# Spatially Different Temporal Filtering with X-Ray Attenuator: A Novel Technique of Dose Reduction in Neuro-endovascular Interventions

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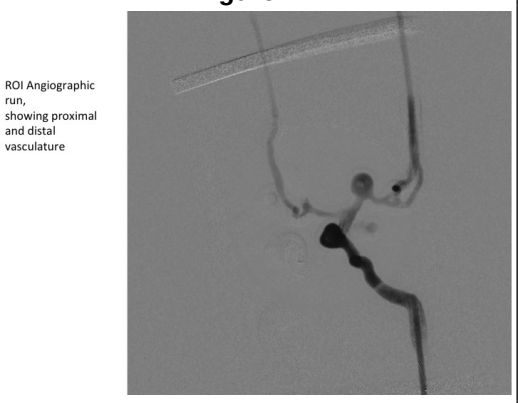
## Introduction

Dose reduction during fluoroscopy is of paramount importance. Our center(Ref1,2) has developed a novel patient-dose-savings technique for image-guided neurovascular interventions, involving a combination of a material x-ray region-of-interest(ROI) attenuator and spatially different temporal filtering. Our technique gives real time full field-of-view as against some previous techniques of restricted view (spot-fluoroscopy). We present our comparative clinical experience with standard flat panel angiography(FPA) and our technique (ROI-FPA).

**Figure 1A**




ROI Angiographic run, showing proximal and distal vasculature

## Methods

Patient data (under IRB approval) from 10 patients(4-MCA-aneurysm, 5-ACA and 1-cavernous-ICA-aneurysms) were acquired using rotational-DSA and CTA for 3D rendering and processing. 3D-models were generated using an Eden-260V-3D-printer(Object-Stratasys) .We performed primary-coiling on the models(Figure-1) using a Toshiba Infinix C-arm. The dose incident to the patient is reduced by using a 0.7mm thick copper attenuator with a circular ROI hole in the middle. The attenuator is mounted inside the x-ray tube mechanism and can be deployed automatically when needed. Each 3D printed model was treated twice, using ROI-FPA and standard FPA. A total of 80 images at varied stages of intervention weres acquired. Each image was shown twice to two neurointerventionist and the images were rated individually. A total of answers to 400 questions based on visibility of aneurysm, proximaland distal vasculature, microwire, coil and guide tip were scored. The intra-rater agreements are measured by Kendall's-tau-b correlation coefficient and the inter-rater agreements are measured by kappa-statistics.

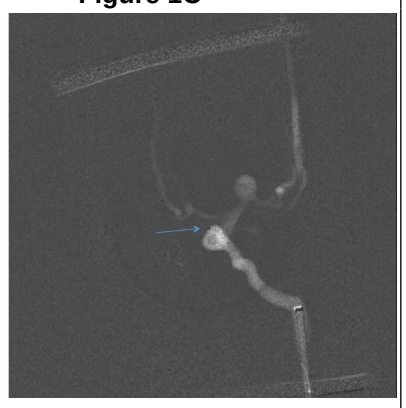
## Results

For the thickness and size of the ROI attenuator used, a total integral-dose reduction of 62% was achieved. The mean scores obtained in the images when ROI was applied did not differ significantly from standard FPA images, suggesting similar image quality. The intra-rater agreement varied from (kendall tau 0.14 to 1) and inter-rater (kappa 0.16 to 0.52).

**Figure 1B**


ROI Roadmap: microwire and proximal guide

**Figure 1C**




ROI Roadmap: Microcathter and guide

## Learning Objectives

1. 62% reduction in radiation dosage could be achieved by our novel technique.

2. Image quality at both the center and periphery of FPA panel is not compromised.

**Figure 1D:**


ROI Roadmap with coils

## Conclusions

Our study has shown that a significant dose reduction could be achieved without compromising the image quality during neuroendovascular interventions.

References:

1. Swetadri Vasan SN, Ionita C, Bednarek DR, Rudin S. A novel Region of Interest (ROI) imaging technique for biplane imaging in interventional suites: high-resolution small field-of-view imaging in the frontal plane and dose-reduced, large field-of-view standard-resolution imaging in the lateral plane. Proc - Soc Photo-Opt Instrum Eng. 2014 Mar 19;9033:90332F.

2. Vasan S. S, Panse A, Jain A, Sharma P, Ionita CN, Titus AH, et al. Dose Reduction Technique Using a Combination of a Region of Interest (ROI) Material X-Ray Attenuator and Spatially Different Temporal Filtering for Fluoroscopic Interventions. Proc SPIE. 2012 Feb 23;8313:831357