Shimadzu Trinias Unity

Clinical Use of RSM DSA

Shimadzu’s Real-Time Smoothed Mask DSA (RSM DSA) is unique Advanced Digital Object Frequency Subtraction for Angiographic Interventional Procedures. RSM DSA provides outstanding vascular visualization with background anatomy information, NO MOTION ARTIFACT even with patient movement or panning the table top. It also automatically suppresses halation of the x-ray radiation during Peripheral Examinations. RSM DSA makes peripheral exams much easier and faster, requiring less radiation dose and contrast.

Description:
SCORE™ RSM DSA is Shimadzu’s unique technology developed to overcome motion artifact in DSA imaging.

In conventional DSA imaging, a mask image is created before the contrast injection and is subtracted from the LIVE image. Patient movement during conventional DSA acquisition causes misregistration between the two images and creates motion artifact.

SCORE™ RSM DSA does not require mask image. SCORE™ RSM DSA effectively picks up the vessel image by subtracting the background object such as bone which is created by frequency processing the contrast image in real time. The SCORE™ RSM DSA image is visualized clearly during patients’ movement and breathing because the core image processing is done during the acquisition of the contrast image.

Clinical Usage:
SCORE™ RSM DSA is most commonly used in visceral, pelvic and peripheral vascular imaging.

Kalispell Regional Medical Center
310 Sunnyview Lane
Kalispell, MT 59901

Kalispell Regional Healthcare is a nonprofit, 341-bed health system located in the iconic Flathead Valley of northwest Montana and serves a population of nearly 200,000 in a service area covering more than 20,000 square miles.

The health system consists of three hospitals, nearly 40 provider clinics and a host of other health care services, including the nation’s first rural air ambulance service (A.L.E.R.T.), which it has maintained for more than 40 years. Founded in 1910, the organization has provided exceptional care for more than 100 years to the communities it serves. Throughout its history, Kalispell Regional Healthcare has continued to grow and evolve with the growth and changing needs of the community.

Nearly 5,000 physicians, nurses, health care professionals and support staff work together to provide patients and their families with a positive, proactive, patient-centered experience. Kalispell Regional Healthcare is regionally known for its programs in cardiovascular care, oncology, neuroscience and spine care, orthopedics, women’s health, pediatrics and behavioral health.
Visceral arterial imaging such as imaging of the celiac arteries (including splenic, gastric, and hepatic arteries), superior & inferior mesenteric arteries, and renal arteries sometimes suffer from breathing motion and blurring the details of the vascular subtractions. Similarly, pelvic arterial imaging can suffer from the same effects of motion artifact.

Peripheral vascular imaging of the legs often suffers from a different type of patient movement. Injections to visualize the vessels of the legs are frequently done as a bolus injection to fill both legs with contrast. Disease process in the legs frequently causes pain the patient and the result is leg movement and misregistration of the subtracted image.

**Clinical Benefits:**
A busy interventional radiology lab like KRMC Interventional Radiology, has a diverse patient population, procedure mix, and imaging needs. KRMC performs a large number of vascular angiography procedures which include liver directed therapies (Yitrium 90, and chemoembolization), peripheral vascular interventions and fistulography. The balance between cutting edge imaging capabilities and radiation dose reduction are crucial, and often are in conflict with each other. The introduction of the Shimadzu SCORE™ RSM DSA has changed the fundamental method of acquiring images, while finding ways to save staff and patients from unnecessary radiation exposure.

Historically, DSA imaging is used for detailed diagnostic vascular imaging but it requires a very cooperative patient, acquisition of a mask image, and long exposure times. DSA imaging only works properly if the patient can maintain a lengthy breath hold and be motionless through the entire mask/acquisition sequence. Shimadzu’s SCORE™ RSM DSA is acquired without subtracting the background with a mask image. Imaging is performed without the need for a mask or with the patient movement restrictions. SCORE™ RSM DSA has vastly improved the ability to get high quality diagnostic imaging, especially body imaging where breathing and bowel peristalsis are major contributors to motion artifact.

In addition, the operator can pan the table in a manual bolus chase without mis-registering the mask during procedures such as peripheral vascular angiography and fistulography. The result is significantly reduced radiation dose because images can be acquired with one bolus chase acquisition and are not affected by patient motion from pain or involuntary movement that often requires repeat imaging.

Routinely, in standard DSA imaging, after obtaining the DSA images, bony landmarks are added back to the image during post processing when reference points are needed. SCORE™ RSM DSA does not fully
subtract bony landmarks and the core image processing is done during the acquisition of the contrast image.

SCORE™ RSM DSA mixed with the Precession function improves diagnostic ability with reduced radiation exposure. Precession moves the tube in a circular motion around the anatomical iso-center and has been proven to be helpful when performing Uterine Fibroid Embolizations and AV fistulagrams. In AV fistulagrams, the RSM DSA Precession sequence is a great tool to visualize the arterial-venous anastomosis in one acquisition. In a typical DSA acquisition for anastomotic imaging, it may take multiple contrast injections and acquisitions before a proper anatomical profile is achieved. With RSM DSA and Precession together, you can practically fly between all obliquities in one acquisition resulting less ionizing radiation exposure and contrast dose.

Some types of procedures are more susceptible to movement or need better delineation of the vasculature. Specific examinations that can benefit from using RSM DSA are:

- Peripheral vascular angiography/intervention of the abdomen
- Fistulography/angioplasty
- Transarterial hepatic chemoembolization (TACE)/radioembolization
- Uterine Fibroid Embolization (UFE)
- Prostate Artery Embolization (PAE)
- Bronchial Artery Embolization (BAE)
- Complex Arteriovenous Malformations (AVM)
- And Complex Arteriovenous Fistula Embolization (AVF)

**Case Study #1 Pelvic Angio**

**Case Description:**
59 y/o male with bilateral iliac artery disease
Left iliac stent placed Improved in-flow and distal run-off
Procedure Results:
On iliac stenting cases, bowel peristalsis will affect image quality if you are using DSA. With RSM, you are not affected by peristalsis and can more precisely deploy stents. This is especially true in the high common iliac arteries.

Case Study #2 Fistulagrams

Case Description:
60 y/o Female Fistula stenosis and venous steal embolization. Improved Flow volumes into the 800 ml/min

Procedure Results:
The vein is transposed to the artery, so it requires complex angles to see the anastomosis in profile. To clearly visualize the anastomosis without performing multiple different projections, RSM DSA is used in combination with the Shimadzu precession function. The outcome is the patient is delivered less contrast and less ionizing radiation with a higher quality image.

Case Study #3 Cholangiogram

Case Description:
56 y/o Female with Cholangiocarcinoma needing internalized stent for ductal obstruction. Multiple projections obtained from Precession movement enables us to see stenosis from multiple angles with just one exposure.
Procedure Results:
Cholangiograms are often performed as a dynamic flow diagnosis, that requires visualizing the contrast flow through the biliary ducts while evaluating the speed of the flow. Flow speed provides as much diagnostic value as the static image. The liver is located directly under the diaphragm so breathing motion is always an issue. With RSM DSA, you can obtain a sustained, dynamic image of dynamic contrast flow with no concern about motion artifact.

Case Study #4 Uterine Fibroid Embolization

Case Description:
43 y/o female with Uterine Fibroids, desire to maintain fertility, symptomatic fibroid. Procedure performed to embolize fibroid to shrink benign fibroid tumor

Procedure Results:
Evaluation of the uterine artery is often difficult with conventional DSA due to various branching patterns of its origin, superimposed multiple vessels and motion artifact of the bowel gas. With RSM DSA, uterine artery origins are feasibly identified. It was noted that the patient had variant anatomy. The arterial flow to one of the ovaries was being fed from a 3rd order uterine artery. Placing embo-spheres into the ovary would have resulted in ischemic demise of the ovary. RSM DSA on this case most certainly prevented non-target embolization of the ovary.

Conclusions:
SCORE ™ RSM DSA is a unique imaging solution for peripheral vascular, visceral, and pelvic arterial imaging. The partially subtracted image defeats motion artifact by providing detailed
imaging in areas where the patient motion from breathing, peristalsis or body movement interferes with the ability to diagnose the patient.

In addition, movement of the imaging system is possible for unique projectional views of the anatomy that are difficult to visualize due to their anatomical position or overlaying vessels.

The clinical benefits are clear from the case studies presented. In most examinations, a single acquisition with multiple views provides visualization to anatomy that would typically require multiple injections and views to visualize otherwise. Thus, reducing the volume of contrast agent and dose to the patient. Furthermore, time savings in minimally invasive procedures has historically shown to reduce risk and complications to the patient.

SCORE™ RSM DSA in pace of traditional DSA imaging for multiple exams, helps to solve the everyday imaging problem created by motion. When used in conjunction with specialized c-arm movements, new techniques in imaging are created that were never possible with traditional DSA.
JASON KALE BARRETT B.S. RRA (ARRT), RPA/RA (CBRPA)
Kalispell, MT

Radiologist Assistant performing minor invasive procedures for an urban Radiology group.

Education:
Weber State University    Bachelors of Science (RPA,RRA); Thesis –
Uterine Fibroid Embolization vs. Myomectomy
University of Arkansas for Medical Sciences Associates of Radiologic Science
University of Kansas    Major in Biology and Minor in Chemistry

Professional Experience
Past President of the SRPE
One of the architects of the RA Medicare Access to Radiology Care Act of 2012
Proposed "Alternative Payment Models" for radiologist assistants to the Centers for Innovations (CMS)

Accolades
2015 Weber State University Recipient of Leadership in Professional Involvement 2015 SRPE Care Award - Awarded by the SRPE Board of Directors
Society of Radiology Physician Extenders President - 3 terms
Representative Member of Intersocietal Committee on Radiologist Assistants
Lead SRPE Legislative Envoy to ASRT, ARRT, ACR
2016 Radiologist Assistant Alternate Delegate to ASRT
Mallinckrodt Award of Clinical Excellence Founder and President of Massachusetts Society of Radiology Physician Extenders, MSRPE, Inc.
Partners Healthcare RPA/RRA committee
BENJAMIN J. POMERANTZ, M.D.
Northwest Imaging, PO Box 9110, Kalispell, MT

Education:
Colorado College-1986-1990; Colorado Springs, Colorado; Bachelor of Arts, Biology
Dartmouth Medical School-7/1/1991-6/30/1995; Hanover, New Hampshire; Doctor of Medicine

Professional Experience:
Northwest Imaging, PC 10/2/2010 - present PO Box 9110 Kalispell, MT 59904 Serving 9 hospitals in Northwest Montana
Assistant Radiologist 12/1/2008-10/1/2010 - Massachusetts General Hospital, Abdominal Imaging and Intervention, Vascular Imaging and Intervention
Instructor Harvard Medical School 12/1/2008-10/1/2010
Clinical Instructor 7/1/2004-6/30/2008 Massachusetts General Hospital 
Harvard Medical School
Instructor, Department of Medicine 7/1/2001-6/30/2002 Division of infectious Diseases University of Colorado Health Sciences Center

Professional Licensure: American Board of Radiology, 6/3/2008
State Medical Licenses: Massachusetts

Postgraduate Medical Training:
Interventional Radiology Clinical and Research Fellow 7/1/2008-11/30/2008 Massachusetts General Hospital, Harvard Medical School Department of Radiology, Interventional Radiology, Boston, MA

Resident, Department of Radiology 7/1/2004-6/30/2008 Massachusetts General Hospital, Harvard Medical School, Boston, MA

NIH Research Fellow 7/1/2002-6/30/2004 Washington University in St Louis Department of Surgery, Division of Cardiothoracic Surgery, St Louis, MO

Post-Doctoral Fellow 7/1/2000-6/30/2001 University of Colorado Health Sciences Center Department of Medicine, Division of Infectious Diseases, Denver, CO

Research Fellow 7/1/1998-6/30/2000 University of Colorado Health Sciences Center Department of Surgery Denver, CO

Resident, General Surgery 7/1/1995-6/30/1998 University of Colorado Health Sciences Center Denver, CO

Publications:

Works in Press:

Workers in revision/submitted/in progress:

Published Abstracts:
- Pomerantz, BJ, Reznikov, LL, Harken, AH, Dinarello, CA. Direct effect of proinflammatory cytokines on human myocardial contractile function is ICE dependent and is mediated by NO. J Leuk Biol Supplement 2001; 333

Patents:
- “Isolomers of eIF-5A: Senescence-induced eIF5A; Wounding-inducing eIF-5A; Growth eIF-5A; and DHS” – China and New Zealand.
- “The use of IL-18 inhibitors in the treatment of ischemic heart disease” - U.S.A., European Union and Israel
- “Histone deacetylase enzyme-inhibiting derivatives of hydroxamic acid as a new cytokine synthesis-inhibiting anti-inflammatory drug” – Israel and South Africa.

Professional Societies:
- Cardiovascular and Interventional Radiological Society of North America, 2008-Present
- Radiological Society of North America, 2004-Present
- American Medical Association, 2004-Present.
- Massachusetts Medical Society, 2004-Present
MASASHIRO HORIKAWA, M.D. Instructor
Interventional Radiology/Interventional Neuroradiology, Charles T. Dotter Department of Interventional Radiology, OHSU
Instructor, Interventional Radiology and Interventional Neuroradiology, Charles T. Dotter Department of Interventional Radiology, Oregon Health and Science University

Education:
2002-2006 M.D. – National Defense Medical College, Tokorozawa, Japan
2000-2002 Premedical, National Defense Medical College, Tokorozawa, Japan

Professional Experience:
2013-2014.7 Research Fellow, Dotter Interventional Institute, OHSU, USA
2012.8-2013.9 Student Instructor, National Defense Medical College, Japan
2010.8-2012.7 Radiology Senior Resident and Interventional Radiology Fellow, National Defense Medical College, Tokorozawa, Japan

Professional Membership:
2015-present Member of Japanese Society of Interventional Radiology
2013-present Member of Cardiovascular and Interventional Radiological Society of Europe
2012-present Member of Society of Interventional Radiology
2014-present Member of Radiological Society of North America
2015-present Healthcare MBA, Oregon Health and Science University & Portland State University (Expected graduation in 6/2019)

Certification:
2011.11 EFIMG certificate

Board Certification:
2017-present Enrollment for Alternative Pathway of JR/OR dual certificate, American Board of Radiology (Expected Board Eligibility in 06/2019)

Research:
2015.9  Cum Laude, Annual Meeting of Cardiovascular and Interventional Radiological Society of Europe 2015, Kentaro Yamada, Masayoshi Yamamoto, Masahiro Horikawa, Hiroshi Shimimoto and Tatsumi Kaji. BRT0 for Gastric Varices with Foam Sclerosant Changed Our Procedure

Work Experience
2015.9 Poster award, Annual Meeting of Society of Interventional Radiology 2015; Masahiro Horikawa, Kosuke Miya, Masaki Ishikawa, Barry Uchida, and John A Kaufman. BRT0 for Gastric Varices—Advanced Techniques and Ideas in Depth to Overcome Anatomical Difficulty and Absence of Required Devices


Bibliography: Peer-Reviewed Articles

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