

## ABSTRACT

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### *Portal dosimetry of dynamic techniques – a new in-vivo measurement method*

#### **Introduction**

This study focuses on the use of portal dosimetry to evaluate the reproducibility of radiotherapy and analyze the applicability of EPID matrices.

#### **Objective**

The objective of the study was to assess the effectiveness of the portal dosimetry system in identifying discrepancies in patient positioning during radiotherapy and to analyze the use of the gamma index as a tool for evaluating treatment reproducibility.

#### **Materials and Methods**

The study was conducted on a group of 30 patients treated at the Radiotherapy Department of the Zagłębie Oncology Center in Dąbrowa Górnicza between 2020 and 2023. Patients were divided into two groups based on the irradiated area: the pelvic region and the head and neck region. Treatment plans were prepared using Eclipse v.16 software, and the EPID AS1200 detector was utilized for analysis. In-vivo dosimetry measurements were performed on a TrueBeam medical accelerator (Varian Medical Systems). The gamma index was calculated for various accuracy criteria: 2%/2mm, 3%/3mm, 3%/4mm, and 4%/4mm. A total of 1552 comparisons were made for the head/neck region and 2339 for the pelvic region.

#### **Results**

The analysis showed that for the pelvic region, reproducibility between fractions was within 4mm and 4%, with a sensitivity exceeding 97%. For the head and neck region, results of 3mm and 4% were obtained, with a sensitivity of nearly 96%. The clinical application of the described in-vivo portal dosimetry method based on the EPID detector was presented, demonstrating the potential for early detection of discrepancies in treatment delivery. As a result, the use of this method allowed for the offline adaptation of treatment plans to the patient's changing anatomical conditions.

#### **Conclusions**

The routine application of in-vivo portal dosimetry using the EPID detector in dynamic treatment plans is feasible for clinical implementation. The proposed method, based on regular verification of EPID images, enhances treatment effectiveness, minimizes the risk of errors, and is safe for patients, as it does not expose them to additional radiation.

**Keywords:** Portal dosimetry, EPID, radiotherapy, quality control, gamma index, transit dosimetry