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**Wpływ parametrów ekspozycji badania tomografii  
komputerowej wiązki stożkowej na powstawanie artefaktów  
wokół wszczepów stomatologicznych.**

**Rozprawa na stopień doktora nauk medycznych i nauk o zdrowiu  
w dyscyplinie nauki medyczne**

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### III. Streszczenie w języku angielskim

Title: **Influence of cone beam computed tomography exposure parameters on peri-implant artifacts formation.**

#### Introduction

Cone Beam Computed Tomography (CBCT) is a popular method to assess bone tissue around dental implants. Despite its undeniable advantages, the presence of metal structures, such as dental implants, causes the formation of artifacts that prevent proper assessment of the surrounding structures.

The aim of this series of publications is to assess the impact of CBCT exposure parameters on the formation of peri-implant artifacts and the possibility of peri-implant bone tissue assessment.

#### Methods

A literature review was performed using MEDLINE electronic database (PubMed) to search for English-language papers published before July 2021, using the search query "(dental OR dentistry) AND implant AND (artifact OR artifacts)." The literature review was supplemented by a manual search of the database. The MEDLINE database search yielded 378 relevant publications. Finally, 46 papers were included in the literature review after title-based rejection, evaluation of full text papers and inclusion of publications from the manual search of the database.

A total of 10 titanium dental implants (InKone Primo, Global D, Paris, France) were placed into two previously prepared bovine ribs. Two bone models and an implant-with-transfer model were scanned with a 3Shape E4 laboratory scanner (3shape, Copenhagen, Denmark). CBCT scans of the two bone models were taken with different values of voltage (60, 70, 80, 90 kV), tube current (4, 10 mA) and voxel size (200, 300  $\mu\text{m}$ ). An implant planning software BlueSkyPlan (BlueSkyBio, Libertyville, USA) was used for model superimposition. Measurements of the buccal bone thickness were performed in two selected regions, using both CBCT and scan cross-sections of the model. The Mean Squared Error (MSE), defined as the squared differences between measurements, was used to assess the accuracy of the CBCT device. The obtained results were analysed

statistically by performing one-way analysis of variance (ANOVA), with statistical significance set at  $p \leq 0.05$ .

## Results

This review, which was based on 46 publications, summarised the current knowledge on the impact of exposure parameters on the occurrence of peri-implant artifacts. The original paper showed statistically significant differences between voltage and MSE ( $p = 0.044$ ), as well as between implant position and MSE ( $p = 0.005$ ). Measurement distortions depend on the thickness of the bone margin, and the higher the distance to measure, the higher the error. No statistical significance was found for current (Student's t-test,  $p = 0.956$ ) or voxel size (Student's t-test,  $p = 0.055$ ).

## Conclusions

The literature review showed that the voltage and current of an X-ray tube as well as the size of the imaging field influence peri-implant artifact formation. The study showed that accurate measurements of buccal bone thickness (MSE below 0.25) can be achieved with voltage values of 70, 80, and 90 kV. Reduced X-ray tube current and an increased voxel size allow to reduce the dose of X-ray radiation while still being able to assess the peri-implant buccal bone.