



BHPA-symposium 2022

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Joint ABRBVS - BHPA session

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Friday 29/04/2022 13h30-15h50

Room 11 - 22

Integrity of personal radiation protective equipment (PRPE): a 4-year longitudinal follow-up study

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ABSTRACT – PRPE are prone to artefacts, resulting in a reduced protection. A systematic quality control of PRPE, revealed that up to 50% of PRPE showed tears and cracks. The latter resulted in 31% rejections. Newly purchased PRPE are not guaranteed to remain free of cracks and tears in the first year of use. This study emphasizes the necessity of regular X-ray based integrity analysis of PRPE to ensure adequate radioprotection of staff using ionizing radiation.

KEY WORDS – Personal radiation protective equipment / Radioprotection /

Introduction

Personal radiation protective equipment (PRPE) such as lead aprons, vests, skirts and thyroid shields minimize radiation exposure of operators using X-ray systems. However, PRPE might be prone to cracks and tears in the attenuating layer of the garments which results in inadequate radiation protection and increased operator dose. This study aims to investigate the prevalence, qualification and quantification of PRPE integrity during a longitudinal follow-up.

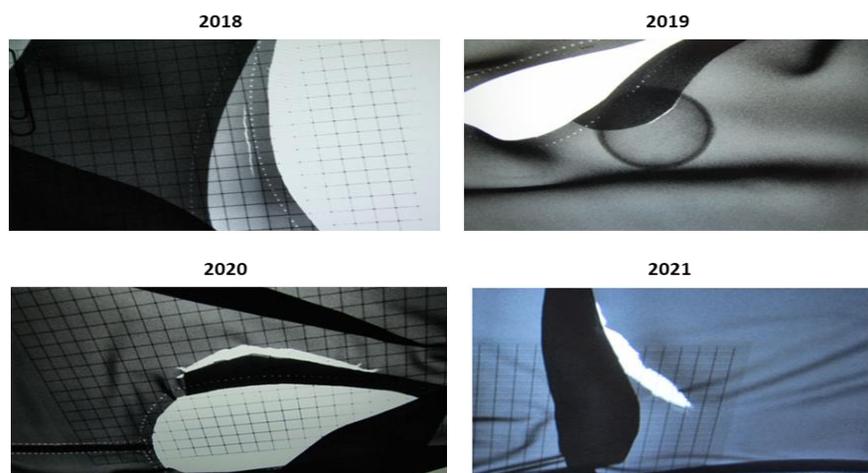
Materials and methods

All PRPE of a large, general hospital was yearly evaluated in the period 2018-2021. The equipment was inspected on a tele-operated X-ray table and cracks and tears were qualified and quantified using an X-ray opaque ruler. Rejection criteria of Lambert & McKeon were applied to accept or reject further use of the PRPE^{1,2}. In brief, all pieces, except for thyroid shields, with a total defect area larger than 670mm² are rejected. Individual tears were subject to an extra rejection criterion of 15mm². For thyroid shields, the rejection criterion is set to 11mm².

Results

In the 4-year follow-up period, a total of 1011 PRPE were evaluated. In total, 47.3% of PRPE showed tears of which 31% exceeded the rejection criteria. More specifically, in 2018, 2019, 2020 and 2021, respectively, 17.6%, 17.3%, 22.3% and 17.3% were rejected. Remarkably, of 287 newly registered PRPE, 7.0% showed tears in the first year of use of which 88.2% needed to be rejected. Brands that allowed repair are systematically higher in rejection rate compared to non-repairable brands. The 4-year average rejection rate of repairable brands versus non-repairable is respectively 24.5% versus 5%. Of the 766 controls performed on repairable pieces, 31.7% led to repairs at least once. Repairation was confirmed the consecutive year by the health and safety department and each repaired piece was labeled with a repair note. Almost 50% (48.1%) of pieces that were at least repaired once, were again rejected the consecutive year.

Figure 1: Tear evolution in a lead-free vest. The piece was sent to the manufacturer for repair each year



Conclusion

Despite the hospital's remedial measures, the necessity of quality assurance of PRPE remains crucial to provide adequate PRPE integrity. New garments are not guaranteed to remain free of cracks in their first year of use. Repair is not a long-term solution to safeguard PRPE integrity.

References

- [1] Lambert K, McKeon T. Inspection of lead aprons: Criteria for rejection. *Health Physics*. 2001;80(5 SUPPL.):S67-S9.
- [2] Stam W, Pillay M. Inspection of lead aprons: A practical rejection model. *Health Physics*. 2008;95(2):S133-S6.