This study investigated the phytochemical evaluation, antioxidant and antibacterial potential of EOECL (essential oil of *Eucalyptus camaldulensis* leaves) and their comparison with commercial essential oil. The primary objective of this study was to develop an oral spray with antibacterial properties, by utilizing full potential of natural antimicrobial agents present in EOECL. The phytochemical screening revealed a diverse range of bioactive compounds, including phenols, cardiac glycosides, carbohydrates, tannins, saponins and flavonoids, in various fractions of the extracted oil. Antioxidant analysis showed higher total phenolic content in methanolic fractions of both extracted and commercial EOECL (0.055 ±0.0019 µg/ml and 0.075± 0.0033 µg/ml) as compared to the lowest in chloroform fractions (0.057 ±0.0025 µg/ml and 0.047 ± 0.0011 µg/ml). Further analysis through Gas Chromatography-Mass Spectrometry (GC-MS) identified several key compounds, including Limonene (1.76% area percentage), 1,8-cineole (10.84%), Alpha-pinene (6.53%), and p-Cymene (9.59%), in the extracted EOECL. Fourier Transform InfraRed (FTIR) spectroscopy revealed the presence of functional groups such as alkane, alcohol, and ester in both the extracted and commercial essential oils. The extracted EOECL demonstrated significant antibacterial activity against dental pathogens, including *Escherichia coli, Staphylococcus aureus, Bacillus subtilis*, and *Klebsiella pneumoniae*, with zones of inhibition ranging from 6-15mm. Formulated oral sprays exhibited varying antibacterial efficacy, with certain concentrations (OS_1 and OS_2) showing the highest zones of inhibition against *E. coli* and *B. subtilis* at 12mm. These findings suggest EOECL as a potential natural antimicrobial agent for oral health applications, paving the way for the development of effective and natural oral care products.