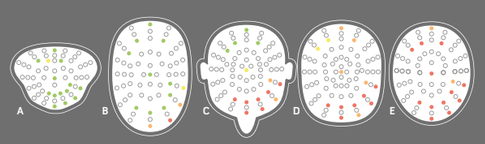
EVALUATION OF A NOVEL THYROID COLLAR DESIGNED TO REDUCE HEAD AND NECK RADIATION EXPOSURE DURING X-RAY GUIDED INTERVENTIONS

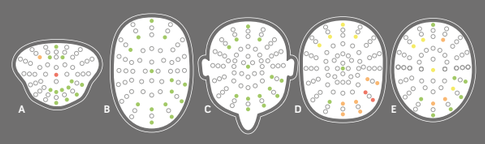
	A	B	C	D	E
1.1	0.97	0.15	0.06	0.06	0.10
2.1	0.97	0.07	0	0.11	0.03
3.1	0.88	0.17	0.11	0.05	0.09
4.1	0.80	0.32	0.04	0.09	0.03
9.1	0.58	0.72	0.66	0.19	0.25
1.3	0.96	0.50	0.10	0	0.07
2.3	0.93	0.44	0	0.04	0
3.3	0.80	0.63	0.09	0.04	0.08
4.3	0.80	0.86	0.15	0.11	0.11
8.3	0.59	0.85	0.70	0.29	0
10.3	0.38	0.82	0.64	0.43	0
11.3	0.70	0.87	0.73	0.31	0
16.3	0.91	0.73	0.01	0.01	0
M2	0.71	0.92	0.48	0.21	0



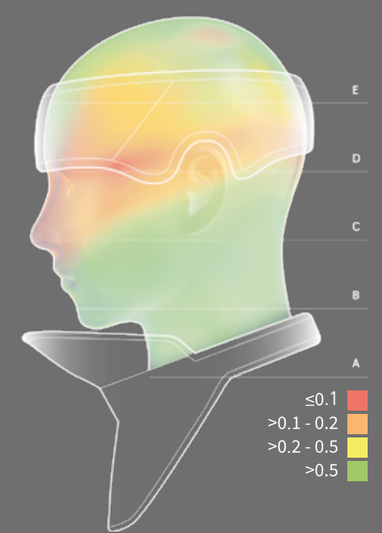
Schematic illustration of the reduction ratios for a standard thyroid collar in phantom slices A, B, C, D, E for the investigated exposure situation.

The tables show the reduction ratios for MindPeace™ and HeadPeace, sep - arately measured in phantom slices (A, B, C, D, E) and (D, E) respectively, for the investigated exposure situation. The tables for HeadPeace showed no shielding effect in the lower slices, data not shown.

	MindPeace					HeadPeace	
	A	B	C	D	E	D	E
1.1	0.97	0.95	0.84	0.17	0.05	0	0.90
2.1	0.97	0.94	0.73	0.19	0.12	0	0.90
3.1	0.90	0.94	0.51	0.08	0.25	0	0.90
4.1	0.86	0.95	0.46	0.15	0.12	0.10	0.90
9.1	0.62	0.83	0.55	0.32	0.58	0	0.10
1.3	0.95	0.96	0.84	0.20	0.22	0	0.20
2.3	0.89	0.87	0.81	0.18	0.17	0	0.20
3.3	0.84	0.96	0.75	0.08	0.17	0	0.40
4.3	0.83	0.94	0.75	0.24	0.23	0	0.50
8.3	0.59	0.82	0.69	0.46	0.23	0	0.20
10.3	0.56	0.80	0.69	0.38	0.32	0.20	0.10
11.3	0.21	0.94	0.76	0.48	0.37	0	0.40
16.3	0.91	0.92	0.78	0.54	0.20	0	0.70
M2	0.03	0.94	0.86	0.53	0.35	0	0



Schematic illustration of the expected result if MindPeace and HeadPeace reduction ratios were combined for the different phantom measurements in slices A, B, C, D and E.



Background: In clinical interventions, medical practitioners are sub jected to relatively high X-ray exposure. Radiation protection equip ment is sometimes difficult to use, resulting in potentially high brain doses. According to ICRP Publication 103, radiation-induced cancer sensitivity of the brain is low. However, ICRP Publication 118 high- lights the need to increase awareness among medical practitioners that the threshold level for circulatory diseases might be as low as 0.5Gy for the brain. In this study, the novel shields HeadPeace™ and MindPeace™ were evaluated for potentially reducing radiation exposure to the neck and head.

Methods: An anthropomorphic phantom (Rando Alderson, CA, USA) dressed in a lead apron of 0.5 mm lead equivalence was exposed to scattered radiation to simulate a clinical situation, where the medical practitioner is exposed from beneath and left. Thermoluminescent dosimeters (TLDs) were positioned at different depths in five different slices (A, B, C, D and E) in the phantom, measuring dose equivalent. Two different measuring set up situations using two different shields, HeadPeace and MindPeace (patent pending, Texray AB, Sweden of 0.25 mm and 0.5 lead equivalence respectively were evaluated. HeadPeace is a head protector, designed to reduce radiation in the upper section of the head. MindPeace is a thyroid collar extended in the front and on both sides. A standard thyroid collar and a ceiling-mounted lead glass shield of 0.5 mm lead equivalence respectively were used as comparisons.

Results: Preliminary TLD data showed that MindPeace reduce radiation exposure in the throat, chin and ear slices (A, B, C). Some shielding effect using MindPeace was also seen in the brain and skull slices (D, E). For the thyroid collar a reduction was only seen in the throat slice (A) and partly in the chin slice (B). HeadPeace showed a shielding effect in the skull slice (E) up to 2 cm depth where HeadPeace covered the phantom head. As expected, the ceiling-mounted lead glass shield reduced the dose equivalent in all measuring points throughout the phantom head. In slice A there is a shielding effect of the lead apron which influence the radiation ratio.

Conclusions: The most effective radiation protection for the head is a ceiling-mounted lead glass shield, when properly positioned. HeadPeace alone (without a lead shield) often does not provide sufficient protection in clinical situations. The combination of HeadPeace MindPeace and lead glass shield seems to provide comprehensive radiation protection for the head and neck, however, further studies are needed.

Take Home Message: For optimal radiation protection of the head, radiation protection devices that protect the entire interventionist's head against scattered radiation should be used, such as ceiling-mounted lead glass shields.

In clinical practice, optimal positioning of a ceiling mounted lead shield may not always be possible. Moreover, operators, particularly during complex cases when radiation protection may be most relevant, do not ensure optimal placement. Add- ed protection using these novel guards may compliment the effect of the lead shield.

Similar to the use of ceiling-mounted lead glass shield, the in- vestigated radiation protection devices will have most benefit in cases of heavier radiation exposure, such as X-ray guided interventions.

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