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The synergistic effects of ultrasound and laser on the enhancement of transdermal insulin delivery in diabetic rats

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The cardinal goal of this study was to examine the effect of 3-MHz ultrasound and/or laser on transdermal insulin delivery and glucose level in diabetic rats. Diabetes was induced in 45 male rats using Streptozotocin. Animals were randomly divided into 9 groups of 5 animals each. A leak-proof chamber containing either normal saline or insulin was placed on the shaved abdominal skin of the rats. These groups include; rats with no intervention (G1); those treated only with normal-saline (G2); those treated only with insulin (G3); those exposed to laser with normal-saline in the chamber (G4); those exposed to laser with insulin in the chamber (G5); those exposed to ultrasound with normal-saline in the chamber (G6); those exposed to ultrasound with insulin in the chamber (G7); those exposed to both laser and ultrasound with the chamber filled with normal saline (G8) and finally those exposed to both laser and ultrasound with the chamber filled with insulin (G9). The level of blood glucose was measured at minutes 0, 15, 30, 45, 60, 75, 90, 105, and 120 after starting the experiments. The minute 0 refers to the exact time that the anesthetic was administered (before starting irradiation with either laser or ultrasound). Non-parametric tests including Wilcoxon, Kruskal –Wallis, and Mann-Whitney were used for data analysis. These results clearly indicate that the glucose level in rats exposed to both irradiations (laser plus ultrasound) was significantly less than those of exposed to any of these two irradiations alone. To the best of our knowledge, this study is the first investigation that assesses the combination effect of these two physical interventions in physical agents- mediated drug delivery. These findings may open new horizons in non-invasive drug delivery.

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