

TITLE: DEVELOPMENT OF AN AUTOMATED READING DEVICE FOR THE DISC DIFFUSION METHOD OF ANTIMICROBIAL SUSCEPTIBILITY TEST

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ABSTRACT:

The disk diffusion is the main method used in the routine clinical microbiology laboratories to determine the antibiotic susceptibility profile of bacteria. Most laboratories use a ruler or a caliper to measure the inhibition zone around the antibiotic discs, which is time consuming and increases the chances of error. The aim of this study was to develop an automated reading device for the measurement of the inhibition zone diameter of the disk diffusion method. The system consists of an apparatus for image acquisition and a software to estimate the inhibition zone in mm by means of an image processing and computational vision. The device consists of a box containing a camera at the upper part which is connected to a computer. At the lower part there is a drawer where the plate with the disc diffusion test is positioned with an array of LEDs to provide a uniform illumination. The proposed algorithm preprocesses the acquired image and improves its contrast by means of a Gaussian filter histogram. The Hough transform method was used to establish the central position of each inhibition zone and the diameters of the inhibition zones are estimated by means of a radial sampling algorithm. Images of 53 disc diffusion tests containing an average of 11 antibiotic discs were acquired and the result of our automated reading device was compared with the results obtained by the commercial equipment Osiris[®] (Bio-Rad). The device developed in this study correctly identified the position of the all possible 597 inhibition zones in all disc diffusion tests. The Pearson correlation coefficient between the measurements of the inhibition zones diameters by our device and Osiris[®] was 0.7728, the Cohen's kappa coefficient was 0.729 and the concordance (in mm) was 86.3%. It is possible to conclude that the device evaluated in this study presented consistent results and a high correlation with the commercial method. The next steps include improvements in the accuracy of the algorithm and graphical user interface as well as to develop a data crossover capability to allow converting the zone diameters in the categorical results (Resistant, Intermediate, and Susceptible) according to the breakpoints established by the Brazilian Committee on Antimicrobial Susceptibility (BrCAST).

Keywords: Antibigram, disc diffusion method, inhibition zone, automated system.

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