Efficient Cardiac MR Gating with Silicon ECG Holder

Nanda Deepa Thimmappa[1], Mitchell A Cooper[1], Silvina P Dutruel[1], Keigo Kawaji[1], Thanh D Nguyen[1], and Jonathan W Weinsaft[1,2]
[1]*Radiology, Weill Cornell Medical College, New York, NY, United States,* [2]*Cardiology, Weill Cornell Medical College, New York, NY, United States*

BACKGROUND: MRA frequently requires synchronization with cardiac contraction using disposable adhesive silver plated carbon leads applied to the anterior chest. However, in patients with hairy chest, shaving may be necessary. Post-operative patients may require adjustment of lead positions to avoid contact with healing surgical incisions. Female technologists and extra privacy may be necessary when applying leads on the female patients. Technologists may be reluctant to utilize ECG gating with MRI to avoid slowing down the schedule except when gating is absolutely necessary.

EVALUATION: A silicon positioner holding up to 4 ECG leads was developed to allow detection of ECG signals from the back without requiring shaving, adhesive or even removal of the gown. The patient lies down on the device such that the patient's weight ensures good contact of the leads against the gown and electrode Gel diffusing through the gown provides electrical contact with the skin (Figure 1). Leads were tested at 1.5 T (GE Signa EXCITE) using axial double IR, FIESTA, fgret perfusion, delayed IR in 12 subjects (Females: 5), mean age: 41 years (27-81yrs) were evaluated with both traditional disposable leads and this reusable ECG pad. Comparison of electrical signals and time for set up was recorded. Qualitative image analysis was performed independently by two radiologists, blinded to the type of gating used on a 4-point scale with consideration to the motion artifacts as follows: Absent=4, Mild but interpretable=3, Present but obscuring some anatomical structures=2, Uninterruptable =1. The ECG signals obtained from pad and leads were analyzed for 'qrs' image quality and rhythm. The Signals were rated as perfect, good, moderate, poor and non-diagnostic.

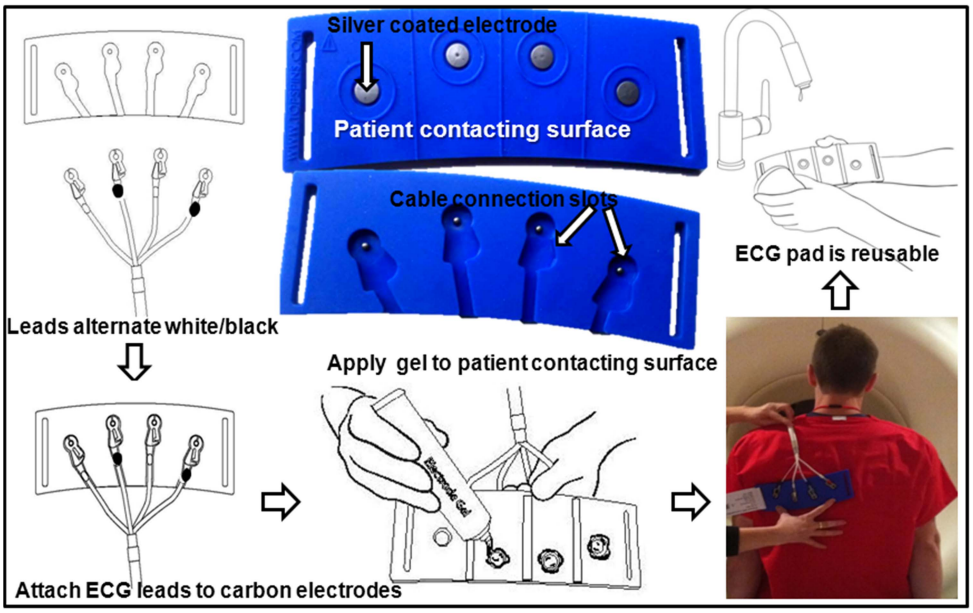

Figure 1. Design and application of ECG Pad

Figure 2. Electrical signals obtained with pad placed on the on the back.

	Set-up time (min.sec)	Scan time	Room exit time	Set up + Room exit time
ECG Holder/Pad	3.38	8.53	1.17	4.56
Standard ECG Leads	5.25	10.05	2.00	7.24
	p=0.0074		p=0.0026	p=0.0048

Table 1

RESULTS: The total set up time (initial set up before the scan and time to take off the leads after scanning) was 7:24 minutes with the leads compared to 4:56 minutes with the pad with a mean difference of 2: 28 minutes (31%, p=0.005). There are no significant differences in the scan times. The ECG signal quality and image quality was comparable for the two techniques (Figure 2). Volunteers Preferred the ECG pad, finding it to be comfortable and convenient.

DISCUSSION/ CONCLUSION: This simplified approach to ECG gating is more convenient and comfortable for the patients without sacrificing ECG signal quality. Robust and comfortable ECG gating with this reusable silicon lead holder has the potential to improve cardiac gated MRI by eliminating uncomfortable disposable adhesive ECG leads.