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Management of Fear and Anxiety in Dentistry: A Robotic Approach

Objectives: Dental treatment-related anxiety is common case in dentistry,affecting especially children and causing problems during their dental treatment. We introduced a humanoid robot to interact with children during their dental treatment.The aim of this study was to use humanoid robots to implement a techno-psychological distraction technique for children between 4-10 years in order to reduce their anxiety and stress-related pain during dental treatment.

Methods: 200 children (102 girls, 98 boys;mean age:6.05±1.66 years)assigned first time for dental treatment were randomly selected (n=100 for each group;CG:Control Group (treatment conducted by dentist alone), RG:Robot Group (treatment conducted by dentist with the assistance of the robot).Pulpotomy and filling were applied as dental procedure for both groups (n=50 for each). A multimodal system supporting audio-based dialogues, videos, gestures and expressions based on face, head, arm, body movements have been developed for a robot (IRobi, Yujin Robot).Child behavior was assessed using Frankl Behavior Rating Scale (FBRS) before and after treatment. Anxiety was measured by using Facial Image Scale(FIS) and pulse rates before,during and after treatment. The results were analyzed by Wilcoxon Signed Ranks,McNemar and Mann-Whitney *U*-test at the 95% confidential level.

Results: The results of the data showed that the pulse rates are statistically higher in CG than RG during and after dental treatment ($p<0.05$).There was a statistically difference found in FBRS between CG and RG after treatment($p<0.05$). FIS scores were significantly higher in CG than RG after dental treatment($p<0.05$). 88.3% of patients in the RG have indicated they want to have robot in their next-treatment-session.

Conclusions: This is the first study to examine the effectiveness of child–robot-interaction for reducing children's dental anxiety during dental treatment.These findings suggest children's pain and anxiety can be reduced in dental treatment using robots. A robot can socially and emotionally help in coping with stress and anxiety more than other conventional intervention methods.

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