

1. In the analysis of portraits potentially serving as comparative material for positive identification in a forensic context, image distortion appears to be a critical optic disadvantage that have the most significant impact on the photograph. Distortion can be defined as an optical aberration that deforms and bends physically straight lines and makes them appear curved in images [15]. This anomaly most often affects wide-angle lenses with focal lengths shorter than 35 mm. It is worth noting that currently most portraits or self-portraits (so-called "selfies") are created using mobile phones that have built-in permanent wide-angle lenses. They seem more universal for the needs of everyday photography because they enable a wide field of view, but on the other hand, when the photo is taken from a close distance to the person being photographed, his or her face becomes unnaturally distorted, which results in changed proportions and, in the case of smile analysis, dislocation of reference (anthropometric) points when it comes to comparing AM and PM data. A similar situation takes place during the use of 18 mm focal length in lenses attached to popular, amateur DSLR cameras, which are used by less experienced users. Typical portrait lenses are those with focal lengths of between 70 and 135 mm [16]. Thanks to their application, the face looks natural and is not distorted by optical defects.

2. When taking photos for comparative dental analysis, the main problem an expert is faced with is the head orientation in space (along the x, y, z axes). Photographs are two-dimensional projections of a three-dimensional object, so if objects in the picture are not positioned in an almost identical setting, such a comparison will be flawed. De Angelis et al. [9] in their research sought to establish a scientifically validated method allowing for an almost perfect reproduction of spatial orientation using cast models. It was found that only the lateral bending of the cervical spine (the ear to the shoulder) will not cause deformation in the 2D image. Flexion (forward bending), extension (backward bending), and torsion (left- right rotation) of the head affect the result of the comparison; therefore, the range of motion of the head can vary only by 2° to both sides without distorting the comparative process.

3. In case of a smile line comparison, all available case reports in which positive identification was obtained using incisal alignment analysis as one of the odontological methods [8] or as a supplementary method [10], did not use such rigorous forms of position control as the above-mentioned research by De Angelis et al. and probably have not followed any scientifically validated methodology. Mehrotra et al. [14] indicate that the comparative photo was taken multiple times, until an image enabling an accurate superimposition was taken. However, despite the lack of perfect positioning, it has been proven that dental characteristics in and of themselves are sufficient to identify an unknown person in each of the cases described in the literature [1,8,17]. However, considering the general lack of validating research for these methods, it becomes justified to investigate this topic more carefully in order to produce the most scientifically rigorous, and, in consequence, reliable methodologies that could be successfully applied in forensic context.

4. Even though many studies have used smile photography for identification purposes, none of the authors paid attention to the limitations and features of the optics that may affect the results of the comparison between postmortem data and antemortem photographs.

Therefore, as the aim of this study we propose to verify:

1. The usefulness of smile photographs of an individual to make a positive identification from the method of comparing the incisal contours of anterior teeth, using an image editing software.

2. Whether the focal length of a lens can affect the reliability of the analysis due to possible distortion of the image.

3. If knowing the focal length of the AM photo and using a similar focal length for taking the PM photograph makes the comparison process more accurate.

Different nomenclature can be found in the literature regarding the marked line, e.g. smile line, incisal contours of anterior teeth, incisal borders of anterior teeth, incisal outline of anterior teeth, incisal alignment, alignment of the incisal borders of anterior teeth. They all means the same and will be used in this article interchangeably.