began our day with the hurry up and wait bag shuffle. The drive to the trailhead took 2 ½ hours but it was enjoyable to see numerous villages along the way. The women appeared to tend to the fields, carrying large loads of bananas on their heads to the markets. The men were predominantly working in construction, building homes made from Adobe brick. Many men were observed enjoying leisure time while I didn't notice the same luxury for the women.

We started our hike at 1400 with over 40 porters lugging our gear ahead of us. We arrived in camp just after 1800 after a hot first day of hiking.



There were many marketplaces like these along the roadside enroute to Rongai trailhead

Date: 23 January (Wednesday, Day Two)

Location: Simba Camp (8,530 ft/2600m) to Second Cave Camp (11,319-ft/3600m)

The team was awakened at 0615 hrs. for breakfast and to sterilize their waters. Breakfast consisted of the daily porridge, bacon and toast. By 0830, we were on trail. Midway through this leg, however the team broke into two separate teams.

This second leg led the team through the Heath Zone, grassy Alpine Plains and Lava Tunnel with a steady ascent to the 'Second Cave' at 11,319-ft. Here we could observe the Eastern ice fields on the rim of Kibo, the youngest and highest of the three volcanoes that form the entire mountain.



Master Chief Will Wilson (BKA):

Longer climb than expected as it turns out but was a great effort by all. I broke into the secondary trail group following Dan Swank closely to monitor his progress and pain levels. He is having some real issues already and is gritting through it thus far. We have made it to 11,460 ft,



not AS HOT today which was good we had a mild breeze which also helped keep us all a bit more comfortable along the trail. As we climbed, I was content staying with the second group, let the young guys beat the trail head into submission, I'll get there! To look up ahead, when I did see them, the group was led by Green Beret Billy Costello, an above knee amputee who is hammering the

Tanzanian Guide Dawson leads the second group followed by Danny Swank, Will Wilson and Arlene Gillis.

hill with grit and determination, proving to himself that he still has what it takes. I felt strong today once I got warmed up which is usual, slow start then hammer away. The cook staff had hot soup and bread

waiting for us in camp, good tasty start to our meal indeed, the rest of the meal is going to be fresh fried chicken, how fresh you ask? I heard clucking and saw a backpack moving about as a porter blew by me on the trail....does that answer that? As we hop scotched with other groups along the trail today, several folks asked if they could take a snap shot of us as we passed by them on break. The look on their faces spoke volumes seeing our prosthetic legs powering our bodies up the mountain, those from the U.S. swelled with pride as we passed, the experience seemed to fill them with necessary inspiration to stand a bit straighter and walk a bit truer as they proceeded forward along their own personal journey up Kilimanjaro.



Arlene Gillis, team prosthetist:

Today was a very hard day for Dan and team, especially for Yeti (Dan's roommate and best friend). Dan and Yeti are like brothers. They truly care and lookout for each other. Dan started with some blistering in the morning. I warned both Dan and Capt' Dave Olson about my concerns for his residual limb and wellbeing. David said that it was Dan's call if he wants to move forward. Dan was determined, as always, to continue the climb against my warning. I think mostly because of his commitment to accomplish the feat or mission. I've noticed that soldiers have a distinct mindset; they value the completion of a mission and accomplishment above their personal wellbeing. They carry this mentality throughout all aspects of their life. These men are truly brothers and look out for one another, "no man left behind". Partially, I think he sees my evaluation of his residual limb as an "obstacle for him to overcome". He does not know me well enough to understand I am looking out for him. The condition of his limb is not something he can or should try to "tough out". I think most



Prosthetist Arlene Gillis evaluates the gait of expeditioner amputees

veterans think that no one cares or understands, especially a civilian like myself. I know about their need to accomplish goals and “missions” and feel fulfilled. I respect them immensely and will not continue to force the issue. I am here as a guest and I know that Dan was just not feeling well at all today. His oxygen levels were low and he struggled. It was a tough climb overall.

I was happy and grateful that I made it today considering how worried I was about my own body’s reaction to the altitude and lack of camping experience. Before this, my camping repertoire included two days at a Disney campground! I have been concerned, but so far doing alright. The views have been spectacular overlooking Africa.

We took footage of Dan and Will. They both worked very hard to accomplish today’s goal. I hope we have a good day tomorrow.



SSG Billy Costello:

We just had a warm lunch after reaching the campsite. We had grilled cheese and carrot soup with tea. We’re over 11,000 ft elevation now and the air is thinning making us breathe harder while feeling short of breath. I was smoked when we finally reached the campsite. After lunch I took off my leg and took a nap for a few hours. Off and On. I was able to get my leg back on and get some dinner.

Quote of the day goes to Colby: “that’s what the day is for – hiking.”





SFC Rodriguez, TBI Self-Study:

We arrived at Camp 2 at about 1330. The 1st group was in good spirits. Billy and Pete did very well, as I watched I was proud to call them my brothers. Billy hid his exhaustion well, as any Green Beret. Pete is one tough Ranger, never once asking for a break or stopping or complaining. I had a few stumbles that my teammates kept from turning into falls, but I also had a few falls that could not be stopped. Aggravation and anger are my first feelings after a fall. I think the anger comes from shame. My headaches have been under control thus far, I hope it continues. Every step is carefully planned and if executed correctly I have no problem. It is when I am distracted or not concentrating that I fall, must focus more. I feel the anger growing in me; I need some personal time to calm myself down. I have not time for immaturity or attention needy people. I am a Quiet Professional with my mission focus and need to maintain. We have a short hike later, should be good.



Theodore Graves, Student, Orthotics and Prosthetics:

Today I witnessed first-hand an amazing drive and determination put forth by these men as they set out to prove to themselves that they are still capable. Our creed is inspire, challenge, and research. I always saw them as an outward projection. The men I saw today internalized that and through challenge, inspired themselves.



Ted was chiefly responsible, and sometimes unpopular, for conducting the twice daily bioimpedance spectroscopy tests with each of the amputees





Dave Olson entry:

It was a very challenging day for Danny. During the evening meal, Dan elected to remain in his tent where I took him dinner. His residual limb appeared very sore and 'shredded'. I realized he was in some serious pain and I informed him that I admired his spirit and that he served as an inspiration to me and all of the others and that he did not have to prove anything more. He indicated that he was through with the test procedures to which I responded that we will stop the research involving him at this point. I further encouraged him to wait through the night before deciding whether to continue on the climb, if he is able, but not to continue if he will further damage his residual limb. Arlene has also been very concerned and has kept me apprised of Danny's condition. The final decision, I indicated to Danny, rested with him. I also gave to SFC Rodriguez a Furosimide to recommend to Danny in the event his shortness of breath worsens or becomes necessary.

Ted Graves is a rockstar on this climb. He has kept up his data call each and every morning and evening religiously. He is ALWAYS in a great mood and a hard worker. He was a great selection for this expedition (even though he was prior Air Force).

Date: 24 January (Thursday, Day Three)

Location: Second Cave Camp (11,319 ft/3600m) to Mawenzi Tarn Camp (14,206 ft/4330m)



The Team, along with guides and their porters display the Explorers Club Flag at the 15,500 ft camp and sing the Jambo Bwana song

Up at 0615 to embrace a very chilly morning. This leg was a short but steep climb up Alpine grasses and through a wide open rock valley providing sweeping views of the Kenyan plains to the north.



Master Chief Will Wilson (BKA):

Woke at midnight to noises in the encampment and could only try to dose off until for the remainder of the night. Insomnia and an inability to return to sleep once I am awakened continue to plague me even when under heavy exertion humping a volcano. Long haul today but not too steep overall, cooler temps helped keep the hydration issues at bay although I know I should have been forcing hydration to stay ahead of the dehydration that can grab you out of nowhere. Hit camp about 1345 for a hot meal and some rest, laid down for a short bit and just chilled in the tent, ate some jerky,



powered down some lemonade to help stabilize my fluid levels. UV is crazy here so near the equator, although I applied SPF 100, I am fried on my face and arms already. What blows me away are the guides and porters here, all very good guys and always very friendly, I have NEVER seen a physically tougher bunch of guys than this, like Energizer bunnies on crack, they just keep going! You will be trudging along and a Porter will blow by you with an incredible load positioned on his head and back in a blown out pair of flip flops with a loud “Jambo Jambo” as he passes, incredible! I can’t help but think that these guys are making next to nothing “comparatively speaking” and it’s a dog eat dog process just to get into position to be a porter much less a certified guide.



Arlene Gillis, team prosthetist:

Today was a great day. Everyone did well, as expected. Dan pushed forward with the heat. He is still a soldier. Because of my previous evaluation of Dan’s limb, I stayed back to climb alongside him. He had significant positive change in his attitude and had a good day pace wise. We got to camp at 1230, only one hour behind the others. It was good to



Ted Graves attaches bioimpedance spectroscopy electrodes to Danny Swank's residual limb

break up into two groups to allow everyone to go at their own pace.

Dan is in good spirits and as the second group reached camp, we got a cheer from the first group. They were all happy to see Dan coming up so strong up the hill.

We are still noticing some undesirable gait patterns on Will and Dan, Dan is still “toe walking”. Ted will continue to monitor this along the trip.



SSG Billy Costello (AKA):

Today was an easy climb for just a few hours. I believe we could have made it to this camp yesterday if we had put it into the plan, but the fact that we didn't, allowed us to have this easy acclimatization day. It also gave us an opportunity to heal and normalize.

I've developed a great respect for the Tanzanian people who make up our porters and guides. They are an extremely generous, hard-working, and kind people. They always offer encouragement and call "Jambo" as we pass on the trail. These guys have to be tough to do this job once a month.

This is a day where, visually, this mountain looks within reach. Yeti moved with the porters ahead of the lead group. He made it in about 1030 hrs.

Quote of the Day goes to Idee: "When you catch your breath, can you pass the sugar?"

Prosthetically, everything is working out well. I've got my 5590 battery with necessary attachments and I've gotten 2 full charges out of it with over 50% battery life left. Tomorrow night, I will recharge before we go for the summit. The leg itself (x2) is working well. I know it like second nature now. I know when the knee will flex and when it won't. If I fully

walk over the toe on gradual inclines the knee will flex as usual. If I don't have a full rollover, the toe will remain rigid. This works to my advantage when navigating rock obstacles. I know exactly where my foot will be placed and ensure a good foothold. The foot (Veriflex XT) is working well except for in instances where the toe lands on a rock and it tries to spring me backwards. I've moved on from a 1 Ply Sock to a 3 Ply Sock, but I'm still losing suction occasionally. Losing suction is the most frustrating



Billy swings his prosthetic in an upward arc to negotiate obstacles in his path. Trekking poles were especially helpful to maintain balance in this rocky terrain.

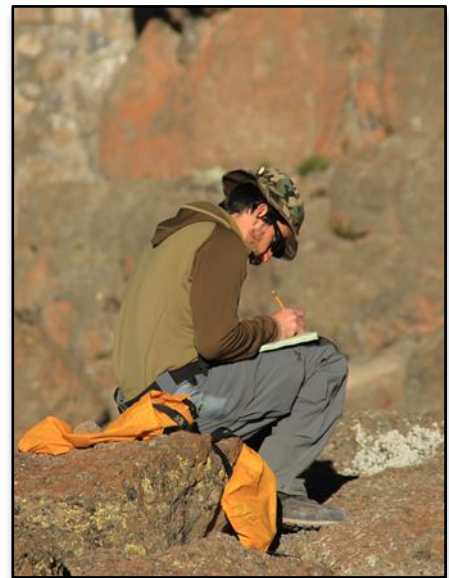
prosthetic flaw. If I can get a good suction, I have a great day. I wonder about adding an additional ring to the liner a few inches higher. That could help create better suction and grip to the socket. The coyote strap I had put onto the socket a a week prior to the expedition has proved to be a necessity. I would have had serious trouble keeping my leg in place over this terrain without it. Of all the things I did to prep, that has proven to be most essential.



SFC Rodriguez, TBI Self-Study:

Got to Camp 3 around 1130. Today's movement was significantly easier than yesterday's in distance and terrain. I decided to put away prescription eyewear in favor of regular sunglasses.

The reason behind that decision is due to fact that I do not have clear Rx glasses with me that protect my face from winds, so I did not want my first time without Rx to be on summit attempt day. I believe you can train for anything, I do not wear my Rx at home in order to be able to operate without them. I did it for years before, so I am doing it on Kilimanjaro from here on out. The rest of the team is in good spirits, we are still unsure if we are going to Kibo camp tomorrow or staying somewhere in-between.



Rod was religious at documenting his progress during the TBI case study in his research journal



Theodore Graves, Student, Orthotics and Prosthetics:

We just made it to our 3rd base camp. Today was an easy few hour hike. The early arrival has seemed to rejuvenate the team, of which all have made it thus far. Data collection

seems to be going well, however it is nerve racking not realizing any shortcomings until after the opportunity has passed. Tomorrow we are scheduled to make it to Kibo high camp, but depending on the team's progress, a base camp half way may be utilized.



Date: 25 January (Friday, Day Four)

Location: Mawenzi Tarn Camp (14,206 ft/4330m) to Kibo Hut/High Camp (15,515-ft /4700m)



Master Chief Will Wilson (BKA):

Another night with very little sleep, a combination of stress and altitude make sleep more difficult to execute even with meds, something as simple as the sound of a tent zipper and boom, I'm up....kind of sucks especially when you have to lay there and listen to everyone else snoring away....it's all good! Onward and upward ththrough. Ready to pack up and head to Kibo Hut, an 8-9 hour trek



Yeti lends Danny a push up a steep encounter

*at best 9-10 at worse maybe. From Kibo, we will plan and execute our summit attempt the following day, we are within reach and each of us is getting a bit antsy in anticipation of what lay ahead. We have been told it's an Alpine start before midnight to hit the summit before or at sun up. I think it will be well after sun up at our pace but that's ok, too. Maintaining focus on the goal is difficult for me at night since the lack of sleep eventually begins to catch up and your energy reserves begin to tap out. It's a cold night and it will be a cold start in the morning so everyone will layer up in anticipation, I'm sure. I run hot so I can't layer too heavy or I will have to stop early and peel off a layer or two, I just get used to that though. We can do this, we have all worked too hard to get here. I know I have put in the hours, weeks & months of training in order to prep the body, now I just have to keep the mind synched in as well. A good evening meal tonight and summit team has been announced; Will, Billy, Yeti, Brett, Dave, Idee, Pete, Rod, Colby & Tim. Start has been pushed back to 0700 for departure for summit bid. Dan Swank is not feeling well at all and his leg is really hurting as well, he and Arlene Gillis will remain at high camp and tend to his condition. Action figures of **Jeremy Maddamma, Justin Legg and Holly Crabtree** are in the backpack to make sure they are with us in form as well as spirit for the big day.....here we go!*



Arlene Gillis, team prosthetist:

Again we broke into two separate groups. Dan pushed himself and I stayed in the second group to help him and Will. Will crossed his own personal threshold from his last climb attempt. I caught that on the GoPro camera. He was very excited about that!

Once we reached camp and got settled, Capt Olson came to talk with me about possible plans for summit day. He said leadership was making some decisions about summit day. Colby came by and asked if I would mind staying behind to help keep an eye on Dan and take care of him if need be. He would not be summiting after all. I, of course, said absolutely, no problem. After all, I was there to help the team achieve their goals. This was not a trip about me summiting, but the team persevering and achieving the goals as a group. I was thrilled to be able to help them personally. I felt as though I had already summited considering my lack of outdoors experience. Making it to high camp and dealing with the weather at 16000 feet was a great personal accomplishment for me! I really wanted to help Dan realize that this was a great triumph for him as well.



The latrine is conveniently located next to the dining tent



SSG Billy Costello (AKA):

0530- The need to evacuate the bladder can no longer be ignored. Getting up in the cold isn't the worst of the issues keeping me grounded in the sack. Putting on my prosthetic without being able to stand up is a chore, in itself, but the seal is never complete. The suction is lost after a few steps. I tripped over my own leg when it came loose. I've found that the leg needs to warm up, too. This isn't exactly the way I like to start the day. But I did get to see the sun rise over Africa and it made up for the stumbles this a.m.

We've reached Kibo camp. As long as everyone is up to it we will summit tomorrow. It's within our reach now. I think everyone will make it. Spirits are high.

When we got into Kibo camp, all the porters gathered around to see what was up with us. I showed off my usual crowd pleaser by

spinning my leg around. The crowd gave an

"oooh" and a chuckle. They see tons of tourists each year and I think they were glad to see something out of the ordinary. They give us encouragement whenever we pass.



Billy's ability to maneuver his prosthetic throughout 360 degrees made him very popular among the Tanzanian porters



SFC Rodriguez, TBI Self-Study:

We made it to Kibo camp today. It took about 4.5 hours, very easy terrain, but gain in elevation was noticeable. Definitely more difficult to breathe. But surprisingly not that difficult of a walk. I was expecting more. I did not wear Rx eyewear again and had no problems, only one fall but never hit the ground, Mr. Olson caught me. As I gathered data today, scores were lower but so were O2 sats. Today's tests were filmed, I really hope this data comes out well. Mr. Olson and I talked about the write up for it and that the whole report would wait on my portion so it would all go up together. So I really have to focus on this so I can create a good product. I feel great, much better than I had anticipated.

I

Tim Hewette and SFC Rodriguez utilized a Kindle Fire as part of their TBI study



wonder if it is Diamox or my ability to acclimate. I have been able to get to high elevations prior to my injuries in the past with very little problems, I hope that hasn't changed. Very strange how much of my life has changed with all my brain injuries, but my altitude ability seems the same. I deal with HA's and those have not changed during this trip. I really hope to get that out to others like me who are too worried to take on tasks like this based off their brain injury. Several others in the team are now developing HA's, I hope they do not get worse.



Theodore Graves, Student, Orthotics and Prosthetics:

We made it into Kibo high camp around 1600. The elevation is above 15,000 feet. Within 30 minutes of arriving, my head was pounding. An hour later my vision started to narrow and twinkle like a hundred little stars. I was in bad shape and seriously began to doubt my ability to make the summit. I felt like I had been hit in the face with a shovel. I took a Diamox and an 800mg Motrin and tried to wait it out. Finally by 2100 my dizziness began to subside and I felt like I was ready to tackle the summit.

Date: 26 January (Saturday, Day Five) – SUMMIT DAY

Location: Kibo Hut/High Camp (15,515-ft/4,700-m) to Gilman's Peak (19,341 ft/5,681m)



Master Chief Will Wilson (BKA):

0500, apprehensive, excited emotional- just a few words to describe how I feel right now. I have worked so hard for this day and I know it is upon me and it's almost overwhelming as I write. I will do my best; I can offer nothing more than that on this summit bid. I am thinking of my wife and children right now and want them to know I love them very much and they mean the world to me.

0700 departure 1600 'summit' (Gilman's Point), what a day! As we departed high camp, down 2 team members, a million things are running through our minds. After Denali, I dressed down as not to overheat again and bonk on the way up. The terrain continues to become more aggressive as we ascend and we encounter several teams on their descent looking "wasted" to say the least. As we move, we criss-cross the side of the mountain to gain elevation and footing in a gradual nature, going a bit slow but steady, too slow?

I was setting the pace behind our guide Dawson and hoped this was going to be good enough, time will tell. I was good to go until about 18,000 ft ASL when a combination of altitude and exhaustion hit me and I relinquished the point to Army Green Beret Billy Costello who led the team to Gilman's point, the first official summit point on the rim of the crater. We stopped there for a



Will Wilson and Dave Olson push each other near the summit

discussion about proceeding to Uhuru which was only some 300 ft higher but two hours further along and the decision was made, due to deteriorating conditions and approaching darkness, that this was going to have to do for a summit. This took a lot out of the sails of the team since we knew it was not the ultimate summit of the mountain but a summit none the same and that's what we as a team needed to reach to validate our efforts.

As I neared the summit, the forward travel became increasingly more difficult for me which hurt deeply as I had trained to what I thought was well above and beyond what it should have taken since our Denali Expedition and I found myself desperately searching for a focus point to concentrate on. The one thing that finally popped into my mindset was my son's name "Bear" and that is what it took. Every dad I think has those moments of reflection when you second guess your decisions and how you have treated the ones you love, with Bear, no two people could have been closer than he and I when he was small but as he grew older I guess we have had our differences and it has been a struggle at times to see eye to eye. With that said, I love my children a great deal and through the recovery process which continues to this moment I have had some rough moments dealing with family in general. As we have tried to get through the tough times, they have confronted me with the fact that perhaps we lash out at those who are closest to us because we figure they will always be there, in large part I think they are correct, it's unfortunate but true in many instances.



As Colby and Tim, our Alaska Mountaineering Guides continued to stress on the ascent, “we need to watch each other and watch ourselves”, they went on to reinforce that if we felt we were physically or physiologically compromised we need to speak up and not let it get to the point of compromising the safety of the team. Although I knew I had reached that point for whatever reason, I also knew deep down inside that I would never give up until I had reached a valid summit point, no matter how bad off I was. Selfish, perhaps, determined to make it.....definitely yes!

Dave Olson fell in behind me for the last 1000 feet of the climb and we reached the summit sign together, fitting that the two elder statesmen would push each other to the end.



I apologized to both Colby and Tim at the summit as they continued to check my progress and I continued to answer, “I will not quit!”

Bear, you were my single source of motivation when the tank was empty and I thank you and I love you son! You saved my life.

Although it will always stick with us that we were “almost there”, it’s something we have to come to terms with due to circumstance and ultimately reflect on the significance of the overall accomplishment and not the shortfall. We came as a team and took 2 below knee amputees, 1 above knee amputee, 1 hand amputee and a soldier experiencing the challenges from a severe Traumatic Brain Injury to the

top of the highest freestanding volcano on the planet, not bad for a bunch of busted up soldiers, sailors and airmen if I do say so myself!

Descent was another story, the lead group trudged off into the waning sunlight and into the darkness as Colby, myself, Rod and two guides descended at a slower pace to accommodate my deteriorated condition. I was glad to be surrounded by these guys as I need to feed off their positive energy. That is what teamwork is all about! Even the strongest guy or gal can find themselves compromised without a good explanation as to why but there they are just the same. It's then that the rest of the team rallies and feeds them the desire to carry on, that's just what they did. Thanks Rod, you helped more than you know my brother!



Arlene Gillis, team prosthetist:

We all went to breakfast in the mess tent. Everyone sounded excited for summiting. Dan was not very talkative. I went out to see everyone off. It was freezing! As I walked with the group to start the ascent, I noticed the banner was still in camp. I called out to Capt. Dave Olson and he returned to camp and gratefully took the banner as they needed it to take pictures with at the summit.

Throughout the day I continued to check on Dan to see if he needed anything. I brought him some chow, drinking water that I treated, and offered him food, but he really did not want anything the porters were making- he made no bones about that. He was ready to eat good old American food again. Later, I took him the mid-day snack of popcorn. He fed the birds with it.

The weather was crazy. It was cold, then hot, then freezing, and then it snowed. It even hailed at one point during a two hour snowstorm. I gave Dan updates on the team's progress throughout the day.

I spent most of the day talking to porters, learning the Swahili language and about their home cultures and medical system. They are hardworking people.

Finally, team entered our camp after a very long day. It seemed as if they were gone for over 15 hours. I was exhausted. I can only imagine how they felt. I was happy to hear they were amazing and all did well.

Colby and Will came in the latest. I stayed up to check on Will's residual limb after their climb. I told Capt. Olson I would let him know if there were any issues and insisted he go get rested up. He had had an exhausting day. I think the mountain and altitude got the best of everyone on the 16 hour trek. I was happy to be able to assist in keeping an eye out for Will.

The team was so tired. My tent mate crashed before I even got a chance to talk to her. Right after dinner she went in the tent and fell asleep before I got back. I was typically the first to go to sleep so I knew she was exhausted by their 16 hours of walking that day.



SSG Billy Costello (AKA):

At 0700, we stepped out for the summit of Kilimanjaro. The walk was long and hard. The altitude alone was one of the hardest obstacles to overcome. Every step higher made it harder to breathe. About 1,000 ft below the summit, we were at a crawling pace. I needed to take a deep breath before every step, and would still get winded. The x2 needs to be adjustable to environmental conditions. The heel would not rise high enough to clear rocks on the trail, and it would not compensate for my weight plus the additional weight of my ruck on the way down. There should be a built-in interface that you can adjust these things on the fly when traversing different terrain.

We reached the summit at 1600 hrs. We were about 2 hours over our scheduled time. We hiked through a hail storm for a good portion of the ascent. It wasn't too bad. But of course, it drained little bits of morale and made for even slower going. Will Wilson led the charge to the summit fighting through his pain the entire time. Danny and Arlene stayed at Kibo Camp because Danny's leg was just too tore up to make the climb. When we finally reached the peak everybody was just smoked. There was no dancing and celebrating. There was a lot of panting and resting. After a brief pow-wow, the



decision was made not to proceed around the crater to the highest point. I, personally, am proud of the work I put into getting to Gilman's Point. I came to climb the mountain, and that's just what we did. We reached the summit, the conditions did not permit most of us the luxury of continuing to the highest point of the mountain. The clouds rolled in with the storm and didn't leave. The amputees were in pain in their respective areas. Everybody was pretty much toast. Rod could have proceeded along with Yeti and either Tim or Colby, but the decision was made to not pursue that option. Rod took it the hardest. I share his need and desire to climb the ladder as high as you can, but in this instance I could clearly see my limitations. We both come from group and competitive nature. That comes with the territory is a part of daily life. One realization that I bring home from this trip is that I will hold my brother's back. Like I did with Rod on this trip to the top of Arica, although I can make it to the top of the mountain, I do not have the abilities to remain operational and be the soldier I need to be to remain an equal among my peers. At the present state of things, I'm a high-risk liability, not a hundred spare batteries can fix that. To ignore reality is an injustice to all involved. I am proud to say that I now know more of what my limitations are. I am also proud that I can say my limitations are as high as they are. Theories don't produce results until they are tested. We have all been truly tested on this expedition and we were successful as a tight-knit cohesive unit - a team with strong values and an even stronger will to succeed. I am truly proud and blessed to be a part of this group of fine Americans.



SFC Rodriguez, TBI Self-Study:

Kibo Camp 0600hrs

Just woke up. Yesterday was our summit attempt and we made it to the crater rim and one of the peaks, but not Uhuru. The day started early with 0600 wake up, 0630 breakfast and 0700 movement. The team was in high spirits and so was I. I had an average HA, and was trying to not think about the "what if's". I was 4th in the order of movement, they wanted the guys who might fall or need help up front. Will Wilson set the pace with Billy behind, then Pete and me. I had a porter behind me the whole time supporting me when I stumbled to keep me from falling. I would have had several falls if he hadn't been there. Movement was slow, very, very slow, too slow. We



got to Gillman's point at 1600, we were behind schedule. During the movement several members of CWVC were exhibiting HA's, dizziness...beginnings of AMS. It was definitely a concern. Ironically I felt no significant increase in my personal TBI symptoms. My HA got slightly worse at about 17k elevation, but nothing of significance. My HA increased at about the same time snow started falling on us, so decrease in Barometric pressure still increased my HA symptoms, unsure if it was Baro or elevation. But I felt strong, VERY STRONG. I did my best to joke with everyone and bring up spirits; I even drew smiley faces in the snow on the trail. Upon arrival at Gilman's, I assumed it was a short stop before final push to Uhuru. As everyone rolled in, Colby addressed everyone on the unknown time needed for descent for amputees. It was nothing we had planned for or trained for. Colby stated his concerns and asked for input, Billy, Idee and myself were the only ones who spoke. My question or comment to him was



"Could some of us make it?" Colby listened to us all and said he would watch the weather a few more minutes. So we took all the photos, I took my data. Then Colby addressed everyone again. He said it was getting late, it was 1630. He did say he wanted to take himself, a Tanzanian guide and myself and create a summit team to push to Uhuru while everyone else began descent, but he ultimately decided against it due to lack of time. I was ready, willing and able to continue on and I thank him for his vote of confidence. But I have to be honest, I was very disappointed at not making the summit, this will take some time for me to process and deal with. I am part of a team, and I will support that team. Will, Colby and me were the last ones to reach high camp after our descent, the team split into two parties anyway, I chose to stay behind to help Will, he wasn't doing so well and I was concerned for his personal health and need for support. Never leave a fallen comrade.

Rod observes Tim Hewette conduct the TBI balance test



Theodore Graves, Student, Orthotics and Prosthetics:

We left for the summit at 0700. It was a late start as most teams departed at midnight, however our team was in need of some additional recovery time. It proved to be an extremely arduous hike. At 1100 the clouds moved in and the temperature began to plummet. The snow began to fall and the driving wind blew it horizontal. We expected to summit by 1300, but due to conditions, we didn't reach Gilman's point until almost 1700. The summit was still almost 2 hours away, but only a couple hundred vertical feet separate us. True summit or not, we achieved our goals. We began our decent into the black of night, arriving back at camp around 2130 completely spent yet proudly victorious.

Gilman's Point - With two-thirds of climbers that set out only reaching as far as Gilman's Point, this 5681m elevation is a popular spot for capturing group shots of those who didn't quite make it all the way up to Uhuru, the highest summit of Kilimanjaro. Only 300 meters off Uhuru, reaching Gilman's Point is an achievement for any climber and the leg to this point is difficult as altitude reaches an all-time low.



Top Row (L-R): Will Wilson, Rod Rodriguez, Vic "Yeti" Thibeault, Pete Quintanilla, Tom Barnhill, Dave Olson
Bottom Row (L-R): Ted Graves, Billy Costello, Idee Belau, Brett Hutchins

Date: 27 January (Sunday, Day Six)

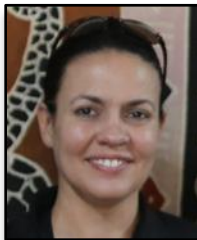
Location: Kibo Hut/High Camp to Horombo Hut Camp (3,720m)

We began the trek down at about 0900 hrs. On this first descent leg, SSG Swank blew out his good knee, further exacerbating an already injurious situation due to his compensating for the injury to his residual limb. Dan needed assistance from this point onward and downward.



Master Chief Will Wilson (BKA):

The Descent back to the trailhead began today, a long trek with Dan feeling the pressure right off the bat and having to glean an assist from the guides all the way, one under each shoulder. The trail was not too challenging and we knew it led to the trailhead which put the team in a different mindset. It was good to get some rest last night after the initial descent from the summit, I needed the sleep.



Arlene Gillis, team prosthetist:

Today we got to sleep in! Breakfast was not until 0830, which is late by mountain standards. We had prepared to have Dan evacuated on a gurney, but he insisted on walking today and promised to use the gurney the following day. I had explained that pressure on the decent would be difficult, but he still wanted to go on his own. Dave and Colby agreed to let him make his own decision. He had a hard day. Once we got to camp we ate a good meal together in the mess tent. Plans were made to evacuate Dan first thing tomorrow morning.





SSG Billy Costello (AKA):

We left Kibo camp this morning for Horombo Camp. It was a smooth hike over rolling hills on a dirt road past amazing scenery. The X2 overheated from the excessive downhill walking. It felt like you could cook an egg on it and it was giving off short vibrating pulses about every 10-seconds. I took my pant leg off of that side so the air could cool it down. My Ischial bone also took a beating from the excessive downhill walking.

It seemed to me that the leg didn't support my weight as well at higher altitudes. I wonder why. During the walk, I felt like I needed some time to myself so I walked alone. I was growing tired of feeling people watch me as I traversed an obstacle waiting for me to stumble and rush to my aid. I came to this mountain to be challenged, not baby-sat. I know that people just want to help and to demonstrate that they care, but I ask repeatedly to be left alone and to be given enough room to fall so that I can fall safely and then pick myself up. There isn't always going to be someone to pick me up when I fall. I need to be able to do it on my own. The appeal of this organization is that it tests your abilities and doesn't focus on your disabilities. I walked alone through the African hills at the base of Kilimanjaro and felt truly at peace. I felt that in all of this grandure and with only the sound of nature around me, that if I ever had the chance to hear God speak to me this was it. I felt the warmth of the sun and the ground beneath my feet in the land of the origin of man and felt truly blessed to be given this day. The day after I stood closest to the heavens with my feet on earth, able to breathe, able to move, able to experience God's creations, able to live. The feeling leaves like a frightened bird that you have gained trust with by seeds, but flies away when a stranger approaches. I should take the time to feel this every day. Sadly, in the morning, Danny will be med-evaced to the Keys Hotel by an African Guide, 6 Porters, and Yeti. They will be using a one-wheeled evacuation platform operated by 2 porters at a time over very rocky terrain. The march today just took a huge toll on his body. He needs to rest and heal. He has been fighting against his own body the entire trip. He has toughed it out through the pain, sweat, and blood of this trip with a smile and a great attitude. He has pushed as hard as he could and we are all proud of him and his accomplishments.

Pole Pole

***Porters bring you water
but they no sterilize
I look into the shitter
can't believe my eyes***

Pole Pole

***My back is gonna crush me
'cause I brought too much weight
Someone take this from me
I'm about to break***

Pole Pole

***I ate the banana
I ate what's in the pot
I sucked the Kili tea down
The toast was like a rock***

Pole Pole

***I stumble into camp now
as everyone turns their head
I'm hearing in Swahili
"What's up with that guy's leg"?***

SSG Billy Costello, Green Beret



SFC Rodriguez, TBI Self-Study:

We arrived at our first descent camp today at around 1300. Everyone was slow starting this morning but once we got going, it went well. I was able to write "Los Guys" for my son's ½ down the trail. Thomas, one of our guides helped me. The trail started off very gradual and flat like a dirt road. I was able to run a little which I thoroughly enjoyed. Once the terrain changed to a rockier trail I had to be careful. I fell once but caught myself several times. Unfortunately Danny had to be carried to camp, he will be getting Medevac'd tomorrow morning. I am looking forward to tomorrow's walk, I believe I have figured out how to use these trekking poles, they have been a huge help. I started getting a worse HA once we arrived at camp, barometer dropped and like normal, HA went up. Still puzzled how I

was able to handle elevation, I was very strict with breathing during movement. That is a major contributing factor, I think, Oxygen is LIFE.



Danny is assisted by porters



Theodore Graves, Student, Orthotics and Prosthetics:

We dropped down to just above 12,000 feet today. It is relaxing to breathe normal and lack the constant headache. On the way down, alignment changes were requested from several of the amputees. It felt good to be gaining the team's confidence and trust as time goes on. Tonight is cool and brisk and I finally have some time for reflection. It's been a great trip thus far, but it's hard not to think of loved ones back home

Date: 29 January (Monday, Day Seven)

Location: Horombo Hut Camp (8,924 ft,2720m) to Marangu Gate (5,905-ft/1800m)



Master Chief Will Wilson (BKA):

The last part of the descent lay before us now, breakfast, a quick hand and face wash and then Dan Swank was loaded on a single wheeled gurney for the final trek to the gate. As they strapped him in, I did not envy the ride he had ahead of him at all. The guides estimated it would take them ¼ of the time it would take us to reach the trailhead as they took off in a slow run up to the initial ridgeline and then out of sight. Later we learned that it was the ride from hell and Yeti ended up assisting porting backpacks as a guide blew out a knee on a fast section and was hobbled. We kept a fairly good pace the entire way down moving through prime evil sections of vegetation that looked like the plant life was dreamed up on a Hollywood soundstage. The trail was not too difficult and we made good time as we passed through several different zones varying from Lunar landscape to high desert and finally through heavily canopied jungle where primates darted through the trees above us and screeched eerie sounds as our menagerie passed beneath them. The final stretch was an unimproved dirt road used by the Park Service and porters for the final stretch into the trailhead, the signs designated it as porters only but we were directed to proceed anyway. As a Park Service rescue truck eased towards us they stopped and conversed with our lead guide Dawson, I suspect to find out why we were on their trail. Dawson pointed out our prosthetics and the Park Service personnel understood and waved us on. The lower part of the trail was in better condition and I decided to stretch out my stride to match



what I had done in training and moved ahead of the group arriving at the trail head a short bit ahead of the main body. We had done it, now it was just getting the gear loaded on the bus, working our way through the locals trying to barter for bracelets and hats and off to Moshi and the Keys Hotel for debrief a meal and the follow on Safari.

An incredible adventure with an incredible group indeed, I am honored to have been lucky enough to have been some small part of the undertaking.



Arlene Gillis, team prosthetist:

Everyone's spirit was up as we headed down after summit day. We had a nice walk down the mountain. It was a brisk walk. We all were worried about Dan and Yeti. We made it to camp and it was just amazing. We took a different path down and we got to see the rainforest. This was the nicest camp yet! There were lots of trees and wildlife. The team was very excited. We had a nice final mountainside mess hall dinner and the tipping ceremony for the porters and cooks. They were all so great and sincere about wanting us all to summit. I think they were shocked at amputees summiting because in their culture amputees do not have the medical care and resources to be able to contribute to society and provide for their families. Again, their culture is that of very strong people who work hard, there are just no strong medical resources available here. I think we inspired the porters as much as we inspired the other people we met along the trail.





Danny is loaded up on a one-wheeled "medevac" cart and prepared for the final descent

Other climbers would stop and applaud the soldiers as they walked, taking the time to thank them for their service if they were Americans. What I found even more inspirational were people from other countries that were moved by the men's determination.

The next two days were less challenging because it was downhill. However it presented challenges for the amputees as we used another set of muscle to control the limbs on decent.

It was an amazing personal journey for me to be able to watch these soldiers persevere and accomplish their own summits.



SSG Billy Costello (AKA):

We walked through amazing landscape today. We trekked through the rainforest and over many (wooden) bridges to our final campsite. We saw a variety of birds and monkeys in the heavily wooded areas. Danny loaded up on the one-wheeler medevac cart and is now back at the Keys Hotel with Yeti, hopefully having a celebratory drink. We will

join them tomorrow night. I wanted to hike the rest of the way home, but logistically, we couldn't make it happen. Tonight was the 'Goodbye Ceremony' between us and the porters and guides. It started with the porters and guides singing the Kilimanjaro Song and moved into Colby distributing tips to all the ones who helped us along the way. I wish we had more to offer them for all of their efforts. They earned it. Each one came up when their

name was called to receive their tips then filed by and shook each of our hands. I honestly didn't realize exactly how many porters were working behind the scenes to help us out. They all seemed genuinely proud of the services they provided and especially proud to be a part of our expedition. I have a lot of respect for these people and thank them for all they did for us. I wish them all the success in the world. We could all learn a lesson from the kindness in which they present themselves. Asanti Sana, Kaka.



The tissue above my ischial bone is sore and swollen from all of the downhill walking. I have to push the hamstring and ischial into the socket to activate the downhill assist. After doing that over 1,000 times, it started to become sore and swell. Also, my x2 ran out of power at dinner tonight so that means it lasted about 3 days with constant motion.



SFC Rodriguez, TBI Self-Study:

Final Campsite 2130hrs

We got to our last campsite on the trail today. Danny and Vic got Evac'd this morning, their loss, I am in no hurry to get off this mountain. When is the next time I will be camping in Tanzania? I was able to take a photo with all of the guides today, I had wanted that picture for a while. Today I realized how well these trekking poles are helping me, they truly have prevented many, many falls. As I walked and looked at the countryside I can't help but think how much I love being outdoors, in nature. It is very therapeutic for me, takes my mind off of things that continually follow me around. Things that I don't know how to feel about, it's very confusing. Sometimes I lose myself and I don't know who I really am. There were storms today that increased HA. Not feeling well today or right now.

Keys Hotel 2200hrs

Can't find my pencil. Got back to keys hotel today. The walk out of Kilimanjaro was very easy walking. Everyone was in good spirits as we finished our adventure. I passed on some of my cold weather gear and equipment to the guides, one even got a Green Beret Foundation patch. I did not have any significant HA problems coming off mountain until



we arrived at Keys hotel and a huge rainstorm moved in. I am looking forward to understanding why significant changes in Barometer increase HA's, but altitude did not seem to affect me as much as I was anticipating. One hypothesis I have is that as we climb it is a gradual drop in pressure. I definitely need to do more research on the subject.



Theodore Graves, Student, Orthotics and Prosthetics:

Tonight is our last night on the mountain. We made it into camp just before 1400 and had many laughs before dinner time. It's hard to believe we have been hiking for seven days with tomorrow being eight. I am looking forward to the safari but I know I will miss the day I laughed hard enough to make my cheeks hurt.



Certificates of Accomplishment

The Expedition Team

AOCM Will Wilson, U.S. Navy (Ret)

Master Chief Ordnanceman James “Will” Wilson was seriously injured while serving aboard USS Enterprise, in May of 2003, when he broke his neck and both legs, ultimately losing his right leg below the knee. Due to the serious damage to his right leg, he chose amputation in December 2007 and has not stopped his return to a full schedule of athletics to prepare for and lead CWVC Challenges. After long periods

of hospitalization and rehabilitation at Portsmouth Naval Hospital, Virginia, and Walter Reed Army Medical Center in Washington, D.C., Master Chief Wilson has beat the odds and now competes in a full regimen of athletics.



Will has previously served as Program Manager for the Navy Wounded Warrior Adaptive and Paralympic Sports Program, a newly established department of Navy Safe Harbor, and currently volunteers as Deputy Director of the Combat Wounded Veteran Challenge. He also serves on the Board of Directors of SCUBAnauts International, a marine sciences program that introduces young men and women, ages 12-18, to informal science education through underwater exploration.

Will has provided senior leadership to the Combat Wounded Veteran Challenge program since its inception in 2010, participated in several of the research Challenges and continues to provide inspiration to the many Combat Wounded and Injured veterans during his visits at Veterans Administration hospitals.

Master Chief Wilson was raised in Lomita, California, just south of Los Angeles and entered Naval service in January 1977. He now resides in Arlington, Tennessee with his wife Gannie and their two children, Bear and McKenna.

SFC Michael Rodriguez, USA (Green Beret)

SFC Michael Rodriguez entered the US Army on June, 1992. He attended Basic Combat Training and Advanced Individual Training at Fort Sill, OK. He also attended Airborne School before moving to his first assignment with the 10th Mountain Division at Fort Drum, NY, where he was stationed from 1992-1996. He was fortunate to take part in deployments to Somalia in 1993 and Haiti in 1994. He also had the opportunity to graduate from both the Air Assault Course and SERE School while assigned to Fort Drum.

SFC Rodriguez's second assignment took him to his home state of New Mexico, where he was assigned as a Stinger Missile Team Chief at White Sands Missile Range. It was shortly after he PCS'd to WSMR when he was selected to attend the Special Forces Qualification Course as an 18D (Special Forces Medic) in 1997. After



completing the required two years of training, he was then assigned to Operational Detachment Alpha 772, 7th Special Forces Group at Fort Bragg. While assigned to 7th Group he deployed throughout Central and South America as well as two tours to Afghanistan in support of theatre operations and the Global War on Terrorism. It was during his last deployment to Afghanistan in 2006 where he received multiple TBI's, one of which was caused by an IED explosion. He was hit while on point on his ATV. As the Senior Medical person on site, Michael chose to stay with his ODA following his injuries rather than accept being MedEvac'd. He chose to stay in the fight. After re-deployment in late 2006

Michael was assigned to United States Army John F. Kennedy Special Warfare Center

and School (Airborne) as a Sniper instructor. Unfortunately for Michael, he continued to downplay and ignore his health issues until his medical condition became so significant that it became a hindrance to his duty performance, as well as his home life. Now impossible to hide his symptoms, he was sent to National Intrepid Center of Excellence where he was diagnosed with multiple TBI's and PTSD.

Michael has always been a fighter, whether as a boxer/MMA fighter, a Green Beret, or even as a father. With the continued support of his wife Kelly, who is also an Active Duty Soldier, and his three sons, Michael will keep fighting. He is currently in the process of a retirement Medical Board and is expected to be medically retired in the summer of 2013. Upon his retirement, Michael will continue to fight for himself and his fellow Soldiers who are battling invisible injuries every day.

SFC Rodriguez first participated with the CWVC program during mountaineering training in Alaska in June of 2012. He was most recently recognized at the Explorers Club Awards Dinner as Co-Chair, along with SSG Billy Costello, as a tribute to the traumatic brain injury self-study he completed during the CWVC Mt. Kilimanjaro Research Expedition.

SSG Pete Quintanilla, U.S. Army (Ret)

Staff Sergeant Peter Quintanilla was born in Honolulu, Hawaii. He enlisted in the Army in 1989, completed Basic training and advanced individual training at Ft. Benning, Georgia, where he was awarded the Military Occupational Skill (MOS) Identifier 11B. Upon graduation, he reported to the US Army's Airborne School, where he earned his jump wings. Graduating from airborne school, he was met by the cadre from the 75th Ranger Regiment's Ranger Indoctrination Program, where he spent the next five weeks proving both mentally and physically that he was able to join the ranks of the men in the 75th Ranger Regiment.



Upon completion of RIP, Peter was assigned to Bravo Company, 2nd Battalion, 75th Ranger Regiment at Ft. Lewis, Washington.

On November 9th, 1997 during a live fire training exercise in the jungles on Panama, Peter was struck in the left ankle by a single round from a M249 Squad Automatic Weapon (SAW). He was medevac'ed to Brooke Army Medical Center at FT Sam Houston in Texas, where in spent the next year rehabilitating and eventually undergoing an ankle fusion on his left ankle. During this time, he served as the Force



Modernization NCO at his unit, where he tested and procured clothing and equipment for the Ranger Regiment, and assisted with tests within the U.S. Army Special Operations Command (USASOC).

After medically retiring from the Army in January 2000, Pete attended the University of Hawaii as an architectural major. Pulling from his experience in the Special Operations community, and ties

to clothing and manufacturing companies; Peter ventured into the business world helping to start-up an outdoor clothing and equipment company. As the company's Vice President, he restructured the company to ensure stable and profitable growth aimed at directly helping service members, government officials, and civilian contractors in the Global War on Terrorism.

Pete has recently opened an office of the Care Coalition, U.S. Special Operations Command, in Seattle, Washington, to care for all Wounded and Injured Special Operations Forces within the Northwest District. Pete was introduced to the CWVC through the Care Coalition at MacDill AFB, Tampa, Florida in 2012.

SFC Billy Costello, U.S. Army (Green Beret)

Staff Sergeant Thomas W Costello was born in Lexington Park, Maryland, on February 22, 1982, and enlisted in the Army in November 2002, after graduating from Great Mills High School. SSG Costello completed Basic Training and Advanced Individual Training at Fort Jackson, South Carolina, and graduated from the Heavy Wheeled Vehicle Mechanics Course. From there, Billy went to Airborne School at FT Benning, Georgia, where he earned his Jump Wings. Upon the completion of his training, SSG Costello was assigned to



1-72 Armor Battalion, Camp Casey, Republic of Korea. SSG Costello volunteered for U.S. Army Special Forces Assessment and Selection in December of 2004, and was selected to attend the Special Forces Qualification Course (SFQC) at the U. S. Army John F Kennedy Special Warfare Center and School. Upon completion of SFQC he was assigned to Charlie Company, 4th BN, 3rd Special Forces Group (Airborne) as a Special Forces Engineer Sergeant. Upon arrival to Charlie Company, he volunteered for the dive team and subsequently attended and passed the Combat Dive Qualification



Course. SSG Costello deployed with his Operational Detachment Alpha team attached to 2nd BN, 3rd SFG(A) in support of operations in Afghanistan.

SSG Costello's mission was to develop Village Stability Platforms in order to support Village Stability Operations for Shah Wali Kot District, Kandahar Province,

Afghanistan. On the 20th of September, 2011, in Kandahar Province, SSG Costello was injured after stepping on a landmine during a route clearance mission. His injury resulted in the loss of his right leg above the knee, a tibia/fibula fracture of the left leg, the fracturing of the middle and index finger of the right hand, and a blown ear drum in the right ear. SSG Costello is currently attached to Able Company, 1st Platoon with the Warrior Transition Brigade, at WRNMMC.

Billy first participated in CWVC Challenges in the summer of 2012 when he was selected by the Care Coalition to join a team of Special Forces amputee divers to conduct research, underwater, on prostheses in an effort to improve performance. Since then, Billy has also completed the Kilimanjaro Research Expedition and is preparing for additional Challenges.

SSG Danny Swank, U.S. Army (Ret)

SGT Dan Swank deployed to Afghanistan with the 1-87th Infantry Battalion at Fire Base Shkin, with “battle buddy” SGT Vic Thibeault, on the border with Pakistan following the September 11, 2001, terrorist attacks. After several traumatic combat events, his team was sent to Doha, Qatar, for three days of R&R before returning to combat in Kandahar with the Tactical Human Intelligence Team 1, a Counter Intelligence Task Force supporting the 10th Special Forces Group. During a door to door interrogation/cordon and search



mission at Martyrs Circle in downtown Kandahar, SGT Swank’s convoy was ambushed and a grenade was thrown through the window of his military vehicle. Dan’s battle buddy, SGT Thibeault, immediately grabbed the grenade from under SGT Dan Swank’s



seat, and, rather than throw it back out into the crowded marketplace, tucked it in the center console of the vehicle to mitigate and shield the effects of the blast from the Afghan civilians who assembled in the square. As a result, both he and his battle buddy, SGT Vic Thibeault, were both critically wounded and peppered with shrapnel. For his heroic actions, Dan received the Bronze Star for “gallantry in action,” and Purple Heart for military merit. After a year’s worth of surgeries attempting to save

both legs, he ultimately lost his right leg, nearly lost his other, and spent the next-year at Walter Reed Army Medical Center in Washington, D.C.

SSG Swank was also stationed twice in Bosnia-Herzegovina and Korea for a year. He proudly served 10 years in the Army and reached the rank of Staff Sergeant. Dan has most recently received his degree as a Structural Engineer from Clarkson University, Potsdam, NY.

Dan has participated in the very first CWVC mountaineering course in Alaska and many subsequent Challenges and events.

SSG Vic “Yeti” Thibeault, U.S. Army (Ret)



SGT Vic Thibeault deployed to Afghanistan with the 1-87th Infantry Battalion at Fire Base Shkin on the border with Pakistan following the September 11, 2001 terrorist attacks. After several traumatic combat events, his team was sent to Doha, Qatar, for three days of R&R before returning to combat in Kandahar with the Tactical

Human Intelligence Team 1, a Counter Intelligence Task Force supporting the 10th Special Forces Group. During a door-to-door interrogation/cordon and search mission at Martyrs Circle in downtown Kandahar, SGT Thibeault's convoy was ambushed and a grenade was thrown through the window of his military vehicle. SGT Thibeault immediately grabbed the grenade from under the seat of his buddy, SGT Dan Swank, and, rather than throw it back out into the crowded marketplace, tucked it in the center console of the vehicle to mitigate and shield the effects of the blast from other Afghan civilians that assembled in the square. As a result, both he and his battle buddy, SGT Dan Swank, were both critically wounded and peppered with shrapnel. Vic applied his own tourniquet and



dragged his unconscious partner to the nearest casualty collection point where both were evacuated. For his heroic actions, Vic received the Silver Star, the Army's third highest award for "gallantry in action," and Purple Heart for military merit. He spent the subsequent 18 months at Walter Reed Army Medical Center in Washington, D.C., for rehabilitation after having lost the majority of his left hand. After a brief break in service, SSG Thibeault reenlisted in the Field Artillery and was honorably retired in March of 2008. He is currently pursuing a degree in Psychology. SSG Vic Thibeault is now a certified EMT in Vallejo, California, where he lives with his wife, Maleney, and two beautiful children, Delilah and Thomas.

Arlene Gilles, CP, LPO, M. Ed



Arlene Gillis, CP, LPO, M. Ed first became interested in the field of rehabilitation when she was very young. Her mother was diagnosed with Multiple Sclerosis and passed away when Arlene was just 12 years old. Determined to help other families who suffer with any kind of physical impairment, she pursued a career in Rehabilitation and Physical Therapy. While pursuing a degree in Physical Therapy she worked with a prosthetic patient. It was during this time she discovered Orthotics and Prosthetics and fell in love with the profession. She immediately transferred into the Orthotic

and Prosthetic program and graduated from Florida International University in 1994.

Arlene worked as an Orthotist/Prosthetist in private practice for over 10 years and has over 19 years in the field. Seeing a desperate need to help the growing number of people affected by limb loss and impairment, she became involved in Education, helping to open the J.E. Hanger College of Orthotics and Prosthetics at Saint Petersburg College – she is currently the Program Director. Arlene developed a consortium with FSU to offer a Master's in Orthotics and Prosthetics. The consortium

was recently awarded the VAI2 award for Innovation in Prosthetic Materials.



Arlene's passion for orthotics and prosthetics, as well as education, pushed her to earn her Master's in Education at the University of South Florida, and she is

currently pursuing a Doctorate in Education. Arlene currently serves as the Vice Chair for the National Commission of Orthotics and Prosthetics (O&P). She hopes that her involvement in various boards and committees for the O&P field makes an impact, not only in regards to the promotion of Orthotics and Prosthetics itself, but to the patients and families that benefit from its progression.

Mrs. Gillis lives in the Tampa Bay area with her loving husband and two daughters. Arlene enjoys spending time with the family and participating in her children's activities.

Theodore J. Graves, Student, Orthotics and Prosthetics

Ted Graves joined the Air Force in August of 2000 as an active duty Electronic Warfare Technician and became the first EW 3-level technician deployed in support of Operation Enduring Freedom. While on his first deployment, he was formally recognized by the 4th Special Operation squadron commander for his roll in diagnosing and repairing an elusive wiring fault to an electronic



countermeasure system installed on the AC-130U gunship. The aircraft was subsequently able to fly two successful missions that night in support of ground forces operating within the Afghanistan Theater. Ted was awarded the Air Forces' Below the Zone promotion as a direct result of his efforts. In the coming years, Ted continued to support the SOF mission with two additional deployments in support of OEF prior to his honorable discharge in 2004.



After his active duty tour concluded, Ted spent the next 6 years working for a defense contractor developing testing platforms for the electronic countermeasures installed on numerous military platforms. As a Field Engineer, Ted developed equipment, software, and testing procedures to ensure the operational status of air based ECM

systems through debugging, integration and RF performance testing.

Ted discovered the field of Orthotics and Prosthetics through a friend whose passion for the field of Prosthetics was contagious. Three months later, Ted resigned from his tenured position and started volunteering part time at a Prosthetics facility. During his time volunteering, he went back to school full time to become a certified practitioner. Having a dedicated devotion to helping others, combined with his technical skills have enabled Ted to transition seamlessly into Orthotics and Prosthetics. This field has given him the opportunity to work with amputees who live a very active lifestyle. Through these athletes, he has learned even more perseverance as well the value of being physically active. With a passion for snowboarding and kiteboarding, he understands firsthand the magnitude of living life to the fullest. Helping amputees achieve their highest level of independence while building a personal relationship enables Ted to meet the patients end goals successfully.

Ted is currently attending the orthotics and prosthetics program at St Petersburg College and resides with is wife, Gita, in Destin, Florida.

Thomas Barnhill, PTSD Counselor and Evaluator

With more than 20 years of wilderness and adventure sports experience, Tom Barnhill brings a rare direct experiential background to psychological research and interventions for combat veterans suffering from PTSD and TBI. Born to a family of sailors, and virtually raised on boats in the high winds and heavy waters of Northern California, his passion for adventure started early and has not stopped since. A self-proclaimed "jack of all trades, master of none" Tom brings high-level competencies in several areas of adventure sports and has climbed, skied, snowboarded, paddled, ran rivers, surfed, windsurfed, biked, ran and sailed in and through various corners of the globe. Deeply committed to using wilderness and adventure activities to support those in need, Tom has continued to choose the road less traveled by shaping his graduate psychology studies toward developing innovative interventions combining the



best of evidence-based clinical psychology practices with cutting-edge outdoor adventures. While completing a masters degree in adventure-based therapy, he also completed extensive clinical training in working with combat veterans with PTSD through both the VA National Center for PTSD, and several graduate academic institutions. He is currently completing his clinical internship at a residential treatment center for combat veterans with PTSD/TBI. Knowledgeable of the clinical and transitional challenges of combat veterans, and committed to supporting them in real-world solutions, Tom brings a ground-level commitment to those wounded in combat service. With a broad resume, including a long stretch in the editorial and sports marketing sides of the outdoor sports industry for companies such as Nike, Patagonia, Mont-Bell and Mountain Hardwear, he's also worked in the major motion picture industry

as a stunt rigger for both film and television broadcast. His writing and photography work has appeared in major adventure sports publications such as Outside, Outside Online, Spin Magazine, Climbing, Summit and Snowboard Life. As a civilian contractor he has provided remote field logistics support for NSF-funded



scientific research in both Southern and Northern polar regions. He spent ten months during two deployments supporting Operation Deep Freeze in Antarctica, and has made two multi-month deployments to the summit of the Greenland ice cap providing field logistics support to the United States Arctic Program. With most of his time spent in the deep field, these experiences brought him to some of the most remote and unforgiving corners of the globe. Fusing his interest in supporting those in need with his own belief in the healing power of wilderness, he guided for several years in a wilderness-based behavioral health program in Alaska and British Columbia, and later served as program director for a therapeutic wilderness program for indigenous youth in the Canadian Rockies. Tom has also spent considerable time with indigenous groups in remote portions of the planet, with a particular focus on cultures of the circumpolar North and resided amongst traditional hunters in Greenland, Canada and Arctic Alaska. Climbing,

surfing, skiing, paddling, and general adventure has taken him to a majority of the seven continents. A trained wilderness field medic since 1992, he has also completed extensive risk management trainings in swift water rescue, grizzly bear management, snow survival, mountaineering rescue, search and rescue techniques, and fixed and rotary aircraft safety trainings. Capable in small boats, snow machines, and the operation of tracked vehicles, he considers himself highly competent in marine, mountain, desert, alpine and polar environments alike. Deeply committed to using wilderness and adventure activities to support those in need, Tom has dedicated his graduate studies to developing innovative interventions combining the best of evidence-based clinical practices with cutting-edge outdoor trips and expeditions in support of those suffering from PTSD and TBI.

Major Brett Hutchins, USAF (Ret)



Brett enlisted in the Air Force in 1978 after receiving his Associate of Arts degree from the College of the Canyons in Santa Clarita, California. After serving for two years as a Security Specialist in Wyoming, Brett was honorably discharged in order to pursue his Bachelor of Arts degree from Colorado State University in Fort Collins, Colorado. Brett graduated and received his commission as a

Second Lieutenant in 1982, and served as an ICBM Missile Launch Officer and an Intelligence Officer in a variety of staff positions, from the tactical to the strategic level for the next 19 years. Brett retired from the Air Force in 2001 while stationed at U.S. Central Command (USCENTCOM), and continued to serve at USCENTCOM until accepting his position as a Strategic Planner at U.S. Special Operations Command (USSOCOM) in 2008, where he remains today. Brett and his wife, Deanna, have five children and reside in Florida with their youngest child.

Aida "Idee" Belau

Idee had the great fortune of being born first in a line of seven globe-trotting military brats. A US Passport holder since the age of ten, Idee has explored ancient Moorish castles, cycled the vast openness of the Dakotas, trekked Maya ruins, and swam with endangered Florida manatees. She recently



filmed the famous Caribbean Ghost Ship, *MS Antilla*, scuttled by her own Captain during WWII. She has a fondness for all things water-related, most notably scuba diving. After earning a resort SCUBA certification in 1996, Idee went on to earn advanced and other diving certifications, and is currently testing as a PADI Master Diver.



Idee has engaged in underwater efforts involving fossil recovery, archaeological site survey, shipwreck site mapping, reef mapping and cleanups, and marine life counts. Of these pursuits, Idee loves nothing more than working with new divers as they experience the wonderment of Earth's inner-space. Her season as a dive guide in West Palm Beach, Florida, reinforced her enjoyment of working in larger groups of divers.

After studying Political Science at University of North Dakota, Idee engaged in hard science research efforts for the Departments of State and Defense, and served the US Immigration Service as a multilingual documentation translator. She is a Certified International Configuration Manager (she can organize anything), a

Microsoft Certified Systems Engineer (she can fix anything), and is conversant in four languages. Idee now studies Economics and Archaeology at Harvard University, and is Lead Consultant for Summit Docs & Data Consultancy.

Idee has volunteered to provide the CWVC program with photography and videography services necessary to record, document and capture visual data to support amputee research.

CAPT David Olson, U.S. Navy (Ret)

David coached sailing at the Naval Academy before reporting to flight school at Naval Air Station, Pensacola, in the fall of 1979. He was designated a Naval Aviator in 1981. While stationed at Naval Air Station Lemoore, California, David met his wife to be, Teresa Pearson, and married in 1984. He entered the Navy Reserve in 1987, served as Commanding Officer of two Naval Aviation Systems



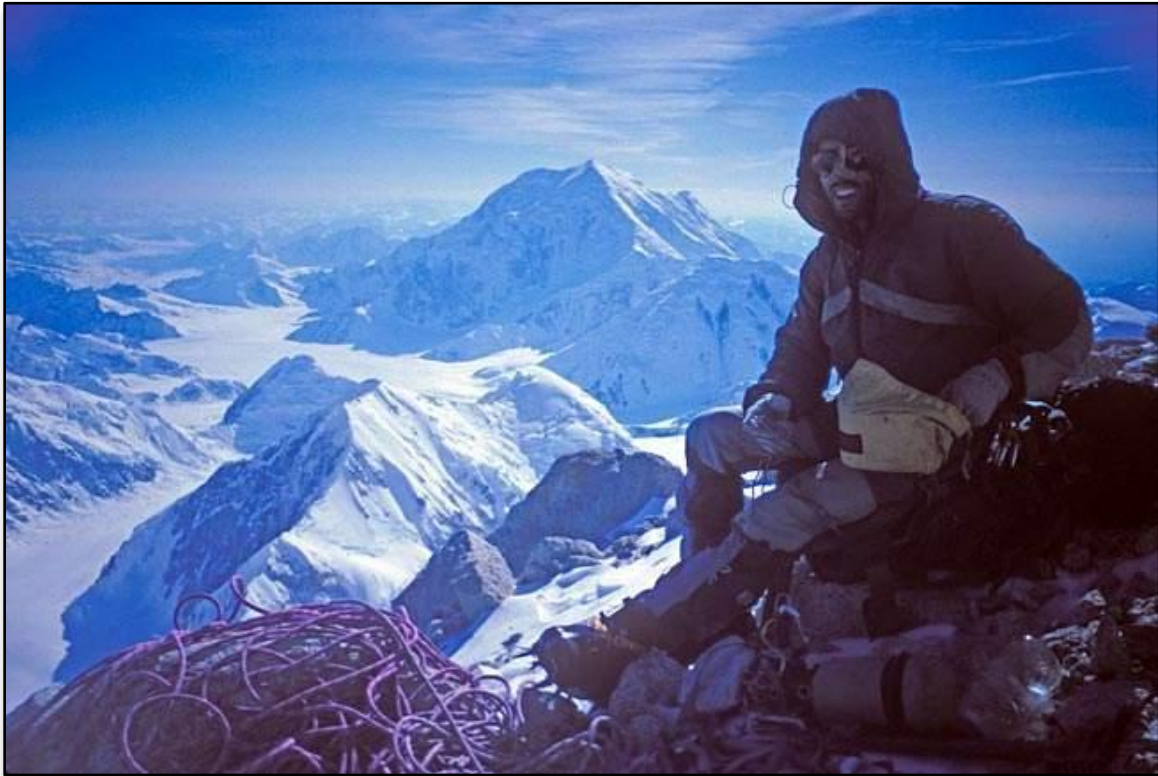
Command reserve units and then re-activated in September of 2001 as a war planner at U.S. Central Command. Together, they completed several assignments and deployments, the last of which was Operation ENDURING FREEDOM and Operation IRAQI FREEDOM while assigned to U.S. Central Command, where he retired as a Navy Captain (2009) and subsequently retired from Federal Service.

David remains active in the local community. He founded SCUBAnauts International in 2001, a marine sciences program that introduces young men and women, ages 12-18, to informal science education through underwater exploration. Today, SCUBAnauts International has expanded to four chapters nationally.

In 2010, David co-founded the non-profit Combat Wounded Veteran Challenge program to improve the lives of our wounded and injured Veterans through rehabilitative, high-adventure challenges, and therapeutic outdoor recreational activities while conducting scientific research to speed their recovery and that of their families.

David lives in Palm Harbor, Florida, with his wife of 29 years, Teresa. They have three boys and one daughter, three of whom currently serve in the military.

Colby Coombs



Colby's love for climbing and wilderness places led him to instruct mountaineering courses for NOLS Alaska at age nineteen, a year after he first climbed Denali in 1985. He guided his first McKinley climb in 1993 for Alaska-Denali Guiding. Colby considers himself a moderate climber, but he has climbed some harder routes as well, such as Wowie-Zowie, Denali's Cassin Ridge, and the Kennedy-Lowe on Mt. Hunter. He and his wife, Caitlin Palmer, started AMS with the help of many friends in 1996. Coombs is a board member of The Ritt Kellogg Fund at Colorado College, and a past board member of the American Mountain Guides Association (AMGA). He is author of "Denali: A Climber's Guide," and co-author with Mike Wood of, "Alaska: A Climber's Guide," published by the Mountaineers Press. He and Caitlin live in Talkeetna, Alaska, with their daughter.

Tim Hewette



A veteran of multiple expeditions to high-altitude summits in Alaska, Antarctica, and South America, Tim feels at home on all of our expeditions. He has led expeditions to big mountains on three continents, to the South Pole, and successfully guided the oldest man to reach the summit of Denali (Mt. McKinley) in 2004. Tim is a year-round outdoor professional acting as a guide for climbers, scientists, hunters, field personnel, as well as anyone else looking for a safe and enjoyable adventure. He is based out of Anchorage, Alaska, where he also works as an outdoor skills instructor, placing an emphasis on mountaineering and improvised rescue techniques in glaciated environments. His favorite part of being an expedition team member is getting to know people from all

walks of life. Tim has a Bachelor's Degree in Outdoor Studies, is a certified Wilderness First Responder (medical), and speaks Spanish.

MSGT Russ Gratz – Ground Support

Biography not available

CAROL E. MARTIN



Carol has proudly spent her entire life residing in Tarpon Springs, Florida, where she established a foundation that supports children and other charitable causes and established the Chair for Downs Research at the University of South Florida.

Following her father's death in 1995, Carol assumed the duties of her father's many and varied businesses, which she continues to this day. She is the Chair of the Ellis Foundation, a

major benefactor in the construction of the new hospital in Tarpon Springs, established a Chair for Parkinson's Research at USF, and established a renewable scholarship program for Tarpon Springs High School (TSHS) graduates. Additionally, Carol has been a major supporter of the Jacobson's Culinary Academy at TSHS, as well an anonymous supporter of many other TSHS programs.

In 2005, Carol and David Olson joined forces to establish a youth marine sciences program in St. Petersburg, Florida, called SCUBA Scouts, USA (SSUSA). The mission of SSUSA is to guide young men and women, ages 12 through 18, along an exciting pathway for personal development by involving them in the marine sciences through underwater marine research activities, such as special environmental and undersea conservation projects that build character, promotes active citizenship, and develops effective leadership skills. SSUSA is now a thriving national organization called SCUBAnauts International, with five chapters nationwide.

In 2010, David Olson and Carol Martin founded the Combat Wounded Veterans Challenge. The Combat Wounded Veteran Challenge improves the lives of our wounded and injured Veterans through rehabilitative, high-adventure and therapeutic outdoor challenges, while furthering the physiological, biomedical, and pathological sciences associated with their injuries.

Award of Flag 93

Capt. David R. Olson, USN (Ret.), FN '11
Combat Wounded Veteran Challenge: Kilimanjaro 2013
January 16, 2013 to February 3, 2013

The Explorers Club Flag is a symbol of courage and fidelity. The award of the flag is a significant accomplishment. Since 1918, the flag has been carried to all of the Earth's continents, as well as under the sea and into the stars. To date, 850 explorers have carried the flag on over 1450 expeditions. A select handful of the 202 Explorers Club flags have been framed and now decorate the Club house in New York. These include flags carried by Roy Chapman Andrews, Bob Bartlett, Thor Heyerdahl, Naomi Uemura, and miniature flags carried aboard the Apollo 8 and Apollo 15.

Your expedition will now become part of the rich history attached to this flag. Earlier expeditions include:

Amos Burg	1939	Frazier Salmon River Expedition
Noel T. Boaz	1990	Semliki Research Expedition
Noel T. Boaz	2005	East Libya Neogene Research Project
Alison M. Jones	2007	No Water No Life: Columbia River Basin Expedition
Alison M. Jones	2009	No Water No Life: Length of the Mara River Expedition
Robert E. Hyman	2011	Honduran Biodiversity Expedition, Gualaco 2011
Scott W. Hamilton	2011	Forbidden Kingdom Drishti Expedition
Patrick L. Gorham	2012	Niani Expedition 2: The Rites of Origin

You can take pride in joining this illustrious group and in your broader membership and participation in exploration.

Alan H. Nichols, B.A., I.L.B., J.D., D.S. (Hon.)
President

Constance Difede
VP for Flag and Honors

TAB A

Using Bioimpedance Spectroscopy to Analyze Residual Limb Volume Fluctuations during High Altitude Activity

Theodore Graves, Student, Orthotics and Prosthetics, J.E. Hanger College of Orthotics and Prosthetics at St. Petersburg College

Edited by: Arlene Gillis and Jillian Gifford

INTRODUCTION

Volume changes in an amputee's residual limb account for a majority of the problems an amputee faces on a regular basis. These problems arise because the socket component of a prosthesis is rigid and static and cannot accommodate for the dynamic nature of the residual limb's volume. The dynamic characteristics of the residual limb are influenced by numerous factors, such as diet and activity level. Amputees have limited ability to manage these discrepancies. Volume management is historically accomplished by adding or subtracting prosthetic socks, or ply, as the volume fluctuation dictates. Volume fluctuation is known to occur in the soft tissue of the limb. In a transtibial amputee, the bulk of the soft tissue is contained within the triceps surae. When residual limb volume is less than that of the socket, a void develops between the residual limb and the socket preventing total contact. Because of this, during ambulation the distal end of the tibia migrates into the bottom of the socket causing pain and skin breakdown. This can be remedied by adding sock ply, but causes additional problems by creating a tourniquet effect at the proximal brim of the socket where volume reduction does not occur. The use of a half sock, that terminates distal to the neck of the fibula, can be implemented. This method more accurately accounts for the volume loss in the triceps surae, but does not readily stay in place and is prone to rolling down, creating a tourniquet effect at the distal end. Any increased pressure on the residual limb, regardless of mode, can restrict blood flow impeding critical oxygen and nutrient delivery to the cells. Because of limited ability to control volume fluctuations, the socket continues to be a source of concern for both patients and practitioners.

Previous studies have correlated the validity and accuracy of using bioimpedance spectroscopy to measure limb segment muscle volume as compared to the more traditional use of MRI [2.]. More recent studies have used bioimpedance analysis to assess limb volume within the socket using elevated vacuum suspension however

physiologic changes are only represented in extracellular fluid results, as all testing sessions were less than 40 minutes. [5.]. While several studies have used bioimpedance spectroscopy to assess limb volume fluctuation over short durations and under lab conditions, none have sought to analyze the volume fluctuations over longer periods and in a real world environment.

Currently few studies focus on traumatic amputees who exhibit a high activity level and are exposed to varying environmental factors as seen in the wounded veteran population.

The purpose of this study was to better understand what factors influence residual limb volume fluctuations and to correlate any extracellular and intracellular fluid changes with varying environmental changes to include activity level, sock ply, and altitude variation. This study was conducted with three participants tracked over an activity period of eight days with a maximum obtained altitude of 5,714 meters during expedition to summit Mount Kilimanjaro.

METHODS

Subjects

This study was comprised of three subjects. Of the subjects that participated, two were transtibial amputees and one was a transfemoral amputee. Their original data of amputation ranged from 16 months to over 8 years. All participants amputations were a result of traumatic injury and were otherwise healthy, active individuals with no additional comorbidities. All three participants current prostheses were fit by a certified prosthetist and were using their sockets regularly prior to the study. No changes to any participants' socket design or prosthesis were made.

Bioimpedance Spectroscopy

Bioimpedance spectroscopy, BIS, was used to analyze both extracellular and intracellular volume fluctuation within the amputees' total body and residual limb. BIS has been proven to be reliable in measuring fluid volumes [2.]. BIS is commonly used to analyze body composition, body fat, and fluid shifts in lymphedema patients. Bioimpedance functions by passing a low current of varying frequency threw the participant's tissue. Because muscle and skin tissue conducts significantly better than bone and adipose tissue, results reflect composition of the muscle and skin. At low frequencies, current will readily pass threw extracellular tissue and be attenuated by

intracellular tissue. At high frequencies the inverse is true with current being attenuated by extracellular fluid while readily passing through intracellular fluid [1.].

Measurements

Data was collected with an ImpediMed SFB7 tetra polar bioimpedance spectroscopy device. The device emits 256 different frequencies between 5 kHz and 1000 kHz and uses the Cole model with Hanai mixture theory to process the data [1.]. A low level electrical current is applied to the skin through two electrodes and the resultant current is measured via two sense electrodes.

Protocol

This study was conducted during an eight day expedition to summit Mount Kilimanjaro in Tanzania, Africa with the Combat Wounded Veterans Challenge. Due to the sedentary nature of trans-Atlantic flights, a baseline data set was collected the day prior to departure. After the expedition began, two data sets were taken each day, once in the morning and once in the afternoon, with the exception of summit day, January 26th. A measurement was not taken on the summit due to the lack of shelter, leading to concerns about the environmental exposure of the participants. In addition, an afternoon measurement was not taken the night of the summit attempt due to the participants fatigue and the deteriorating conditions at high camp. To clearly identify what volume fluctuation took place in the whole body versus the amputees' residual limb, each data set consisted of a total body measurement and a segmented measurement of the amputees' residual limb for comparison. In addition to BIS, other variables were also recorded. Altitude and activity level were monitored and recorded with a Garmin GPS, morning ambient temperature was recorded with a Suunto Core watch, the residual limb was visually inspected each day, and the required sock ply was noted.

For consistency, BIS measurements were collected in each of the participant's tents lying supine on their respective sleeping bags. All jewelry was removed and metallic objects were cleared away. All measurements were conducted with the prosthesis doffed. For each measurement, the participants were informed to empty their bladder prior and remain supine for several minutes.



Image 1

To capture the most accurate picture of what is going on in the residual limb at rest, the morning data set was conducted before the participants donned their prostheses and became ambulatory. Conversely, the afternoon data set was collected within a couple of hours of completing the day's hike immediately after doffing the prosthesis to accurately capture fluid shifts during activity.

Electrode sites for total body measurements were all on the sound side of each participant. They consisted of a sense lead placed next to the ulnar head, current source lead on the dorsal surface of the hand, second sense lead on the ankle level with the malleoli, and a current sink lead on the dorsal aspect of the foot. For segmented measurements of the transtibial residual limbs, the current source lead was placed 2 inches proximal to the superior border of the patella, the sense lead was placed at the superior border of the patella, the second sense lead was placed 2 inches proximal to the distal anterior tibia, and the current sense sink was placed at the distal anterior tibia. The transfemoral segmented measurement electrode placement consisted of the current source lead placed at the greater trochanter, the sense lead 2 inches distal to the greater trochanter, the second sense lead 2 inches proximal to the distal anterior femur, and the current sink lead at the distal anterior femur. As not to influence the integrity of the data, care was taken when selecting the electrode sites as not to place them on scar tissue while still using readily identifiable bony landmarks that would aid in electrode placement consistency. The electrode sites were dried of any perspiration and cleaned with alcohol wipes. Single tab electrodes supplied by ImpediMed were used and they were attached to their respective lead by alligator clips. Measurements were taken and the raw data was saved to the ImpediMed SFB7 internal memory.

BIS Electrode Placement

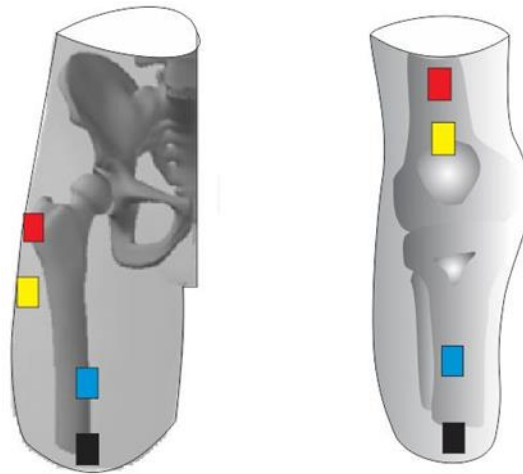


Image 2

Data Processing and Analysis

Extracellular fluid and intracellular fluid percentages were used for discussion in this article as they provide the most accurate and repeatable data set gathered with bioimpedance spectroscopy. Segmented limb total volume as measured in liters, can be affected by minute differences in electrode placement and can skew data points over a period of time. Studies that measure volume fluctuation differences without the electrodes having to be repositions, do not suffer from this shortcoming. That was not the case with this study, as it required the electrodes to be placed and subsequently removed for every measurement.

Software provided by Impedimed for use with the SFB7 was used to calculate extracellular and intracellular fluid percentages. The software uses Cole model with Hanai mixture theory to process the raw data into its components [1.].

RESULTS

Case Study 1

The first participant was a 42 year old male that underwent a left transtibial amputation in July of 2004 secondary to complications suffered from a gunshot wound to the ankle. His weight was 101.2 kg and measured 182.9 cm tall. He was a K4 ambulator and considers himself athletic. His residual limb length measures 23.0 cm from mid patella tendon and is of cylindrical shape. His current prosthesis was a suction socket with sleeve suspension and a dynamic response Renegade foot from Freedom Innovations. He has a slight toughening of the skin at the mid patella tendon, but has no additional history of skin breakdown or abrasion.

Throughout the expedition the participant was consistently in a zero ply fit. On summit day, he stated he felt he needed an additional ply. He donned a single ply sock, but it increased his discomfort and he soon doffed it. The next morning he complained of soreness on his distal anterior tibia and visual inspection revealed a slight redness at the distal anterior tibia and extending upward along the tibial crest.

Extracellular and intracellular fluid percentages for total body measurements deviated a maximum of 3.51% with a daily mean variation from morning to afternoon of 0.96% over the period of 9 days this study was conducted. Segmented measurements of the residual limb deviated a maximum of 6.37% over the same time with a mean daily variation of 2.66%.

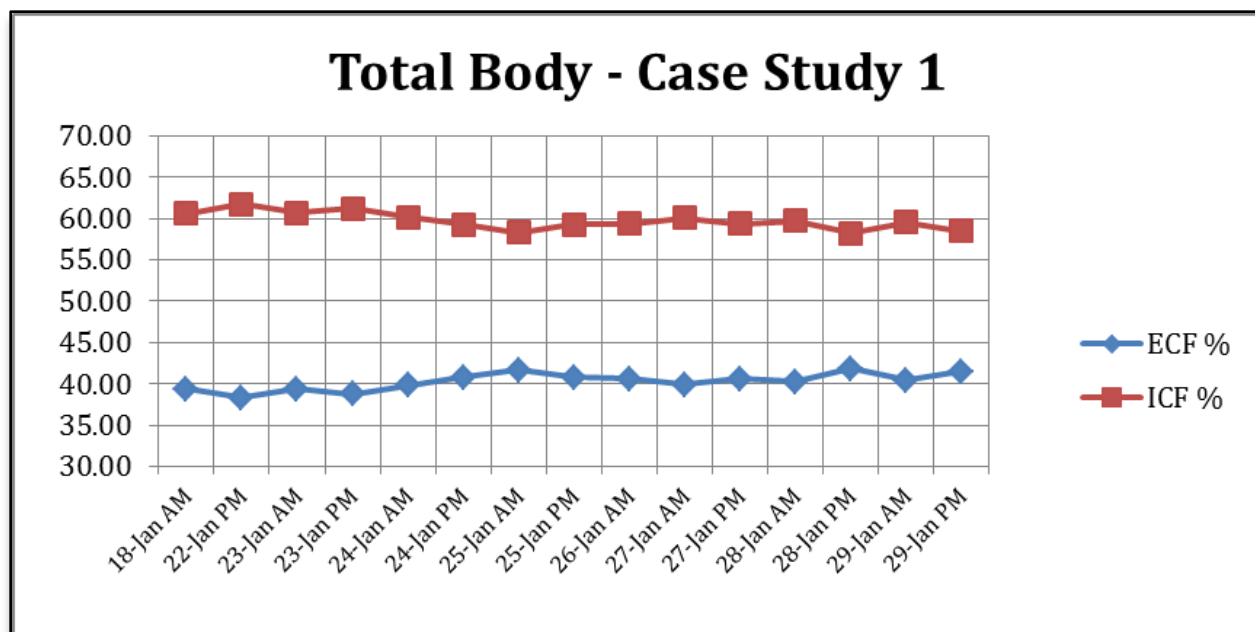


Figure1

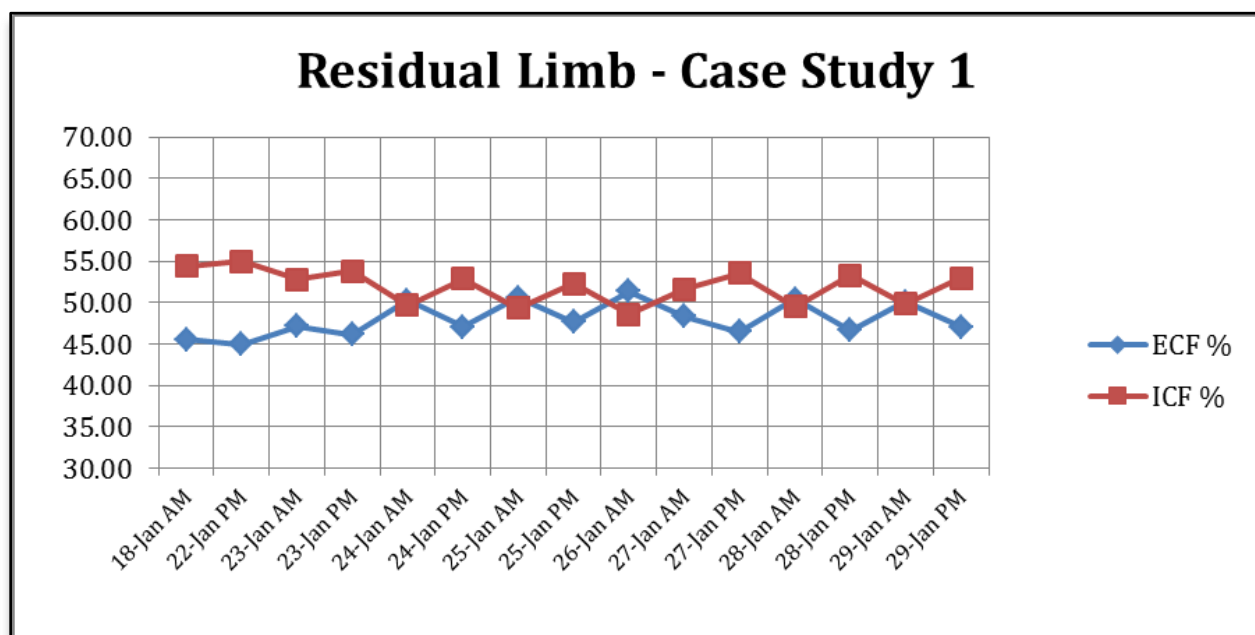


Figure 2

Peak extracellular fluid and minimum intracellular fluid occurred the morning of summit day with the values being 51.39% and 48.61% respectively. The inverse was true the first afternoon measurement of the hike producing the lowest extracellular fluid at 45.02% and peak intracellular fluid at 54.98%. Comparing the lowest afternoon

extracellular fluid percentage to the highest afternoon extracellular fluid of 47.67% taken the day prior to the summit attempt, an increase of 2.65% can be seen that directly coincides with an increase in altitude.

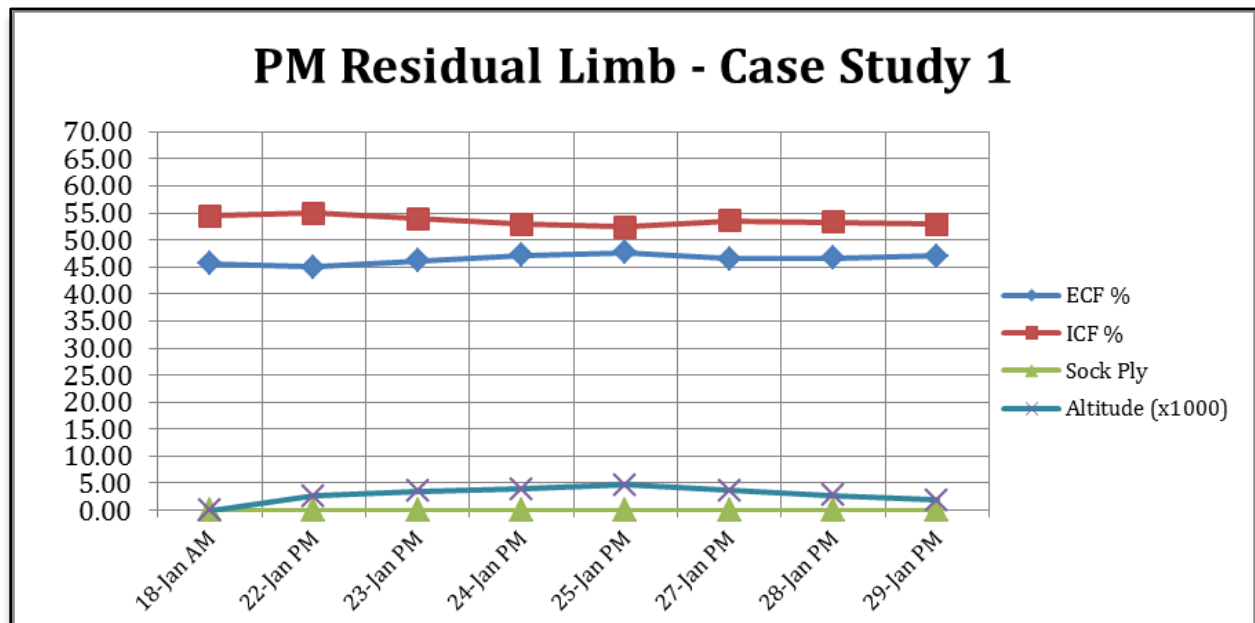


Figure 3

Case Study 2

The second Participant was a 52 year old male who underwent a right transtibial amputation in December of 2007 secondary to complications suffered during a fall. His weight was 95.3 kg and he was 182.9 cm tall. In addition to the amputation, he had an internal fixator on vertebrae C4 to C7. He was a K4 ambulator and considered himself athletic. His residual limb length measures 22.5 cm from mid patella tendon and is of cylindrical shape. His current prosthesis is a suction socket with sleeve suspension and a dynamic response VSP foot from Ossur.

This subject's volume varied between 9 ply with a 1 ply half sock on the day of baseline to 12 ply with a 1 ply half sock the day after the summit attempt. On the 2nd day of the climb, a slight abrasion over the medial condyle began to develop. On the 3rd day, additional redness developed over the distal anterior tibia and he stated he felt loose in the socket. The day after the summit attempt, skin breakdown and redness was noted in the popliteal area along with redness and discomfort in the distal anterior tibia, tibial crest, and medial condyle. On the 28th, the subject donned only 9 ply's of socks as he

was missing a needed 3 ply sock. By the last day he developed a slight redness over the distal lateral fibula possibly due to ambulating with the reduced ply of socks.

The total deviation of extracellular and intracellular fluid percentages for total body measurements was 4.8% over the course of the study. The average daily change from morning to afternoon measurements was 0.88%. While during that same time segmented measurements revealed a maximum deviation of 8.16% with an average daily change of 3.09%.

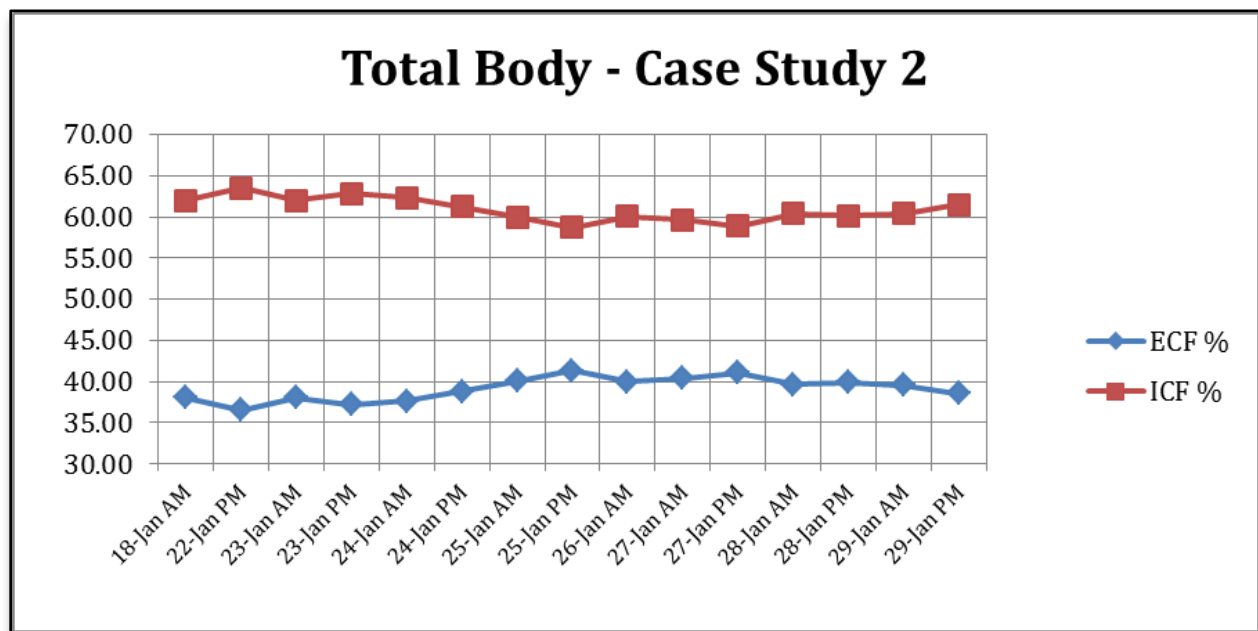


Figure 4

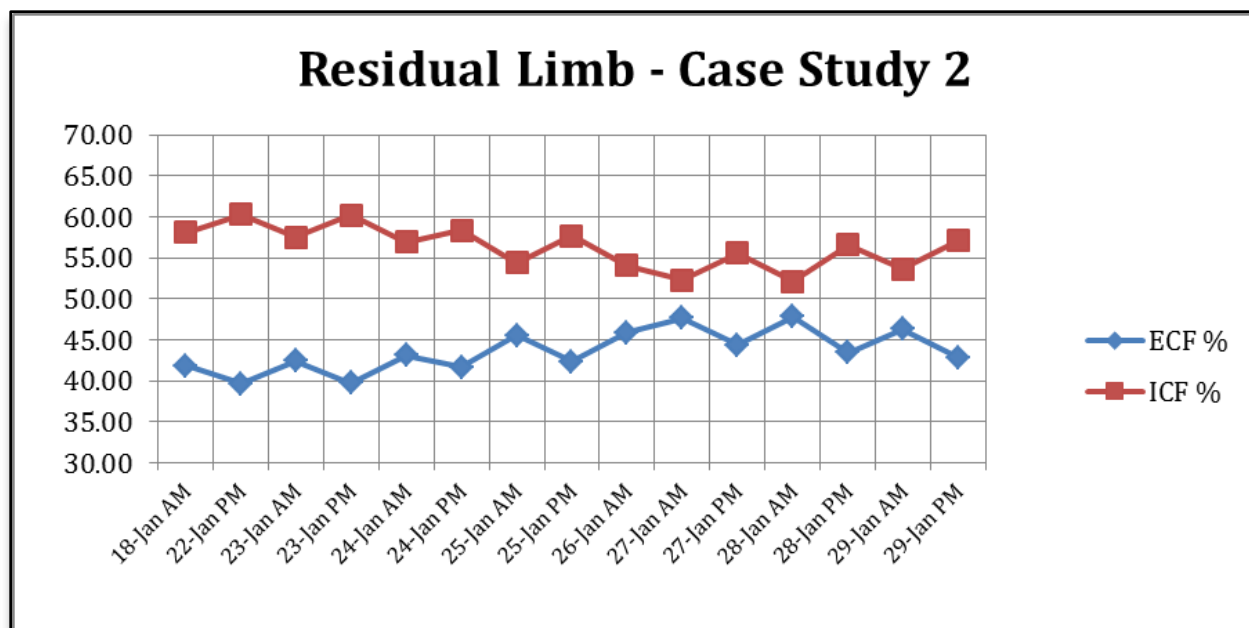


Figure 5

In segmented measurements, peak extracellular fluid and the lowest intracellular fluid were recorded 2 days after the summit attempt and 8 days into the study. The lowest extracellular fluid and peak intracellular fluid values were measured on the first day of the climb. Looking at afternoon measurements only, extracellular fluid volumes peaked at 44.40% the day after the summit attempt and were at their lowest the first measurement of the climb at 39.69% with a change of 4.71%. This change directly correlates with an increase in altitude.

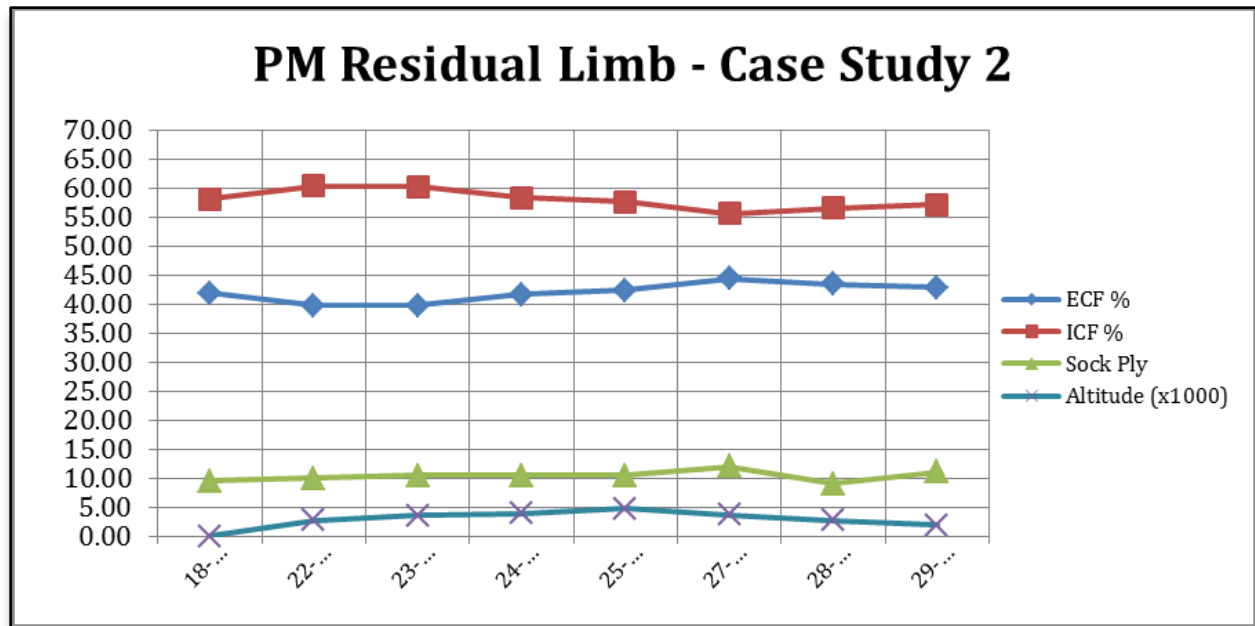


Figure 6

Case Study 3

Participant is a 30 year old male that underwent a right transfemoral amputation in September of 2011 secondary to an improvised explosive device. As a result of his injuries he has heterotopic ossification at the distal and of his femur. His weight is 64 kg and he stands 175.3 cm tall. He is a K4 ambulator and considers himself athletic. His residual limb length measures 28.5 cm from the ischial tuberosity to the distal in of his femur. His current prosthesis is an ischial containment socket with suction suspension achieved with an Ossur Iceross Seal-In liner. A Coyote Proximal Lock provides auxiliary suspension and rotational control. Subject has a well-healed residual limb with no skin breakdown or abrasion. A slight invagination exists on the distal lateral aspect of his residual limb.

The participants' volume fluctuated from his normal 1 ply fit to a 4 ply fit the day following our summit attempt. He complained of tenderness on his anterior lateral distal femur however visual inspection of his residual limb revealed no redness or skin breakdown. During the two days of decent, the subject had pain at the proximal anterior trim line and his skin was red and inflamed.

Total body fluid shifts for extracellular and intracellular fluid deviated a maximum of 2.87% during the course of this study with a daily average of 0.71%. Segmented

measurements of the transfemoral residual limb showed a max deviation of 4.62% with a daily average of 0.80%.

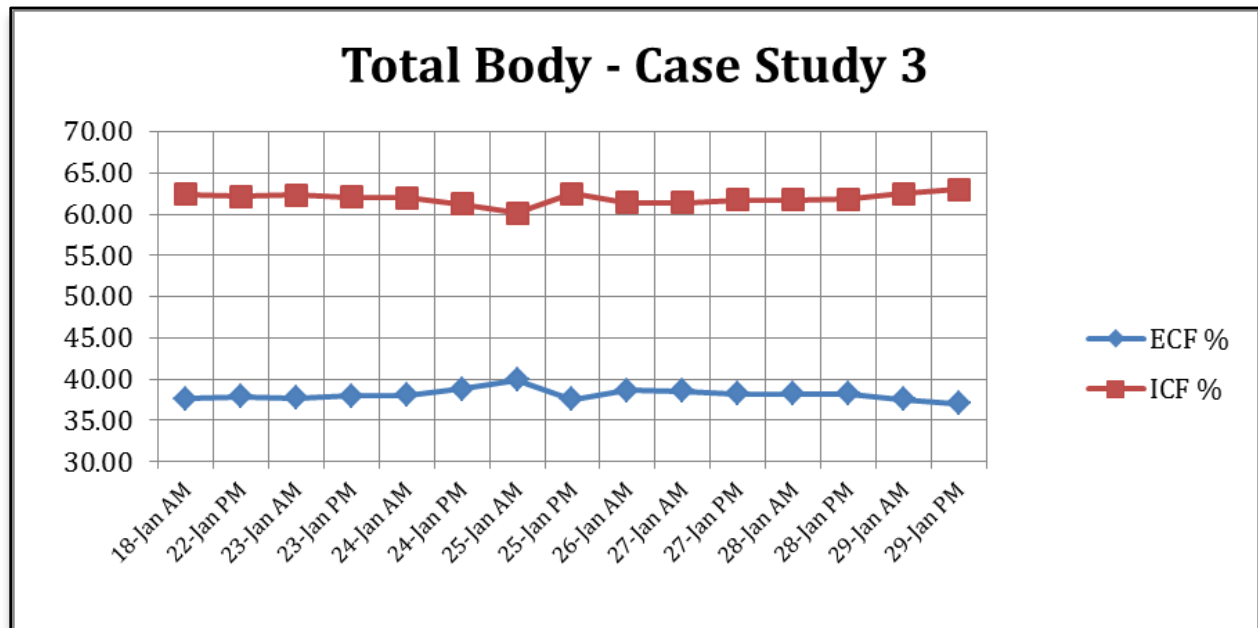


Figure 7

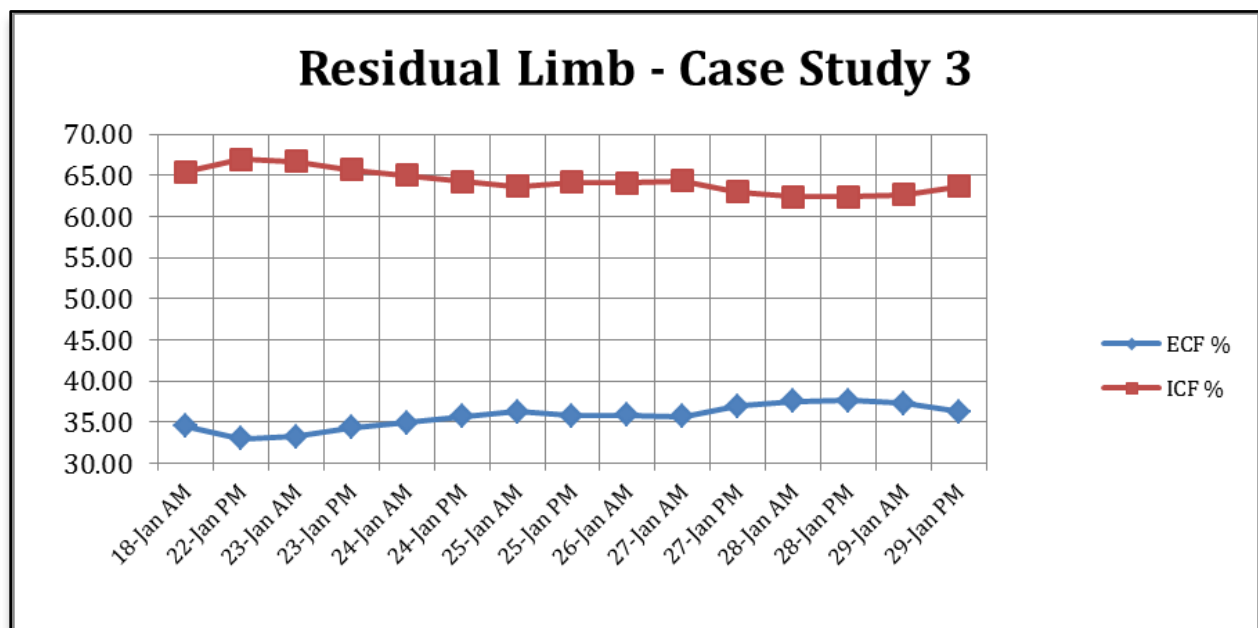


Figure 8

Afternoon segmented peak extracellular fluid occurred two days after the summit attempt and 8 days into the study with a value of 37.63%, while the value was at its lowest the first day of the climb at 33.01%. While fluid shifts were less pronounced from morning to afternoon, an increase of 4.62% still occurred over the course of this climb, which directly correlates with an increase in altitude.

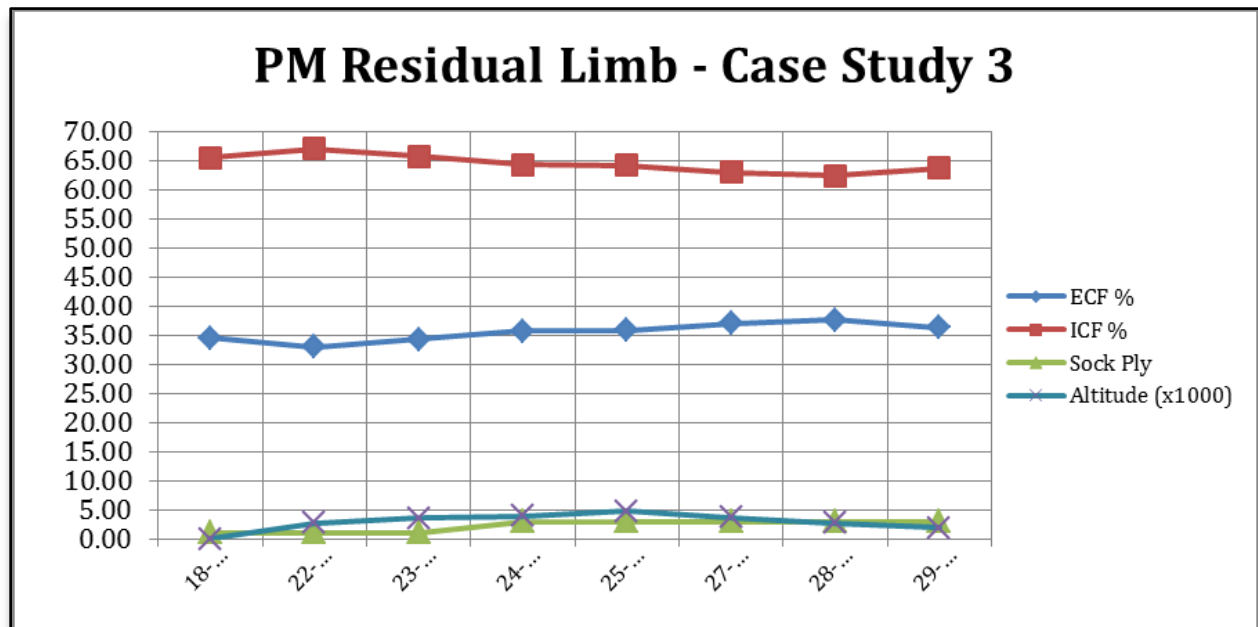


Figure 9

DISCUSSION

In an effort to understand what factors influence residual limb volume fluctuations in amputees, this study observed three participants and recorded their fluid shifts in varying levels of activity and environment.

In current publishing's, it has been documented that donning the socket forces extracellular fluid out of the transtibial residual limb [4.]. When comparing our morning readings to our afternoon readings, the Bioimpedence Spectroscopy (BIS) measurements recorded for extracellular fluid (ECF) in the residual limb demonstrate that donning the socket does indeed force ECF out of the limb in our two transtibial participants, thus support previous findings. The migration of ECF fluid caused by donning the socket was not observed in the participating transfemoral subject. (See Figure 10) The two transtibial participants showed significantly more fluid fluctuation in their residual limb between morning and afternoon than did the transfemoral participant. The two transtibial participant's fluid shifts are dependent on time of day and activity level and seemingly independent of their total body fluid data levels. The transtibial

subjects had a mean segmented data deviation of 2.66% and 3.09% from morning to afternoon while the transfemoral participant only had a mean daily deviation of 0.80%.

To confirm that the ECF fluid shift only occurred in the residual limb and was not a factor of total body physiology, the BIS readings for total body percentage were compared to the segmented BIS readings. In this comparison, it is noted that volume deviations do exist in the residual limb from morning to afternoon, but is not evident in the total body measurements. In fact, total body measurements show minimal deviations between morning and afternoon, and between the subject populations (See Figures 10 and 11).

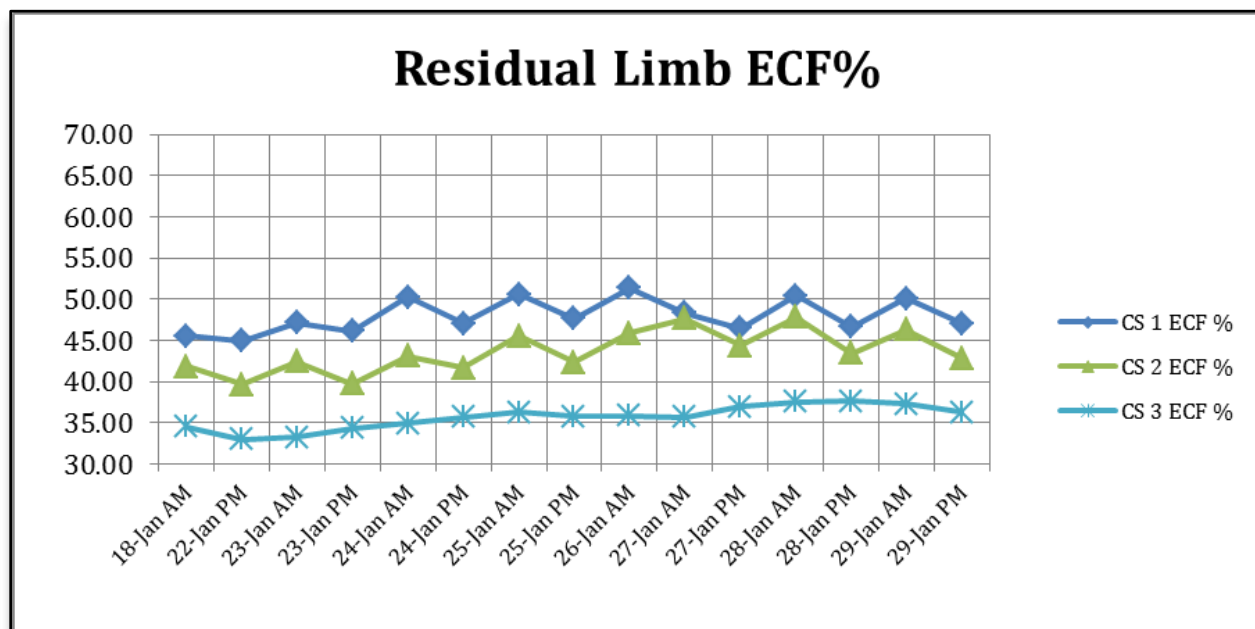


Figure 10

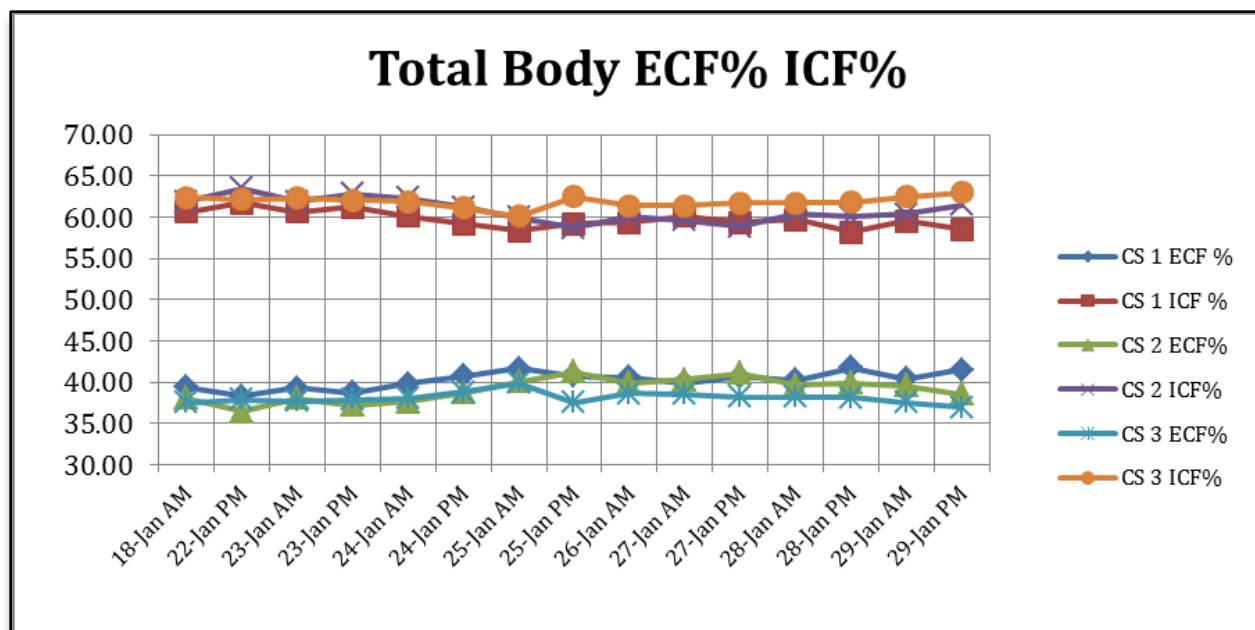


Figure 11

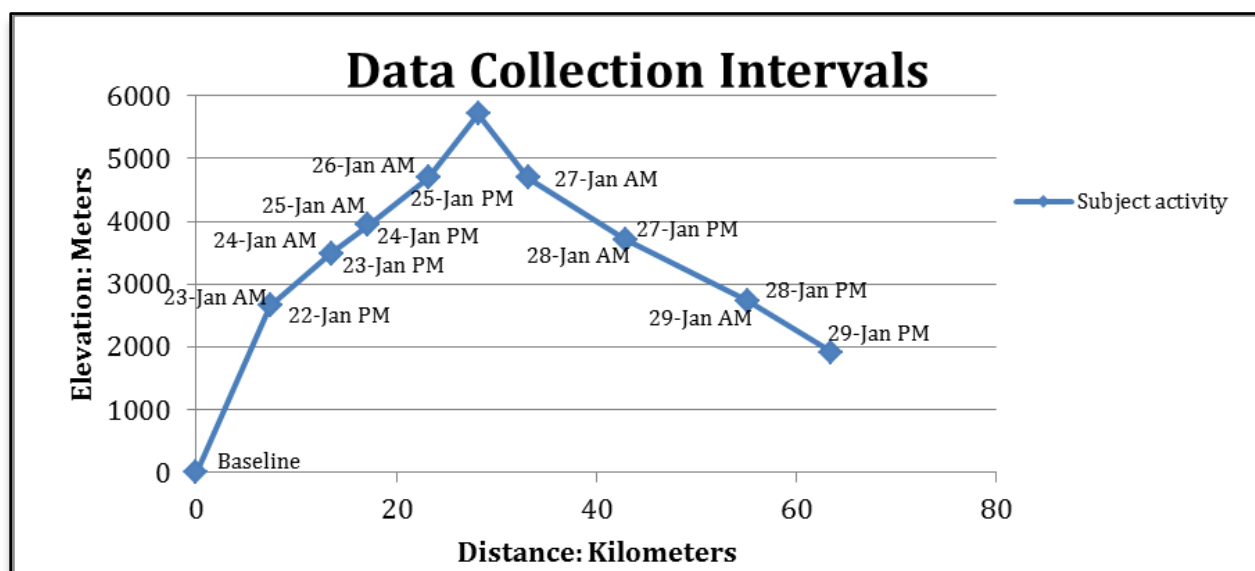
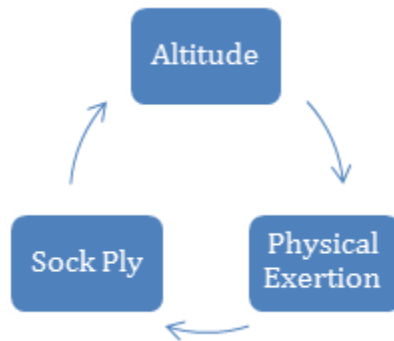


Figure 12

Another trend observed, was the relationship of ECF and ICF in the residual limb to overall activity level. Due to the nature of observation outside of a controlled lab environment, it was impossible to isolate the external factors that contributed to the participants' overall "activity level" during the expedition. These factors included

physical exertion, altitude, sock ply, and ambient temperature. An increase in overall activity level coincided with altitude gain, additional sock ply, increase in physical exertion, and a decrease in ambient temperature. A decrease in overall activity level was accompanied by the inverse of these factors. Because physical exertion was the only factor not quantified, altitude was used as a measure of physical exertion. As an increase in altitude was achieved, the difficulty of the terrain increased. This coupled with the diminishing oxygen proved to be more challenging for the team.



In all three cases, minimum extracellular and maximum intracellular fluid was noted on the first day of the climb. Their extracellular fluid levels began to rise throughout the climb with their values peaking within a 3 day window of each other, centering around the most physically demanding portion of the climb. The data suggests that although the socket forces extracellular fluid out of the limb, other factors can counter this effect. During the period of extracellular fluid values rising, several factors must be taken into account. The team was operating in sustained high elevation while in the most physically demanding portion of the climb and sock ply was added to compensate for residual limb volume loss. Although it is well known that the prosthetic socket forces ECF out of the residual limb, our findings imply that this effect is only in the short term. Overall interpretation of this data suggests that observation over a sustained duration actually demonstrates overall ECF in the residual limb increases proportionally with activity level (See Figure13).

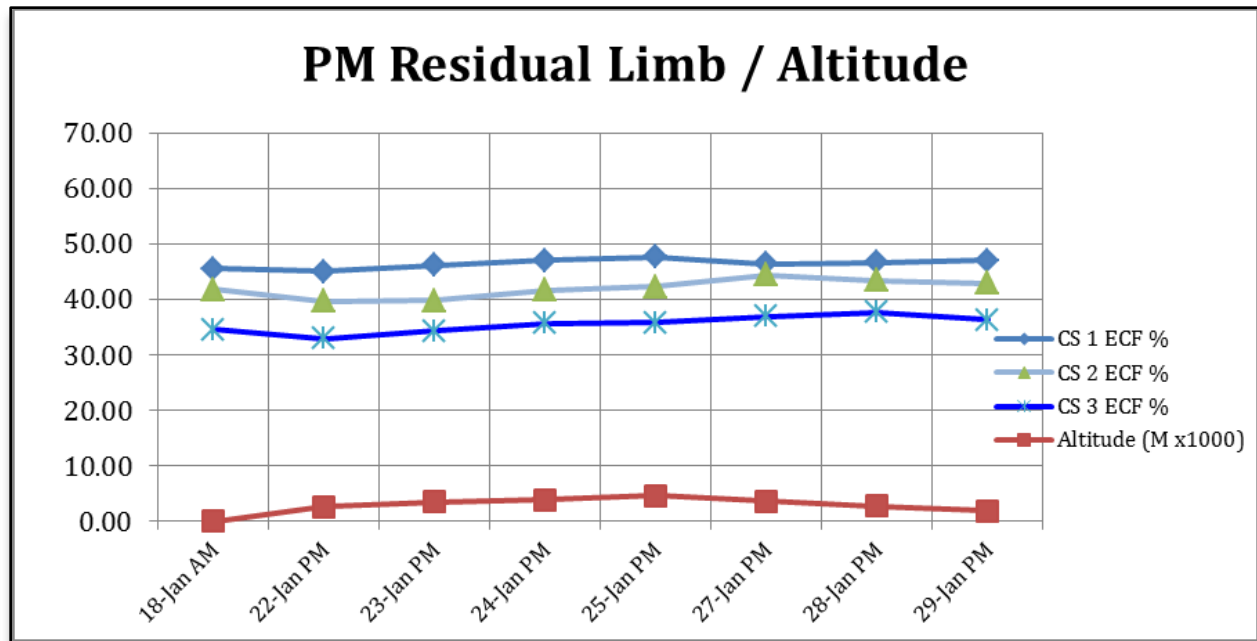


Figure 13

In a field environment, limitations exist that are not otherwise seen in a controlled environment. There are a few potential elements that may have influenced the BIS data collection. Data collection was accomplished in two-man tents that were not always placed on a completely horizontal piece of land. The subjects were instructed to remove all jewelry and lie supine on their respective sleeping bags, however it is unknown if the metal zipper from the bag or any surrounding equipment in the cramped space influenced the accuracy of the data. Also, the temperature was not consistent. The morning temperatures varied between from 11.7 °C to a low of 0.6° C. The BIS measurements themselves produced consistent data with minimal noise, which suggest a high reliability. Electrode placement was specifically selected to be over easily identifiable boney prominences and avoid scar tissue but minute discrepancies in their placement from day to day are conceivable.

Summary

In summary, results from previously documented studies regarding extracellular fluid being initially expelled from a transtibial amputee's residual limb shortly after donning their prostheses, were easily duplicated in a real world environment. That same phenomenon was not observed in our transfemoral participant.

Interestingly, it was found that sustained levels of overall high activity, defined by a combination of factors stated earlier, resulted in a return of extracellular fluid percentage to the participant's residual limb over the course of several days. Conversely, as activity level decreased, these levels started to return to baseline.

TAB B

The Effects of Atmospheric Pressure and Elevation on Traumatic Brain Injury

**A Self Study conducted by
SFC Michael R Rodriguez
US ARMY Special Forces
Green Beret
2013**



Purpose

As an active duty United States Army Special Forces Green Beret with a history of multiple Traumatic Brain Injuries (TBI's) sustained from blast and blunt force, still exhibiting residual neurological symptoms, I conducted the first self-study on how elevation and atmospheric pressure affect TBI's. With the desired end-state of finding and documenting more effective ways to differentiate between Altitude Sickness diagnosis and progression versus residual TBI symptoms, and learning how an individual with TBI can prepare for the these symptoms. My hope is that this data will increase the survivability of service members operating in high altitude environments by delineating possible duty limitations for those with a history of TBI, or even provide a safe way for an individual with neurological injuries or deficiencies to take on the challenges that increases in elevation can offer.

Dr. Thomas Ravenhill was the first to describe Altitude Sickness in a paper he wrote in 1913. He was the medical officer at Collahuasi and Poderosa mines in northern Chile. He described noticing a variety of symptoms the miners were repeatedly presenting at the mine, situated 4000 meters above sea level. Altitude Sickness, as defined by the International Mountaineering and Climbing Federation (UIAA), is an “umbrella term” and includes three components. The first, acute mountain sickness (AMS), is essentially headache and nausea at about 3000m or more and is a benign illness. The other two, high altitude pulmonary edema (HAPE) and high altitude cerebral edema (HACE) are the life threatening forms of the illness and include water collection in the lungs or water collection in the head. It is suggested that some people are genetically predisposed to develop Altitude Sickness versus others, which makes it a relatively unknown variable, yet to be clearly identified. That being said, it is clear that Altitude Sickness has nothing to do with any one person's physical fitness level. In fact, It is even suggested that those who are in better shape tend to be more at risk of developing Altitude Sickness due to the assumption that those individuals may challenge themselves more than the common man and push harder than they really should. According to Official Standards of the UIAA Medical Commission (Vol 16) and the Consensus Statement of the UIAA Medical Commission (Vol. 13), persons with pre-existing medical conditions (Sleep Disorders, Migraines, Brain Trauma/TBI's) should be very cautious about undertaking any attempts at elevation, if at all.

Method

This study consisted of both a cognitive and physical data collection plan, which included tests that, when measured against a control patient, could show how the TBI patient (myself) would compare to a patient with similar anatomy and physiology, but no history of TBI. Someone with a history of TBI's ability to acclimate and operate is a relatively unknown science due to the risks involved. I accepted those risks and, after the conclusion of this experiment, see the potential to explore more research in environments like these, where the climate and elevation play such a huge role in the human body's ability to function. The tests I used were chosen because quantifiable data could be gathered and compared. I will now outline the tests that were conducted, present the data and draw my own conclusions/theories. A baseline set of tests were conducted in Moshi, Tanzania, before the expedition at 921 meters above sea level. The schedule of tests were as follows: immediately upon arrival at new basecamp/elevation, and repeated the following morning before movement to next basecamp and new elevation. For the purpose of presenting my findings, I will refer to myself as the TBI patient and the control patient as the control patient.

Patient History

38y/o WDWN male, 70" 175 lbs, 20+ years in the US Army as a Special Forces Green Beret. History of multiple TBI's (>10 consisting of both blast and blunt force trauma). The following is a list of notable diagnosis:

Post Concussion Syndrome, Diplopia/Strabismus, Photophobia, Bilateral Hearing loss, Dysarthria, Vestibular Balance disorder, Post Traumatic Headaches, Cervical and Lumbar Degenerative Disc Disease with disc herniation/bulges, Bilateral Achilles ruptures. Severe PTSD.

List of medications-

Depakote 1500mg qd

Trazodone 50mg qd

Ambien 5mg

Zoloft 100 mg qd

Oxycontin 10mg prn

Oxycodone 5/325 prn

Baclofen 100mg prn

Acetazolamide 250mg tid

Physical preparation:

Crossfit was done 3-5x a week

Medical treatment received prior to expedition:

Surgical repair of Achilles ruptures 2008, 2009.

18 Months of vestibular physical therapy
Hyperbaric Oxygen Therapy, 2.6ATA x 40 trx's in October 2012

Control Patient History

32 y/o W/DWN male, 72" 205 lbs, 10 + years as a professional mountain guide. History of orthopaedic injuries acquired during work related activities include broken neck resulting in fusing of C5-C7. No medication currently being taken. Patient regularly exercises 3-5x weekly involving both cardio and strength related exercises.

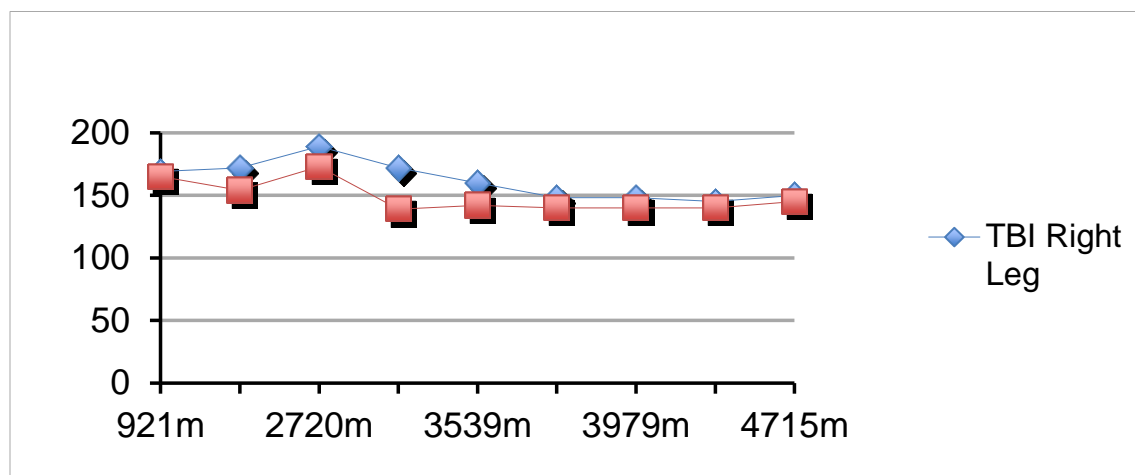
Headache journal

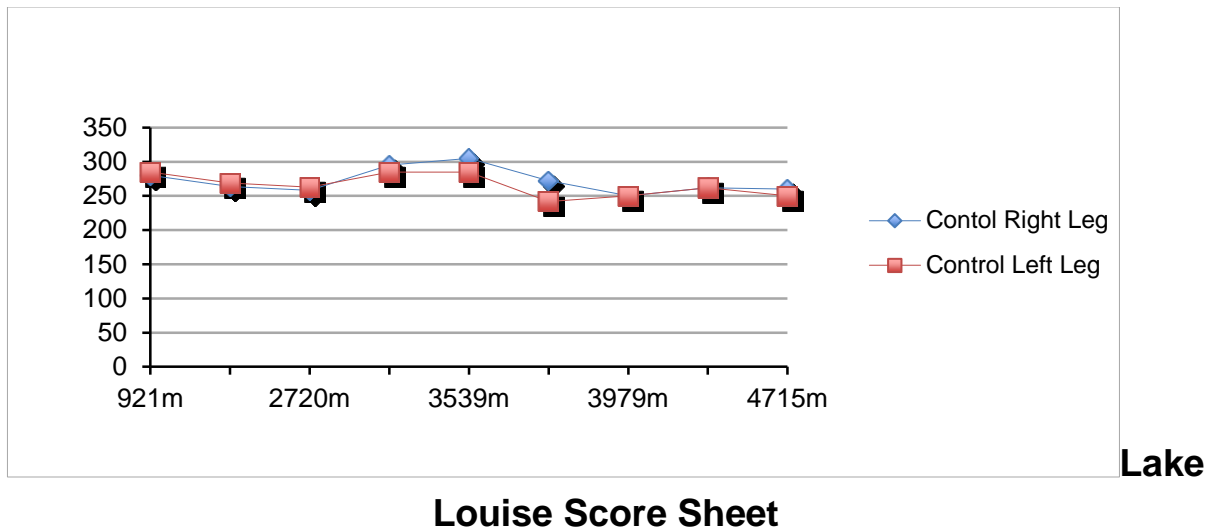
One of the latent/residual effects for the TBI patient is headaches (HA), which at least once a week leave TBI patient bedridden, with increased photophobia, dizziness, pain and vomiting. A common factor over the years reported by TBI patient was that he could tell when the barometric pressure dropped in the environment (ie. Onset of rain or storm). Pressure increase could actually be felt in his head. The pain is unilateral, never on the same side, and at a level of 7-9 on the pain scale. By using OPQRST (O-onset, P-provokes, Q-quality, R-radiating/region, S-severity 1-10, T-time) a daily log was kept for any headache pain. During the whole expedition the Control Patient never developed any severe HA symptoms. The TBI patient had a HA of varying degree during entire expedition. Below is the chart listing HA severity and notes based off of elevation. It is clear that the symptoms did change during the climb and that altitude/pressure did play a role. Notably, the most severe of headaches experienced by TBI patient on Expedition was at one of the lower altitudes but coincided with a very large storm in the rainforest region.

Elevation	Severity	Notes
921 m	4	Constant dull pain right side focal point
2720m	5/3	HA focal point was on rt side Temporal lobe and increased during climb, sharp pain, by following morning had subsided slightly
3539m	5/3	Focal point was at base of skull, sharp pain, by following morning subsided to throbbing dull pain in same area
3979m	5/5	HA increased 1hr into movement with increased photosensitivity, pain centered behind eyes with slight nausea, pain moved to left temporal lobe by morning
3979m	5/5	HA increased 1hr into movement with increased photosensitivity, pain centered behind eyes with slight nausea, pain moved to left temporal lobe by morning
4715m	3/4	HA slightly subsided once focus was put on controlling deep breathing but woke up in morning with increased pressure and pain
5681m	5/6	HA throbbing, focused on left side, increased photosensitivity with slight nausea. During climb, HA symptoms controlled by deep breathing
4714 m	5	HA subsided slightly during descent but maintained increased photosensitivity
3767m	4/3	When arrived at lower camp HA pain changed focus back to eyes. By morning had slight relief
2807 m	5	Increased pressure with storm front once we arrived to camp. Pain covered entire skull and had severe pressure with increased photosensitivity and nausea/dizziness

Star Excursion Balance Test

This was the standardized balance test used to check for increase or change in Vestibular Balance Disorder. The regions measured were anterior, posterior-lateral, posterior-medial, respectively on each leg, three attempts were made by each limb in each direction and measurements were taken only on ascent. Averages were taken and all measurements were added to get total centimeter of balanced travel. As the charts depicts, the TBI patient had a trend of decrease in scoring with increase of elevation past 2720 meters while the control did not show any shifts until 3539 meters. The TBI patient had a marked increase in ataxia as elevation increased, which could have contributed to lower scores. Ataxia is an indicator of High Altitude Cerebral Edema, combined with altered mental status in a patient at higher elevation. Increased Ataxia in a patient who exhibits Ataxia could also be used as an indicator, but the TBI patient never exhibited a change in mental status. Both patients are right hand dominant and is exhibited with higher scores on their dominant side.





In 1991, Hypoxia and Mountain Medicine Symposium at Lake Louise, Canada, experts reached a consensus for the diagnosis of Acute Mountain Sickness (AMS). The first criterion is high altitude signs and symptoms occurring in the setting of a recent gain in altitude of greater than 2500m. The second criterion is the presence of headache. The third criterion is the presence of at least one of the following symptoms: gastrointestinal tract symptoms, e.g. nausea, anorexia or vomiting; fatigue or weakness; dizziness or lightheadedness; and sleep difficulty. Patients fulfilling all three criteria can be considered to have AMS. With a baseline score of three, one is considered to have mild AMS. The TBI patient has a baseline score of 3-5 depending on headache and dizziness, so this presented a great challenge and an excellent opportunity to attempt to differentiate between AMS or residual TBI symptoms. The shift that occurred on the morning at elevation 3539 meters, focused more on sleep disturbances than the expected HA symptoms. The shift that occurred at arrival to camp at 3979meters was due to an increase in HA symptoms and the prior nights' sleep disturbances. The shift that occurred at 5681m (Gillman's pt) was due to an increase of HA. The increase of score at elevation 2807 is attributed to the headache. Differentiating between residual neurological symptoms and AMS symptoms remained difficult. Further testing and study will be needed to reach definitive conclusion.

ELEVATION	TBI PATIENT	CONTROL
921m	3	0
2720m	3	0
2720m	3	0
3539m	3	0
3539m	4	0
3979m	5	0
3979m	3	0
4715m	3	0
4715m	3	0
5681m	4	0
3767m	3	0
2807m	5	0
921m	3	0

Lake Louise data collection chart

Sleep Log

A daily sleep log was kept, which included number of hours, quality and number of wake ups. No significant change was noted during the number of hours that either patient received, as compared to their normal sleep. TBI patient was controlled with 5 mg Ambien and 50 mg Trazodone, while no medications were taken by control patient to regulate or control sleep. TBI patient reported frequently waking from sleep, which is the norm, but stated he was slightly out of breath. This may be due largely in part to the TBI patients' sleep apnea and not the elevation, as he noted it happened at lower elevations and did not increase during increase in elevation and change in atmospheric pressure.

ELEVATION	TBI PATIENT	CONTROL
921m	4 hrs	7 hrs
2720m	4 hrs	7 hrs
3539m	5 hrs	9 hrs
3979m	5 hrs	8 hrs
4715m	5 hrs	7 hrs
4715m	4 hrs	7 hrs
3767m	4 hrs	7 hrs
2807m	5 hrs	8 hrs

Sleep log data

Falls during the day

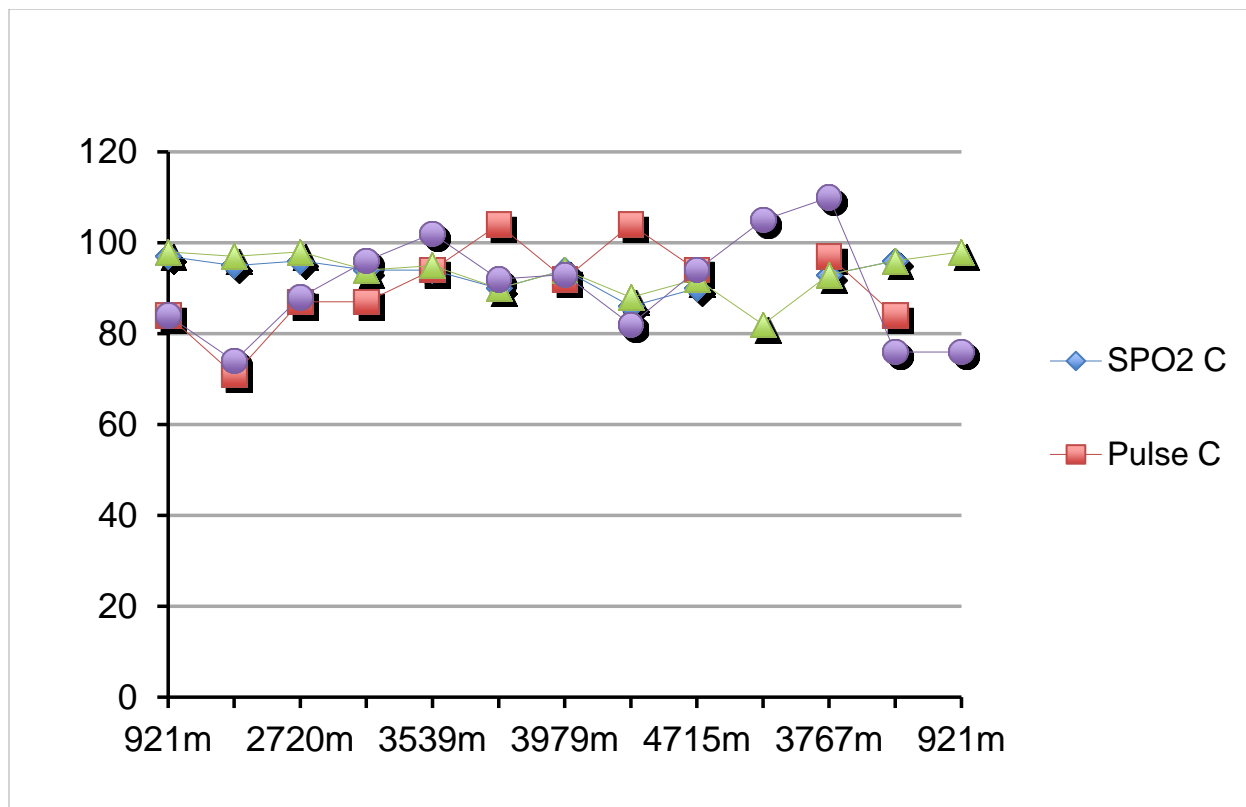
A running tally of falls were noted during the expedition. A fall was defined as the patient losing control of stability and actually falling off their feet. This included falls that were prevented by a team member, object or outside influence. A stumble was defined as the patient losing control of stability, but remaining on their feet. As defined before, a stumble did not include falls that were prevented by outside influence. The control patient did not experience one fall or stumble on the entire expedition, whereas the TBI patient experienced no less than two falls per day and had five on day three of expedition. The terrain on that day involved a more rocky environment. The TBI patient also experienced no less than 4-5 stumbles daily. What was clearly noted during the whole expedition was that the use of the trekking poles during the whole expedition did provide a broader base for the patient to stabilize and stay on his feet. As the expedition continued, the trekking poles also became more than just a stability aid, but since the patient did not wear his prescription prism eye glasses, which aid in his diplopia and strabismus, the poles were actually used to differentiate between which objects were real, versus the double vision version. Use of the trekking poles were imperative for TBI patient. Prior use or training with them would have enhanced their usefulness.

SPO2 and Pulse

Oxygen saturation and pulse were taken at every collection time. As noted in SPO2 and Pulse chart, there were no real significant differences between the TBI patient and the control patient. The TBI patient had been exposed to higher elevations prior to some of his TBIs and successfully acclimated to an elevation of approximately 4500 meters in the mountains surrounding La Paz, Bolivia, in 2003. It was unknown if his history of TBIs since then would affect his ability to do the same, especially since the most notable and significant TBIs occurred following his deployment to Bolivia. Notably, the TBI patients' Hyperbaric Oxygen Therapy was completed in October 2012. A study was conducted by the Department of Neurosurgery, Southwest Hospital of the third Military Medical University in Chongqing, P.R. of China titled "Hyperbaric oxygen preconditioning protects against traumatic brain injury at high altitude". They concluded that Hyperbaric Oxygen (HBO) preconditioning attenuates TBI in rats at high altitude. Decline in Matrix metalloproteinase-9 (MMP-9) expression may contribute to HBO preconditioning-induced protection of brain tissue against TBI.

At higher elevations, the environment which creates hypobaric hypoxia in the human body will stimulate the carotid body to produce a hyperventilation response. This response attempts to correct the hypoxemia, however, results in decrease in carbon dioxide saturation in the blood and respiratory alkalosis may occur. The cerebral blood flow and blood volume will rise. The permeability of the blood-brain barrier also increases, which in turn causes brain swelling to produce the signs and symptoms of AMS and High Altitude Cerebral Edema (HACE).

To understand how HBO preconditioning can possibly decrease the effects of AMS or HACE, one needs to understand what MMP-9 is responsible for in relation to the brain. Matrix metalloproteinase-9 (MMP-9) is one kind of zinc-dependent endopeptidases and is associated with blood-brain barrier opening and brain edema formation after TBI. Is it possible that the inhibition of MMP-9 can reduce the risks of AMS and HACE? If so, the argument can definitely be made that HBO preconditioning, which declines the expression of MMP-9, can reduce the risks of AMS and HACE, not just protect against TBI. While Hyperbaric Oxygen Therapy continues to be controversial, I believe this warrants more research and study.



Neurological/Cognitive testing

A program called “Brain Lab”, designed by Sixdead Entertainment, was downloaded onto a Kindle Fire prior to the expedition. The tests were conducted at every data collection point and produced quantifiable data that could be measured and compared. The data that was collected included evaluations of Memory, Logic, Calculation and Visual skills. Each of the tests were 60 seconds and self paced. With the TBI patient presenting with memory problems and diagnosed with a slight cognitive disorder, there was some expectation to have lower scores. As all of the score tables (Attachment 1) illustrate, a pretty constant score was maintained in three areas of observation. The only noticeable drop in score was recorded in the TBI patients' Logic Score once 3979 meters of elevation was reached. There were some shifts but these can be attributed to normal human errors, as the trend between both patients was very comparable. There were a few increases/changes in the control patients' score. When the patient was asked how he got such high scores, his response was “I got lucky”. It appeared that the control patient “learned” or “strategized” better than the TBI patient, but whether this was due to cognitive deficits or natural ability is difficult to analyze. Data would indicate that there were no significant cognitive affects based off of either the elevation or the atmospheric pressure.

Conclusions

This self-study provided the unique opportunity to collect data on myself with the aid of fellow expedition team mates, with the goal seeing what residual effects multiple Traumatic Brain Injuries have in high altitude. This expedition was not just to gather the data, but rather to demonstrate CWVC's motto "Vulneror Non-Vincor", Wounded But not Conquered. The risks involved with research of this kind are not to be taken lightly, but were well worth the outcomes. If we never faced risk, mankind would not be what it is today. The human race has evolved, developed and thrived because of those who have faced danger, those who have placed their own personal safety aside, those who were driven to discover the unknown- to think outside the box. Several conclusions and arguments can be made based off of the data that was collected. One thing cannot be argued, the need for further expeditions, the need for more real-world research. The possible benefits are limitless, not just to fellow Traumatic Brain Injury patients, but to mankind as a whole. The understanding of how the human brain works will never be fully complete, but any step towards better understanding of how an injured brain operates will only add to the vast knowledge that is out there waiting for us. I do not see myself as someone who suffers from Traumatic Brain Injury, but as someone who has had significant changes in how their mind and body works but will never back down or give up.

Resources

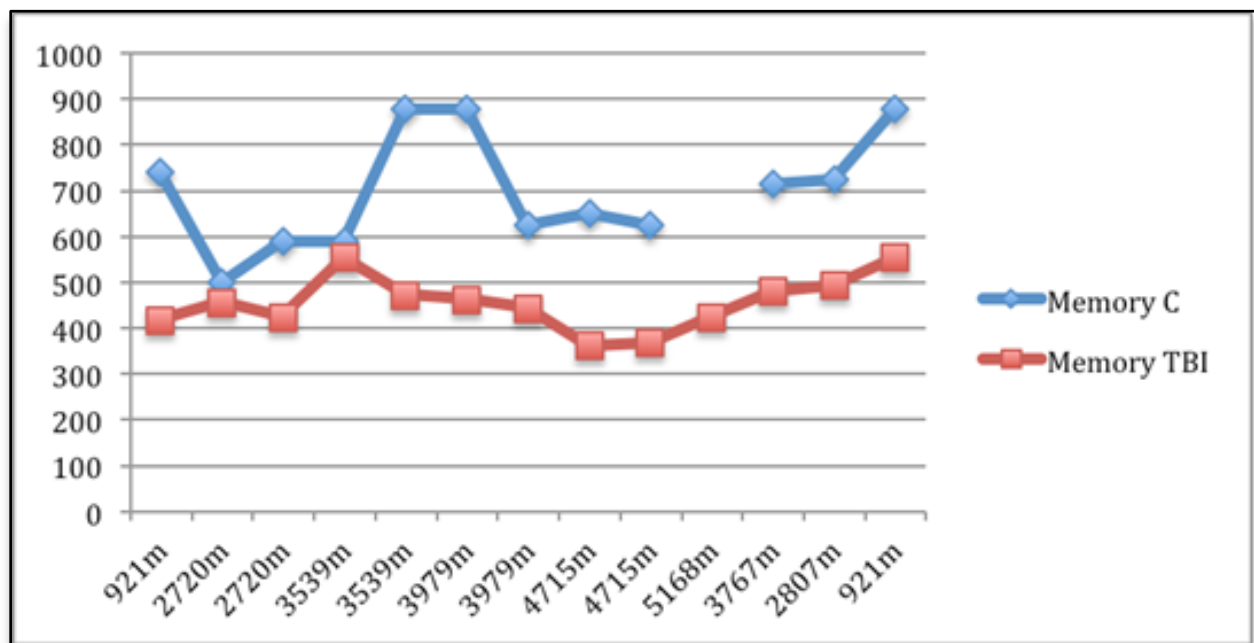
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Department of Neurosurgery, Southwest Hospital of the Third Military Medical University, Chongqing, P.R. China
- 4- Union Internationale Des Associations D' Alpinisme (www.theuiaa.org), Consensus Statement of the UIAA Medical Commission Vol 2. Emergency Field Management of Acute Mountain Sickness, High Altitude Pulmonary Oedema, and High Altitude Cerebral

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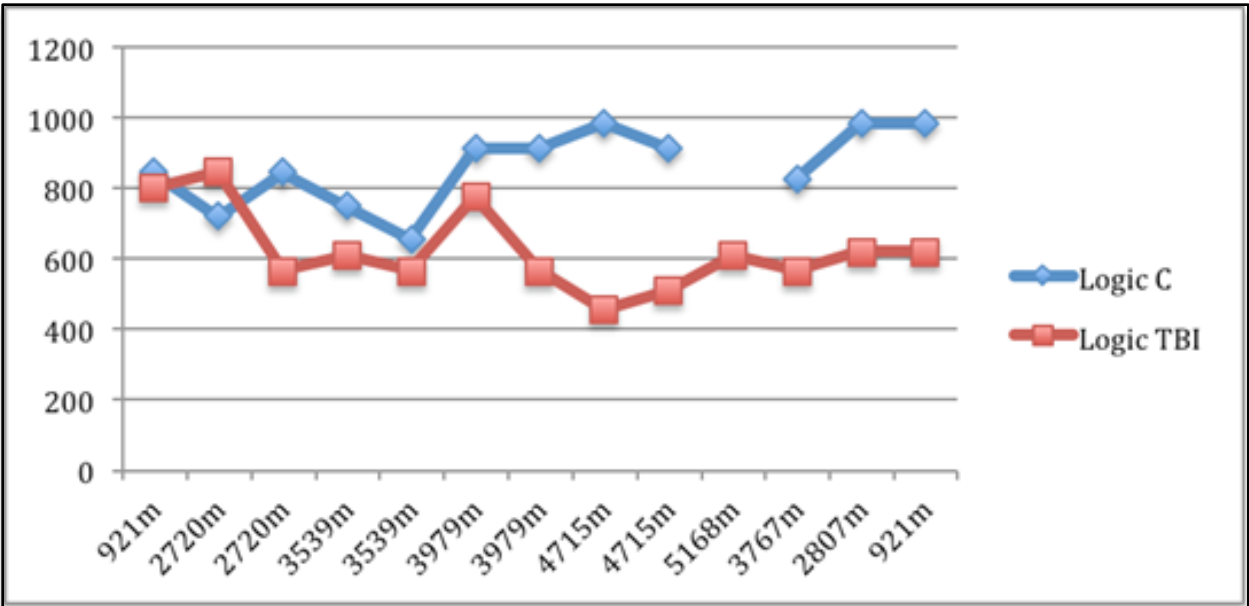
5- “High Altitude Medicine” Dr. Man-kam HO, Dr. Axel Yuet-chung SIU
Hong Kong Medical Diary, Vol 16, No. 6, June 2010

6- www.altitudemedicine.org/
Institute for High Altitude Medicine at Telluride

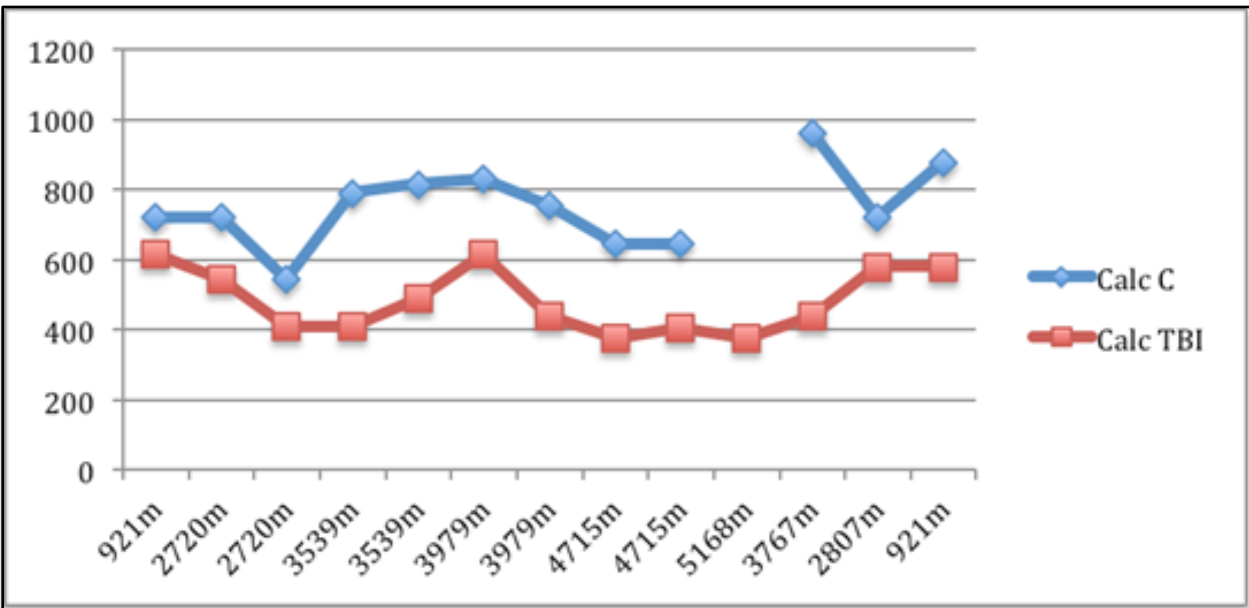
Attachment 1: Neurological/Cognitive testing tables



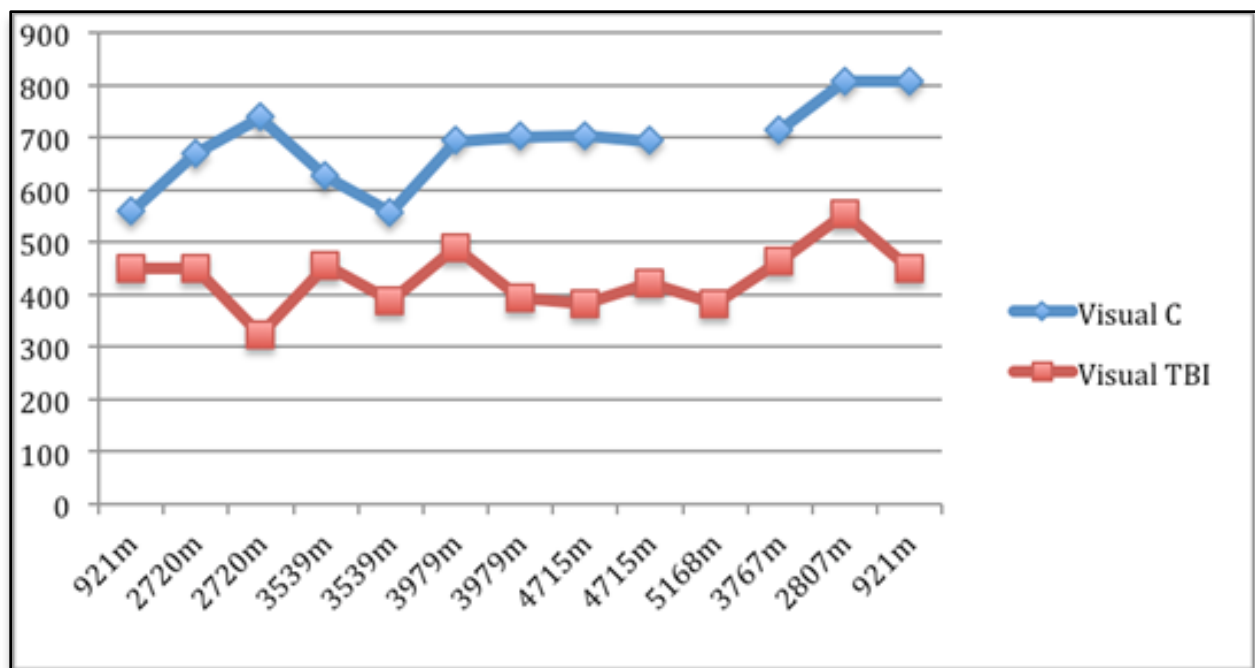
Memory Table



Logic Table



Calculations Table



Visual table

