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Report of “Research Award of Oral Sciences”

Major: Oral Sciences

Grade: 4

Department: Prosthodontics and Oral Rehabilitation

Name: Adityakrisna Yoshi Putra Wigianto

Title: Utilization of contemporary dental magnetics, materials, and digital workflow techniques to address mechanical and biological limitations in prosthodontic treatment

1. Aim of research and results obtained (Approximately 400 words):

The following studies were aimed to clarify solutions or treatment alternatives by performing research on contemporary dental materials, dental magnetics, and digital workflow involvement. The summaries of the obtained results and progress from each research project are described below.

The additional study on antimicrobial efficacy evaluation of a 2-methacryloyloxyethyl phosphorylcholine (MPC) coating activation device resulted in an effective effect on *Candida albicans* biofilm on polymethyl methacrylate (PMMA) and SARS-CoV-2. Utilizing the default settings of the Kirei Keep Light device for 3 minutes reduced the number of *C. albicans* on PMMA by 91.01%. Nevertheless, the efficacy of an ethanol-based chemical disinfectant has a higher rate of reduction (99.98%). It might be useful as a surface disinfection as an addition to a coating activation device. The results of this study have been published in *Hygiene* 2024, 4(1), 93-102; <https://doi.org/10.3390/hygiene4010006>.

Regarding the study on a direct bonded fixed partial denture (DBFPD) using artificial tooth, we have completed the evaluations on the retentive force between two different adhesive systems: a self-cure resin cement 4-methacryloyloxyethyl trimellitate anhydride in methyl methacrylate initiated by tri-n-butyl borane (4-META MMA TBB) (Super Bond Universal, Sun Medical, Moriyama, Japan) and a light-cure resin for fixating mobile tooth (G-FIX, GC, Tokyo, Japan). Based on the results of the retentive force evaluation by fixating the artificial tooth to a custom metal jig, we found that the adhesion was significantly stronger in the self-cure resin group than in the light-cured

group. These results were consistent with our previously performed experiment using a shear bond test. The presence of retentive undercuts did not enhance the retentive force further. A digital stereomicroscope and scanning electron microscope were utilized to confirm the failure patterns of the debonded specimens. Mixed failure (adhesive & cohesive) patterns were observed in both groups.

Lastly, our research on developing magnet-retained removable partial denture without denture base (magnetic removable bridge: MRB) utilizing a novel ultra-thin magnetic attachment (UTMA) and digital workflow has been completed. Each set of a 0.6 mm thickness, Ø4 mm magnet assembly (MA) and 0.4 thickness, Ø4 mm keeper (KP) possesses retentive force at 3.02–3.62 N. The MRB was designed using computer-aided design (CAD) and then fabricated through computer-aided manufacturing (CAM). The retentive force of MRB was 6.86 ± 0.63 N and did not change significantly ($p > 0.05$) throughout the durability test until 10,000 times (6.66 ± 0.79 N). Based on the surface evaluation, minimal or no changes were found on the MA, KP, and MRB surfaces following the durability test. The MRB was considered stable and possesses adequate retentive force for clinical use.

2. Self-evaluation of research achievement:

All studies that were ongoing at the time of applying research award of oral sciences have been completed. The first project on MPC curing box antimicrobial properties has been published in the Hygiene, MDPI journal. The second project on direct bonded fixed partial denture has been completed and is currently under manuscript writing process. The third project on developing MRB utilizing novel UTMA was also completed. The manuscript has been completed and I am going to submit it to the Journal of Prosthodontic Research by the end of this March. There are still many possibilities for further research on this new magnetic attachment.

3. Meeting presentation:

Innovating micro-magnets to boost the quality of life of globally aging population, HIRAKU 3 minute thesis competition, Hiroshima, 11 November 2023, **Adityakrisna Yoshi Putra Wigianto**, oral presentation competition.

4. Journal publication:

Antimicrobial Efficacy of a Portable UV-C-Based Coating Activation Device against *Candida albicans* Biofilm and SARS-CoV-2 as an Additional Feature: An In Vitro Study, Hygiene 2024, 4(1), 93-102, 18 February 2024, **Adityakrisna Yoshi Putra**

Wigianto, Megumi Watanabe, Yuki Iwawaki, Takaharu Goto, Tamaki Otsuki, and
Tetsuo Ichikawa.