Eating habits, smoking, drugs and chemicals can cause undesirable staining of teeth. Tooth whitening has become a popular dental practice to remove stains from the tooth surface for aesthetic or therapeutic purposes. Traditional in-office tooth whitening involves applying dental gel (active compound: H$_2$O$_2$) on patient's teeth for several 15-20 minutes intervals. However, studies have shown that prolonged use of clinical teeth-whitening gel (with concentration of H$_2$O$_2$ up to 30-40%) can be harmful$^1$.

In this work, we present tooth-whitening results of extracted teeth treated by a direct-current, cold, atmospheric-pressure air plasma micro-jet (PMJ). Dental gels (Beyond Technology Corporation, USA) with different concentrations (6%, 15%, 25%, 35%) of H$_2$O$_2$ are applied to teeth during the treatments. A considerable improvement of the whitening effect was observed when dental gel with lower (such as: 6% and 15%) concentration of H$_2$O$_2$ was applied. The improved whitening is attributed to the effective production of reactive oxygen species (ROS) such as atomic oxygen (O), hydroxyl radical (OH) and singlet molecular oxygen ($^1$O$_2$). The surface temperature of the tooth during the plasma treatment was monitored and found to remain below 40 oC. Modification of tooth surface was detected through a scanning electron microscope (SEM), X-ray microanalysis (SEM/EDS) and microhardness test. This novel tooth-whitening approach, especially the improved whitening effect with lower concentration of H$_2$O$_2$ in dental gel, might revolutionize clinical tooth whitening process.


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