

# The Effect of Cigarette Smoke versus Vaporized Nicotine on the Healing of Lumbar Spinal Fusion in a Rat Model

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## INTRODUCTION:

The purpose of this study was to compare the effects of inhaled combusted tobacco and e-cigarettes, as well as nicotine exposure, on spinal fusion, using a small-animal model.

**METHODS:** Fifty-eight Sprague-Dawley rats randomized into five groups: combusted tobacco with nicotine, combusted tobacco without nicotine, e-cigarette with nicotine, e-cigarette without nicotine, or compressed air. Each group had preoperative exposure for two weeks before receiving a single-level L4-L5 posterolateral lumbar fusion using iliac crest autograft followed by eight additional weeks of exposure. The spinal segments were harvested, fusion rates were assessed using manual palpation radiographs and micro-CT. Statistical evaluation was made using chi-squared test of independence.

**RESULTS:** The manual palpation analysis demonstrated trends of definite fusion rates of 46%, 36%, 33%, 50%, and 20% for compressed air, e-cigarette without nicotine, e-cigarette with nicotine, combusted tobacco without nicotine, and combusted tobacco with nicotine, respectively (Figure 1). Radiograph imaging showed fusion rates of 61%, 27%, 25%, 41%, 20%, while micro-CT found fusion rates of 53%, 27%, 25%, 41%, and 10% for the previously cited groups (Figure 2 and 3). Despite these trends, no significant differences were appreciated across the groups fusion rates as determined by these three methods.

## DISCUSSION AND CONCLUSION:

The most important finding from this study is that cigarettes with nicotine trended toward being the most detrimental exposure to lumbar spinal fusion. This trend was observed across our different methods of evaluation. Notably when focusing on our micro-CT analysis, our findings revealed that only 10% of those exposed to cigarettes with nicotine demonstrated fusion. The negative impact cigarettes with nicotine have on bone fusion demonstrated in this sample is consistent with previous literature, studying cigarettes' relationship with bone healing. When examining e-cigarettes' impact, both e-cigarettes with and without nicotine have a lesser, but notable, role in contributing to poor bone formation. This suggests that the other chemicals and additives in e-cigarettes could be as, if not more, deleterious to bone formation than the non-nicotine components in traditional cigarettes. This emphasizes the importance of additional preclinical studies into the "benign" non-nicotine additives of highly popularized e-cigarettes.

Figure 1: Manual Palpation Data. Asterisk (\*) indicates statistical significance using Chi Square Testing (p < 0.05).

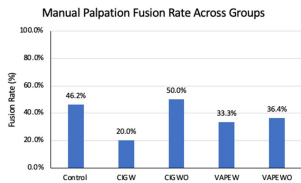


Figure 2: Radiographic Data. Asterisk (\*) indicates statistical significance using Chi Square Testing (p < 0.05).

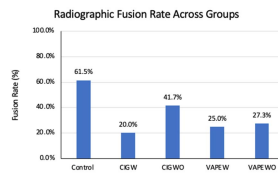


Figure 3: Micro-CT Data. Asterisk (\*) indicates statistical significance using Chi Square Testing (p < 0.05).

