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Lead X-Ray Vests: Pros and Cons in Dental Radiography and Patient Education on Radiographic Technology

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Abstract:

Problem: There is a greater need to emphasize and educate patients and providers about radiologic advancements and patient exposure. The tradition of placing lead x-ray vests on patients for all radiographs is no longer a necessity. Without the explanation of why lead aprons are no longer needed, unnecessary steps for the provider and potential harm to the patient could be caused.

Methods: This review of literature was assembled by analyzing data from primary and secondary sources through online databases. The most recent research on the risks and benefits of the use of lead x-ray vests towards patients in the dental office was examined. Articles included in this review were published within the last five years.

Major Findings: Studies show the use of lead x-ray vests is widely obsolete with most new types of radiographic technology.

Conclusions: Collimation and new digital radiographic devices have dramatically decreased patient radiation exposure by limiting the beam to a confined space on the patient's oral cavity. There is also a risk that vests may pose a lead exposure hazard if not taken care of properly. The general patient population is widely unaware of these advancements in x-ray technology and of the ineffectiveness of lead aprons.

Introduction:

Radiographic imaging is a crucial step for providing accurate and appropriate dental diagnosis. Lead x-ray vests have historically been used to prevent radiation exposure to patients during dental radiography. New technological advancements in some forms of dental radiography have made these lead vests unnecessary. Digital panoramic and cone-beam computed radiography emit lower levels of radiation because of advancements in radiation filtration (1,2). There is virtually no difference in radiation levels between patients wearing lead vests and those not wearing lead vests while undergoing these types of radiographic imaging (1,2). This reduction in radiation is the same for Rectangular Collimation Radiography, including systems that use film, phosphor storage plates (PSPs) and digital sensor receptors for imaging (3); although it is still necessary to wear lead vests with round collimation radiography, rectangular collimators reduce radiation by almost half across the board (3) and do not require lead vests. Not only do lead vests not have beneficial effects with these kinds of radiographs, they also, disputedly, pose a possible lead exposure hazard if not cared for properly (4). This study was necessary because there is a lack of patient education on the subject of radiographic technology (5). It is important to inform patients on the advancements in radiation filtration technology to increase patient comfort and to offer the best care possible.

Methods and Materials:

This review of literature used the following databases: PubMed and Google Scholar. Additionally, a textbook was sourced. The following key terms and MeSH Terms were used to identify current research: "dental," "lead shield," "lead vest," "lead apron," "x-rays," "patient safety," "patient education," "radiography," and "diagnostic imaging." The studies reviewed used previously validated primary and secondary research. All articles in this review were published within the last five years. Librarians from the VCU Tompkins-McCaw library as well as staff from the VCU School of Dentistry Radiology Department were consulted.

Surface Lead was Found on...

27% of lead aprons hung up by hangers

67% of lead aprons stored in drawers

(In a Study Conducted by Burns et al.) (4).

Although this is not yet proven to be harmful, care should be taken with vests to prevent possible lead exposures.

Results/Discussion:

- **Low levels of Environmental Radiation in Digital Panoramic and Cone Beam Technology make Lead Vests Unnecessary**

Rottke et al. Panoramic Study: Absorbed Radiation Dose Mean *with* Lead Shield: 87.99 (μ Gy)
Absorbed Radiation Dose Mean *without* Lead Shield: 87.34 (μ Gy) (1).

Rottke et al. Cone Beam Study: Absorbed Radiation Dose Mean *with* Lead Shield: 754 μ Gy
Absorbed Radiation Dose Mean *without* Lead Shield: 749 μ Gy (2).

- **Rectangular Collimation is Better at Lessening Radiation Levels than Round Collimation**

Shetty et al. Study: With rectangular collimation, radiation was reduced by 40-92% compared with circular collimation (3).

- **Potential Hazards From Dental Lead Apron Use and the Necessity of Maintenance**

Burns et al. Study: 63% of lead shields tested had detectable surface lead (4). 88% of lead aprons classified as in "bad condition" had high amounts of lead dust on their surfaces (4). 27% of lead aprons hung up by hangers had surface lead, versus aprons stored in drawers which had 67% testing positive for surface lead (4).

Shoag et al. Study: There was no increase in lead exposure between employees who used lead aprons versus those who did not (6).

- **Patient and Provider Education on Dental Radiology Exposure Needs to be Updated**

Sharma et al. Study: Out of the 1,000 adult male and female patients ages 20-70 who participated in this questionnaire, only 24.7% had prior knowledge about the process and equipment of the radiology examination they received (7).

Radiographic technology has developed to produce less and less radiation as improvements have been made to the science. Dennis Rottke et al. performed studies showing the negligible amounts of environmental radiation with digital panoramic and cone-beam radiology (1,2). Shetty also conducted studies showing the decrease in radiation with rectangular collimation (3). Comparing the research, some studies suggest lead aprons pose a threat to patients and providers due to lead dust being present on the surface of the lead aprons as well as internal damage to the shield itself. More research is needed to definitively prove whether or not lead aprons cause harm to patients. Patient knowledge on radiology and the potential health risks associated with receiving radiographic exams is perceived to be high from the providers standpoint, but research shows otherwise. Education on the minimal level of risk with many of the radiographic techniques described in this review, to both the patient and the clinician, would allow for better overall patient care.

Conclusion:

Studies have shown the use of lead x-ray vests is no longer necessary in coordination with many of the new collimation and digital radiography devices. There remains a need for further studies to definitively prove lead x-ray vests may be harmful to patients. To inform the patient on these findings is an important aspect of patient care while conducting radiographic procedures.

Lead Vests Are Not Needed With...

- Radiographic imaging with Rectangular Collimation (using film, phosphor storage plates, and digital sensor receptors)³
- Cone Beam Computed Tomography²
- Digital Panoramic Radiography¹

Lead Vests Are Needed With...

- Radiographic imaging with Round Collimation (using film, phosphor storage plates, and digital sensor receptors)³

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