

Scientific Report: “Assesment of antimicrobial effect of Quantum Fusion”

The antimicrobial effects of Quantum Fusion were investigated at the University of Padova, Department of Molecular Medicine, scientific activity Dr Paola Brun, in the context of the scientific research project concerning the study of antimicrobial devices.

EXPERIMENTAL PROTOCOL

Bacterial strains (*Escherichia coli* ATCC 25922, *Staphylococcus aureus* ATCC 6538, *Pseudomonas aeruginosa* ATCC 9027) were grown and maintained in Trypticase soy or in nutrient broth or agar at 37°C.

Fungus *Candida albicans* (ATCC 10231) was grown and maintained in YM agar or broth at 30°C.

Herpes simplex virus type 1 (HSV-1 strain F, ATCC VR-733) was propagated and tested in VERO cells and stored at -80°C.

At the time of experiments, 1×10^7 colony-forming units (CFU)/ml of bacteria or fungus and 1×10^7 plaque-forming units (PFU)/ml of HSV-1 were prepared.

1. Evaluation of the antimicrobial effects

Under aseptic conditions, 100 µl of the microbial inocula were transferred on sterile glass surfaces and introduced into the Quantum Fusion. Samples treated for 2 minutes at the highest position.

2. Evaluation of the antimicrobial effects at different distances

The glass surfaces with the microbial inocula (100 µl) were positioned at the lowest position and treated for 2 minutes.

3. Evaluation of the antimicrobial effect under operative conditions.

Staphylococcus aureus ATCC 6538 (100 µl of 1x10⁷ CFU/mL) were transferred on lens, stems and cases of sunglasses previously positioned at the highest position on the Quantum Fusion. Sunglasses were then exposed to UV-C for 2 minutes.

At the end of the treatments, microbial inocula were recovered, properly diluted and seeded on microbiological culture plates or on VERO cell monolayers. The plates were incubated at 37°C or at 30°C and colonies or virus-induced cytopathic effects were observed every 24 hours, over a period of 72 hours.

Results are reported as killing percentage calculated over control samples set as described above but not exposed to Quantum Fusion. Data are reported as mean±st err of 3 independent experiments.

RESULTS

1. Antimicrobial effects

As reported in Tables 1, Quantum Fusion reported an effective antimicrobial activity. Indeed, following 2 minutes of treatment >99.8% of tested microorganisms were inactivated.

Table 1. Killing reduction (%) in bacterial strains transferred on glass surfaces and exposed to Quantum Fusion for 2 minutes.

	2 minutes
<i>E. coli</i>	99.95±0.05
<i>S. aureus</i>	100.0±0.00
<i>P. aeruginosa</i>	100.0±0.00
<i>C. albicans</i>	99.78±0.13
HSV-1	100.0±0.00

2. Antimicrobial effects at different distances

To assess the impact of different distances on the antimicrobial effects, microbial inocula were transferred on glass surfaces and positioned in Quantum Fusion at the highest position or at the lowest position. Samples were treated for 2 minutes. The results relative to the highest position are reported in Table 1 and recalled in Table 2 for comparative purposes.

As reported in Table 2, we did not record statistically significant differences in the antimicrobial effects between the lowest and the highest position, indicating that the antimicrobial efficacy of Quantum Fusion does not depend on the position of the sample.

Table 2. Killing reduction (%) in microbial strains transferred on glass surfaces, positioned at the lowest or the highest position and treated for 2 minutes. The white column reports the data already described in Table 1. No statistically significant differences were reported between the lowest and highest positions.

	lowest	highest
<i>E. coli</i>	99.81±0.12	99.95±0.05
<i>S. aureus</i>	99.79±0.13	100.0±0.00
<i>P. aeruginosa</i>	99.94±0.06	100.0±0.00
<i>C. albicans</i>	99.74±0.17	99.78±0.13
HSV-1	100.0±0.00	100.0±0.00

3. Antimicrobial effects under operative conditions

To better reproduce the operative conditions of Quantum Fusion, lens, stems and cases of sunglasses were positioned at the highest position of Quantum Fusion and contaminated with inocula of *S. aureus*. Samples were treated for 2 minutes. As reported in Table 3, the antibacterial effect of Quantum Fusion was confirmed under operative conditions and no statistical differences were recorded in the antibacterial effects among the different tested surfaces.

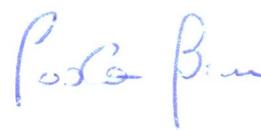
Table 3. Killing reduction (%) in microbial strains transferred on lens, stems, or cases. Samples were treated for 2 minutes. No statistically significant differences were reported between the different tested surfaces.

	2 minutes
lens	100.0±0.00
stem	100.0±0.00
case	100.0±0.00

CONCLUSIONS

Overall, the collected data indicate that Quantum Fusion is endowed with a robust antimicrobial effect following 2 minutes of treatment. The effects are not dependent on the position of the samples inside the Quantum Fusion or on the tested surfaces.

Padova, 25/06/2020

A handwritten signature in blue ink, reading "Paola Brun". The signature is written in a cursive style with a large initial 'P' and 'B'.

Paola Brun