**Segmentation, characterization and superimposition of PSP damage-induced dental X-ray artifacts**

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**Introduction**

Phosphor storage plates (PSPs) are commonly used sensors for digital intraoral radiography. They are made of a polyester base coated with phosphor particles which store a latent image in the form of energy when excited by X-ray. The energy is then released as blue fluorescent light under a helium-neon laser beam and the image is shown on a computer system1. In comparison to this indirect way of acquiring images, complementary metal oxide semiconductor (CMOS) sensors are connected through a cable to the computer and can display the image immediately after exposure. PSPs have the advantage of allowing easier placement in the oral cavity and causing less discomfort to the patients2. PSPs are meant to be reusable. However, after a prolonged period of use, damages accumulate on the plates and can introduce artifacts to the acquired images. A study in Turkey showed that 20% of the images obtained via PSPs over a six-month period contain visible artifacts3. And PSPs-induced artifacts have been shown to adversely affect the diagnostic ability in digital mammography4. Thus, this has raised the concerns of possible missed diagnoses when using damaged sensors. Clinics are now dealing with this issue by discarding the plates after a certain times of use. Previous study comparing images of PSPs with different used times has suggested that each plate can be used up to 200 times without showing statistically significant changes5. However, this decision is made rather arbitrarily by clinicians in real life. Thus, a standard model needs to be established to characterize and quantify the artifacts and to give an accurate prediction as in whether a damaged sensor would impede diagnosis or not based on its artifact characteristics. Clinicians can therefore be informed of when to discard a plate without hurting diagnosis, as a consequence of doing so too late, or wasting money, as a consequence of doing so too early. Previous attempts have been made to categorize these artifacts. In a study done by Kalathingal et al., the authors subjectively rated the damaged plates into five categories of severity in order to study the effect of wiping as a means to remove surface contaminations6. And in a recent paper published by Çalışkan and Sumer, the artifacts were placed into five categories based their appearances: cracking, scratches, peelings of edges, bite-marks and crescent-shaped bending7.