ISBN 978-623-7054-43-6

PROCEEDINGS

The 4th International Conference on Sustainable Innovation (ICoSI) 2020

Cutting Edge Innovations for Sustainable Development Goals

Universitas Muhammadiyah Yogyakarta (Indonesia)
October 13 - 14 2020

https://icosi.umy.ac.id/

Focal Conferences

- **(ICPU)** The 2nd International Conference on Pharmaceutical Updates
- **(ICOMS)** The 6th International Conference on Management Sciences
- **(ICLAS)** The 9th International Conference on Law and Society
- **(ICMHS)** The 4th International Conference Medical and Health Sciences
- **(ICAF)** The 6th International Conference for Accounting and Finance
- **(ILEC)** The 2nd International Language and Education Conference
- **(ICONURS)** The 2nd International Conference on Nursing
- **(ICITAMEE)** The 1st International Conference on Information Technology, Advanced Mechanical and Electrical Engineering
- **(IConARD)** International Conference on Agribusiness and Rural Development
- **(ISHERSS)** The 2nd International Symposium on Social Humanities Education and Religious Sciences
- **(ICONPO)** The 10th International Conference on Public Organization
- **(DREAM)** The 5th Dental Research and Exhibition Meeting
- **(ICHA)** The 5th International Conference on Hospital Administration
- **(ICOSA)** The 3rd International Conference on Sustainable Agriculture

ISBN 978-623-7054-43-6

Proceedings

4th International Conference on Sustainable Innovation

2020

Publisher UMYPress

Lembaga Penelitian, Pengabdian, dan Pengembangan Masyarakat (LP3M)

Universitas Muhammadiyah Yogyakarta

Address

Gedung D Lantai 2

Universitas Muhammadiyah Yogyakarta

Jalan Brawijaya, Bantul,

55183 Indonesia

ISBN : 978-623-7054-43-6

ISBN 978-623-7054-43-6

The 4th ICoSI 2020 Commitees

Advisory Board

Dr. Ir. Gunawan Budiyanto, M.P, IPM
Prof. Dr. Ir. Sukamta, M.T., IPM
Prof. Dr. Nano Prawoto, S.E., M.Si
Dr. Suryo Pratolo, M.Si, Akt
Prof. Hilman Latief, MA., Ph.D
Prof. Dr. Achmad Nurmandi, M.Sc

Chairs

Dr. Yeni Rosilawati, S.IP., S.E., MM
Dr. Arie Paksi, S.IP., M.A
Dr. Dyah Dewanti

Secretariat

Abdul Rasyid Ghazali, M.Sc.
Mariska Intan Sari, S.S., M.A
Fitria Rahmawati, S.Pd. M.Hum.
Khanza Nabila Iftina, S.I.Kom
Qholiva Yuni Fadilla, S.I.Kom

Treasurer

Twediana Budi Hapsari, S.Sos., M.SI.,Ph.D
Safaroh Ivory Fananda, S.Sos

Scientific Committee

Prof. Agus Setyo Muntohar, S.T., M.Eng.Sc., Ph.D.(Eng.)
dr. Iman Permana, M.Kes., Ph.D
Dr. Sudarisman, M.T
Iwan Satriawan, Ph.D
Dr. Indira Prabasari, M.P
Eko Priyo Purnomo, S.IP., M.Si., M.Res., Ph.D
Dr Nuryakin, M.M
Prof. Dr. Achmad Nurmandi, M.Sc.
Rizal Yaya, S.E., M.Sc., Ph.D., Ak, CA
Dr. Mukti Fajar ND, SH., M.Hum

Proceedings and Journals

dr. Iman Permana, M.Kes., Ph.D
Dianita Sugiyo, S.Kep., Ns., MHID
Dr. Dyah Mutiarin, M.Si.

Program and Event

Hijriyah Oktaviani, S.IP, M.M
Krisna Mulawarman, S.Sos, M.Sn

ISBN 978-623-7054-43-6

IT Support

Miftahul Yaum
Winny Setyonugroho. S.Ked., M.T., Ph.D
Anhar Wahyu, S.E

Food and Beverages

Dr. Alni Rahmawati, M.M
Dr. Sri Handari Wahyuningsih, M.M
Siti Wijayanti
Dra. Luluk Chusniati

Equipment, Facilities and Infrastructure

Bagus Subandono, ST, M. Eng
Aris Nuryanta, S.H
Galuh Sudarsono

Assets and Logistics

Eko Wahyudi, S.E
Noor Fajari
Suparno

ISBN 978-623-7054-43-6

Reviewers of 4th ICoSI 2020

Ahmad Zaki, Ph.D.
Al Afik, S.Kep., Ns., M.Kep.
Ali Awaludin, Ph.D.
Ana Majdawati
Angga Fajar Setiawan, S.T., M.Eng., Ph.D.
Anita Rahmawati, S.T., M.T.
Anugrah Ilahi, Ph.D.
apt. Aji Winanta, M.Sc
apt. Binar Asrining Dhiani, Ph.D
apt. Didik Setiawan, Ph.D
apt. Erza Genatrika, M.Sc
apt. Hari Widada, M.Sc
apt. Indah Hairunisa, S. Farm., M.Botech
apt. Ingenida Hadning, M.Sc
apt. Lusi Putri Dwita, M.Si
apt. Nurul Maziyyah, M.Sc
apt. Raditya Weka, M.Farm
apt. Rifki Febriansah, M.Sc
Assoc. Prof. Dr. Khairil Azmin Mokhtar
Asti Widuri
Azizah Khoiriyati, S.Kep., Ns., M.Kep
Cahyu Septiwii, M.Kep., Sp.Kep., MB., Ph.D.
Dedi Suryadi
Dina Wahyu Trisnawati, Ph.D.
Dr. Ahim Abdurahin M.Si., SAS., Ak., CA
Dr. Anas Puri, S.T., M.T.
Dr. Ani Hairani
Dr. apt. Bangunawati Rahajeng, M.Si
Dr. apt. Dwi Utami, M.Si
Dr. apt. Ika Yuni Astuti, M.Si
Dr. apt. Nurkhasanah, M.Si
Dr. apt. Siska, M.Farm
Dr. apt. Supandi, M.Si
Dr. Arni Surwanti,M.Si.
Dr. Astuti Masdar
Dr. Birgit C. P. Koch, PharmD, Ph.D
Dr. dr. Arlina Dewi,M.Kes., AAK
Dr. Dr. Nur Hidayah,M.M.
Dr. dr. Sri Sundari, M.Kes.
Dr. drg. Dwi Aji Nugroho MDSc
Dr. Drh. Sapto Yuliani, M.P
Dr. Edi Soesanto, S.Kp., M.Kes
Dr. Eko Hanudin
Dr. Elsye Maria Rosa, M.Kep.
Dr. Fadia Fitiyanti
Dr. Firman Pribadi, M.Si.
Dr. Firman Pribadi,SE.,MM.
Dr. Hosam Alden Riyadh A.Alazeez, M.S.A
Dr. Ihsan Nurkomar
Dr. Ika Nurul Qamari,SE.,M.Si
Dr. Indah Fatmawati,M.Si
Dr. Innaka Ageng Rineksane
Dr. Istianah ZA
Dr. Lis Noer Aini
Dr. Lisa Musharyanti, S.Kep., Ns., M.Med.Ed
Dr. Mahendro Prasetyo Kusumo
dr. Maria Ulfa, MMR.,Ph.D.
Dr. Muhammad Ichsan
Dr. Muria Indah Sokowati, M.Si
Dr. Ns. Umi Solikhah, S.Pd., M.Kep,
Dr. Nur Chayati, S.Kep., Ns., M.Kep
Dr. Nuryakin,MM.
Dr. Qurratul Aini, S.KG., M.Kes.
Dr. Seplika Yadi
Dr. Siti Nur Aisyah
Dr. Titih Huriah, M.Kep., Sp., Kom
Dr. Yeni Rosilawati
Dr.Eng. Rahmita Sari Rafdinal, S.ST., M.Eng.
Dr.Eng.Pinta Astuti, S.T., M.Eng.
Drg Arya Adiningrat PhD
Drg Atiek Driana R Sp.KGA
Drg Dian Yosi A MDSc PhD
Drg Dwi Suhartiningtyas MDSc
Drg Edwyn Saleh Sp.BMM
Drg Erlina Sih Mahanani
Drg Fahmi Yunisa Sp. Pros
Drg Hartanti Sp.Perio
Drg Iwan Dewanto MMR PhD
drg Sartika Puspita MDSc
Dr. Dyah Ekaari Sekar J
Eko Purwanti
Eko Purwanti, Ph.D
Ema Waliyanti, S.Kep., Ns., MPH
Endro Dwi Hatmanto
Erna Rochimawati, Ph.D
Erna Rochmawati
Etik Kresnawati, Dr., M.Si.
Evi Rahmawati, S.E., M.Acc., Ph.D., Ak., CA.
Evy Rahman Utami, S.E., M.Sc.
Fanny Monika, S.T., M.Eng.
Ferika Indarwati, S.Kep., Ns., M.Ng
Fitri Arofiati, S.Kep., Ns., MAN., Ph.D
Galuh Suryandari
Genesiska, S.Si., M.Sc.
Gina Puspita
Hafiez Sofyani, S.E., M.Sc.
Harjanti Widiastuti, Dr., S.E., M.Si., Ak.
Hendy Setiawan, Ph.D.
Hidayatul Kurniawati
Ida Faridah, S.Kp., M.Kes
Ietje Nazaruddin, Dr., M.Si., Ak., CA.
Ika Setyawati
Ikhlas Muhammad Jenie
Iman Permana
Imaniar Ranti
Inayati
Indira Prabasari, Ph.D.
Ir. Latif Budi Suparma, M.Sc., Ph.D
Iwan Satriawan, Ph.D
Jebul Suroso, Ns. M.Kep
Jenita Doli Tine Donsu, S.KM. M.Si
Lilis Suryani

ISBN 978-623-7054-43-6

M. Bahrul Ilmi, S.E., M.E.Sy
M. Endriyo Susila, Ph.D.
M. Syifa Amin Widigdo, Ph.D
Mahendro Prasetyo Kusumo
Matyana Dwi Cahyati, S.T., M.Eng.
Meika Kurnia Puji, RDA,M.Si.,Ph.D."
Muhammad Chairunsyah Riskyta Akbar
Muhammad Hazyar Arumbinang, S.H., LL.M
Muhammad Ibnu Syamsi, S.T., M.Eng.
Mundakir, S,Kep. Ns. M.Kep
Naim Abdul Majid
Nasrullah, S.H., S.Ag., MCL.
Naufal Bagus Pratama, S.H.
Noriko Kuwano
Nurvita Risdiana, S.Kep., Ns., M.Sc
Prof. Djoko Legono
Prof. Dr. Alan Lau, Pharm.D., FCCP
Prof. Dr. apt. Dyah Aryani Perwitasari S.Si., M.Si
Prof. Dr. Arthorn Riewpaiboon
Prof. Heru Kurnianto
Tjahjono,MM"
Prof. Hilman Latief, Ph.D.
Prof. Hironori Yasuda
Prof. Iman Satyarno
Prof. Ir. Mochamad Teguh, MSCE., Ph.D.
Prof. Jamsari
Prof. Keith Walters
Prof. Kriengsak Panuwatwanich
Prof. Maria Rosa Mosquera Losada
Prof. Maurice S. B. Ku
Prof. Michael Henry Boehme
Prof. Normah Mohd Noor
Punang Amaripuja,SE.,ST.,M.IT
Ratna Indriawati
Retno Widowati PA.,M.Si.,Ph.D.
Rizal Yaya, S.E., M.Sc., Ph.D., Ak., CA.
Rizka Fakhriani
Rofi Aulia Rahman, S.H., LL.M
sabtanti harimurti
Shanti Wardaningsih, Ph.D
Sherly Usman
SN Nurul Makiyah
Sri Atmaja P. Rosyidi, S.T., MSc.Eng., Ph.D., PE
Sri Rejeki M
Sri Sundari
Sudarisman
Suryanto
Suryo Pratolo, Dr., S.E., M.Si., Ak., CA., AAP-A.
Sutantri, Ns., M. Sc.,Ph.D
Talqis Nurdianto
Taufiq Hidayat, S.P., M.Sc.
Taufiqur Rahman, S.IP, M.A, Ph.D.
Titiek Hidayati
Tri Pitara
Tri Wulandari Kesetyaningsih
Tumin, Ph.D
Twediana Budi Hapsari, Ph.D
Wantoro, M.Kep., Ns., Sp.Kep., M.B., Ph.D
Warih Andan
Winny Setyonugroho,Ph.D.
Yanuar Fahrizal., S.Kep., Ns., M.Kep., Sp.Kep.J
Dr. Yoni Astuti
Yordan Gunawan, S.H., Int.MBA., M.H

ISBN 978-623-7054-43-6

Preface by the Chairperson of the 4th ICoSI 2020

Dr. Yeni Rosilawati, S.IP. S.E., MM.

Assalamu'alaikum Wr. Wb.

All praise is due to Allah, the Almighty, on whom we depend for sustenance and guidance. Prayers and peace be upon our Prophet, Muhammad SAW, his family and all of his companions.

On behalf of the organizing committee, it is my pleasure and privilege to welcome the honourable guests, distinguished keynote & invited speakers, and all the participants.

With the main theme of "Cutting-Edge Innovations on Sustainable Development Goals (SDGs)", the 4th International Conference on Sustainable Innovation (ICoSI) 2020 serves as a forum to facilitate scholars, policy makers, practitioners, and other interested parties at all levels from Indonesia and abroad to present their novel ideas, promote cutting-edge research, and to expand collaboration network. The conference has about 1373 participants participating from more than 8 countries 4 continents all over the world, making this conference a truly international conference in spirit.

This multidisciplinary conference was first held in 2012 and has undertaken various changes and adopted to the current technological trends of our education system. From having this conference with just 175 participants back in 2012 we have come a long way in making the conference a huge success with more than 1373 participants participating in this two-day conference.

Formerly, this conference consisted of only 9 (nine) focal conferences. This year, there are 14 focal conferences from various disciplines, namely: 1) The 2nd International Conference on Pharmaceutical Updates (ICPU), 2) The 6th International Conference on Management Sciences

ISBN 978-623-7054-43-6

(ICoMS), 3) The 9th International Conference on Law and Society (ICLAS), 4) The 4th International Conference Medical and Health Sciences (ICMHS), 5) The 6th International Conference for Accounting and Finance (ICAF), 6) The 2nd International Language and Education Conference (ILEC), 7) The 2nd International Conference on Nursing (ICONURS), 8) The International Conference on Information Technology, Advanced Mechanical and Electrical Engineering (ICITAMEE), 9) The 2nd International Conference of Agribusiness and Rural Development (IConARD), 10) The 10th International Conference on Public Organization (ICONPO), 11) The 2nd International Symposium on Social Humanities Education and Religious Sciences (ISHERSS), 12) The 5th Dental Research and Exhibition Meeting (DREAM), 13) The International Conference on Hospital Administration (ICHA), and 14) The 3rd International Conference on Sustainable Agriculture (ICoSA).

Accordingly, We are proud to announce that this year, the 4th ICoSI 2020 breaks the Museum Rekor-Dunia Indonesia (MURI) record as the Virtual Multidisciplinary Conference with the Largest Number of Area of Fields in Indonesia

In addition, this year, this conference holds special value since this is the first conference in the history of our university where the entire conference is taking place remotely on a digital platform through the use of advance technologies due to the Covid-19 Pandemic.

I would take this opportunity to express my highest respect to the Rector of Universitas Muhammadiyah Yogyakarta, Dr. Gunawan Budiyanto who gave approval and ensured the maximal support from all the faculty members of Universitas Muhammadiyah Yogyakarta (UMY) that made this event a big success. In addition, my appreciation goes to all the support teams who have provided their valuable support and advice from planning, designing and executing the program.

Let me conclude my speech by encouraging the delegates to participate with an increasing number in all the activities and discussions through the digital platforms for the next two days. I wish everyone a successful, safe, and fruitful conference.

Thank you!

Wassalamu'alaikum Wr. Wb.

Yogyakarta, Indonesia, 14 October 2020

ISBN 978-623-7054-43-6

Welcoming Remarks by the Rector of Universitas Muhammadiyah Yogyakarta

Assoc. Prof. Dr. Gunawan Budiyanto

Innovation is the beginning of the development of technology, and technology is a development machine that is expected to provide benefits to humans and provide the smallest possible impact on environmental quality. In the concept of sustainable development, development must improve the quality of human life without causing ecological damage and maintain the carrying capacity of natural resources.

International Conference on Sustainable Innovation (ICoSI) is an international conference which is an annual conference held by the University of Muhammadiyah Yogyakarta (UMY), Indonesia. In 2020 this raises the issue of "Cutting-Edge Innovations on Sustainable Development Goals." Therefore, on behalf of all UMY academics, I would like to congratulate you on joining the conference, hoping that during the Covid-19 Pandemic, we can still provide suggestions and frameworks for achieving sustainable development goals.

ISBN 978-623-7054-43-6

About The 4th International Conference on Sustainable Innovation (ICoSI) 2020

Cutting Edge Innovations for Sustainable Development Goals

The 2030 Agenda for Sustainable Development is enacted by the United Nations as a shared blueprint for peace and prosperity for people and the planet, now and into the future. It consists of strategies to improve health and education, reduce inequality, and spur economic growth while also conserving natures by 2030.

This year, however, at the first one-third of its timeline, the SDG Reports shows that the outbreak of COVID-19 did hinder the achievement, or at least decelerate the progress of achieving the 17 goals. In fact, according to the report, "some number of people suffering from food insecurity was on the rise and dramatic levels of inequality persisted in all regions. Change was still not happening at the speed or scale required", accordingly.

Therefore, in this event of pandemic, the quantity and quality of research, innovation, and more importantly multi-disciplinary collaboration are indispensable. Furthermore, there needs to be clear ends of those works. That is how those research are applicable and benefits directly to the society. That is how those research is incorporated as the drivers of policy making, and used practically in the society. Hence, the stakeholders especially the triple helix of higher education institution, government, and industry must be re-comprehended and supported to reach the common goal of the SGD.

International Conference on Sustainable Innovation (ICoSI) has been essentially attempting to strengthen this regard since its first establishment. One of the goals of ICoSI is to provide primarily a platform where scholars, practitioners, and government could grasp the development and trends of research. Hopefully, meeting these actors altogether would result in stronger collaboration, sophisticated and advantageous research, and brighter ideas for further research. Based on these reasoning, this year, the 4th ICoSI 2020 UMY is themed 'Cutting-edge Innovations for Sustainable Development Goals".

Improving from last year conference which brought nine focal conference, this year ICoSI 2020 UMY brings 14 disciplines, from social sciences, natural sciences, and humanities. ICoSI 2020 received as much as 1005 papers. The paper works submitted in ICoSI 2020 UMY will be published in Atlantis Proceedings, IOP Proceedings, National/International Journals, and ICoSI ISBN-indexed Proceedings.

Nevertheless, ICoSI believes that publication is only the beginning of research dissemination. The publications will enhance the chance of the research known by wider audience, and then used, applied, and incorporated at either system, institutional, or personal level of human lives.

ISBN 978-623-7054-43-6

CONTENTS

ISBN 978-623-7054-43-6

ISBN 978-623-7054-43-6

ISBN 978-623-7054-43-6

ISBN 978-623-7054-43-6

TRACK ECONOMICS, LAW, EDUCATION, SOCIAL, AND HUMANITIES

ISBN 978-623-7054-43-6

The Effect of Rosella Flower Tea Solution Onto Discoloration of Plate Heat Cured Acrylic Resin Base

Fransiska Nuning Kusmawati[1,*] Tabitha Nurul Arifa[2]

[1] *Departement of Prostodonsia, Faculty of Dentistry, University Prof. Dr. Moestopo (Beragama), Jakarta*
[2] *Student of Departement Prostodonsia, Faculty of Dentistry, University Prof. Dr. Moestopo (Beragama), Jakarta,*
[*]*Corresponding author. Email: nuningphynx@gmail.com*

ABSTRACT
Background: The loss of teeth from one's mouth will increase the need for dentures. The denture base used was heat-cured acrylic resin, in Indonesia. Many natural products are offered to the community where these products have many benefits for the body, one of which is rosella flower tea. Rosella flower tea contains natural dyes, anthocyanins, if consumed regularly it can cause discoloration on the acrylic resin plate. Aim: This study was to determine the effect of immersing heat-cured acrylic resin in a solution of rosella flower tea (*Hibiscus sabdariffa L.*) on discoloration. Material and method: Experimental study with control group pre-test and post-test design. The samples were heat cured acrylic resin plate with N number was 32 and divided into 2 groups, the control groups and the treatment groups. The control group (16 samples) was immersed in distilled water and the treatment groups (16 samples) was immersed in rosella flower tea solution. First, all of the samples 32 samples were immersed for 7 days, dried and performed color changed measurement, then immersed again for additional 7 days, dried and performed color changed measurement. Color changes were measured using the VITA Easyshade device both before and after 7 and after additional 7 days of immersion. Results: The result of the Friedman test showed significant color changes in acrylic resin plates in treatment group, especially on the value of chrome. The result of the Mann Whitney test showed that they were significant differences in the heat acrylic resin plate after immersions in distilled water solution and rosella flower tea for 7 days, and after additional 7 days especially in the chrome. Conclusions: Immersing heat cured acrylic plates in rosella flower tea has color changes effect, the longer the immersion time, the greater the potential the color changes

Keywords: *Heat cured acrylic resin plates, Rosella flower tea, Color changes*

1. INTRODUCTION

The base material for dentures consists of various materials, but the material commonly used in Indonesia is acrylic resin. The type of acrylic resin that is often used is hot polymerization acrylic resin because it has the advantage of being harmonious with the surrounding tissue so that it meets the aesthetic factor, it can be coated and re-affixed easily, is relatively lighter, the manufacturing and polishing technique is easy, and the price is relatively cheap. While the drawbacks of acrylic resin are that they break easily when they fall on a hard surface or due to material fatigue due to long use and experience a change in color because they can absorb water or liquid, food scraps or chemicals considering that this type of resin also has porosity properties[1][2]

Porosity in acrylic resin results in the absorption of water or liquids (drinks) and foodstuffs and chemicals slowly for a certain period of time, this can affect the color change in acrylic resin due to the entry of food or beverage liquids that have been consumed. This color change in acrylic resin can occur due to the habit of consuming solutions containing dyes. The absorption of the dye into the acrylic resin can affect the color of the denture base. One of the beverage ingredients that can affect color change is tea. [2].

Rosella flower (*Hibiscus sabdariffa L.*) has been used by the global community as a herbal medicine, such as in Sudan and South Africa, Indonesia itself which is a country producing roselle flowers also utilizes the properties of these flowers, where the roselle petals are brewed and consumed as tea. also known as red tea. [3] According to Augustine, anthocyanin-rich rosella extract is an effective antioxidant. Studies have also stated that poly-phenolic acids, flavonoids and anthocyanins found in roselle flowers are powerful antioxidants [4]. According to research by Diansari (2015) states that soaking hot polymerized acrylic resin in roselle flower tea for 1, 3, 5, and 7 days can causes dimensional changes. The duration of soaking is determined by an average person drinking roselle flower tea for 5 minutes three times a day, so the total time to consume rosella flower tea is 15 minutes per day. [5] So that 7 days of immersion is equivalent to 22 months of consumption, and +7 days is equivalent to 44 month of consumption. Because of the differences in the results of previous studies, it is the reason for the researchers to further investigate the effect of immersion of hot polymerized acrylic resin into rosella flower tea solution (*Hibiscus sabdariffa L.*) on color changes.

ISBN 978-623-7054-43-6

2. MATERIALS

2.1. Heat-Cured Acrylic Resin

Acrylic resin is a material that is still used in the field of Dentistry. More than 95% of the denture plates are made of acrylic resin material. [6] Acrylic resin is the result of polymerization of acrylate or methacrylic acid or its derivatives, used for the manufacture of medical prostheses as well as restorations and dental equipment. Polymethyl methacrylate is the basic material for acrylic resin in dentistry which is used as a material for making removable denture bases. Acrylic resin is an ethylene derivative which contains a vinyl group in its structural formula. Based on the reaction setting, acrylic resin is divided into chemically polymerized (self-cured) acrylic resin and heat-cured (heat-cured) acrylic resin. Hot polymerization acrylic resin is one of the denture materials which polymerization process by applying heat. [7]. Today most denture bases are made of heat-cured acrylic resin based on polymethyl methacrylate. This material is packaged in a powder and liquid system. The liquid contains non-polymerized methyl methacrylate and the powder contains the pre-polymerized polymethyl methacrylate resin in the form of small grains. Hot polymerized acrylic resin qualifies as an ideal denture base material, because hot polymerized acrylic resin is non-toxic, does not irritate tissue, has good physical and aesthetic properties, is relatively inexpensive, can be repaired, is easy to manipulate and manufacture. However, the disadvantages are that it breaks easily when it falls on a hard surface or is due to material fatigue due to long use and changes in color after some time being used in the mouth and is also easy to porous and easily absorbs fluids, both water and chemicals [8].

One of the physical properties is porosity caused by the evaporation of unreacted monomers and low primary molecular weight, when the resin temperature reaches or exceeds the boiling point of the acrylic resin material, this results in bubbles that can appear on the surface and / or under the surface of the denture base. Porosity can also come from the incomplete stirring of the powder and liquid components. If the mixing process is not perfect, then during the polymerization process some resin masses will contain more monomers than others, and some parts of the resin mass will contain less monomer. These two things cause the formation of porus. [9] [2]

Acrylic resin material has the property of absorbing water slowly over a period of time. One of the shortcomings of acrylic resin is the diffusion process of liquid into acrylic resin because it not only affects the color stability of acrylic, but also the dynamic and polymeric properties caused by the slow absorption process of liquid over a long period of time. Acrylic resin absorbs relatively little water when placed in an alkaline environment, and vice versa when placed in an acidic environment, acrylic resin absorbs relatively much water. This water absorption ability will usually increase the weight of acrylic by 1.0-2.0% [9] [2]. .

Heat-cured acrylic resin exhibits good color stability. The discoloration of the acrylic plate can be caused by the ability to absorb liquid in the material and the environment around the denture, so that the absorbed substance can react with the elements in the acrylic resin. Color stability and surface roughness are closely related. This is because surface roughness will affect plaque retention and accumulation of stains in the restoration material. The rougher the surface, the easier it is to accumulate stain and cause discoloration of the restoration material [2]. The discoloration of the acrylic plates is not only caused by immersion in a disinfectant solution, but also by food and beverage consumption factors such as tea, coffee, drinks containing dyes, and fruit juices. [2]. This is due to the accumulation of color pigments on the surface and absorption of the adhesions of the particles. The discoloration of the denture base can be caused by intrinsic factors and extrinsic factors. The intrinsic factor is the chemical change in the material itself, namely the polymerization process that is not perfect, while the extrinsic factor is in the form of an external factor, namely the color change. Extrinsic factors include the habit of consuming beverages such as tea, coffee, wine or other beverages that contain coloring agents. This is due to the accumulation of color pigments on the surface and absorption of the adhesions of the particles[10].

2.2. Rosella Flower Tea

Rosella flowers as shown in Figure 1 have both pistils and pollen so they do not need other flowers to reproduce. Rosella (*Hibiscus sabdariffa L.*) can live in areas that have a humid and warm climate in tropical and sub-tropical regions. Roselle has advantages compared to other tropical and subtropical plants, namely that it can withstand very cold weather and can live in rooms that have little lighting but the best growth is obtained in open spaces with sunlight. The most nutritious part of the plant is on the petals. Where is the way to consume it by drinking steeping rosella flowers. [11].

Figure1. Rosella flower

Rosella petals contain several chemical compounds needed by the body, namely carotene, riboflavin, anthocyanins, ascorbic acid, niacin, calcium, iron and vitamin C. The human body needs 22 amino acids. Of these 22, 18 of them are fulfilled from rosella flowers. Rosella flowers are widely used to reduce appetite, respiratory problems caused by flu, and discomfort in the stomach. Rosella is used to treat ulcers and inflammation of the skin, burns, canker sores, and herpes zoster infection. [11] The most dominant secondary metabolic compound in red rosella is the presence of anthocyanins that form flavonoids

ISBN 978-623-7054-43-6

that act as antioxidants. Rosella flavonoids consist of flavonos and anthocyanin pigments. Anthocyanin compounds contain delfinidin-3-siloglucoside, delfinidin-3-glucoside, cyanidin-3-siloglucoside, which are a source of natural dyes found in roselle flower petals and in almost all plants that provide strong colored pigments. While the flavonoids contain gosipetin and mucilage (rhamnogalakturonan, arabinogalactants, arabinan). [9] [11].

Anthocyanin compounds are a source of natural dyes found in roselle flower petals and in almost all plants which provide strong colored pigments and when applied in water will cause red, orange, purple, and blue colors. [9] In addition to producing strong color pigments, anthocyanin compounds are also functions as an antioxidant which is believed to cure degenerative diseases. Antioxidants, known as scavengers, are molecules that can react with free radicals and function to neutralize free radicals [12].

2.3. Discoloration Measurement Tool

Measurement of color change on heat-cured acrylic resin plates in this study using the VITA Easyshade tool, as can be seen in Figure 2. The VITA Easyshade is the newest spectrophotometer used in clinical use. The spectrophotometer is a digital color measuring instrument. This tool is often used for laboratory and research purposes. Over time, the spectrophotometer was made more compact and lightweight so that it could be used for everyday clinical purposes. The spectrophotometer is a tool that consists of 3 principle elements, namely as a light source, a tool for directing light to objects. A spectrophoteter is a tool that measures light in certain waves. Traditionally, spectrophotometers use a diffraction grating and a Charge Couple Device (CCD) line detector. [13]. The software of this instrument is programmed to provide absolute hue, value, chroma / chrome measurement results according to the Munsell color system. [14]

Figure 2. Vita Easy Shade

3. METHODS

The design used was experimental laboratory research. The study was conducted at laboratory room Faculty of Dentistry Prof. Dr. Moestopo (Beragama) in October 2018. 32 samples of heat-cured acrylic resin plates with sample length of 20 mm, width 10 mm, and sample thickness 1 mm. Sampling by simple random sampling.

The work procedure of the research was carried out as follows : (1) Preparing the tools and materials to be used in the study (2) Each sample was cleaned with water and dried with a dry tissue (3) Perform measurement with the Vita Easyshade test on each sample (pre-test) (4) The process of making rosella flower tea solution began by provided 7 petals (± 5 grams) of dried flower petals. The roselle petals were infused with 250 ml of boiling water (90ºC) for 5 minutes, then the petals were removed and the solution was waited until it reaches room temperature (5) Then it was poured into the 6 ml plastic container that had been provided (6) Prepare distilled water in a measuring cup as much as 6 ml, then put in a plastic container (7) The samples were divided into 2 groups, which were control and treatment group with 16 samples in each group. Control group was immersed in a plastic container filled with aquadest, while treatment group was immersed in a plastic container that contained rosella flower tea which was already in a 6 ml dose (8) Both control and treatment group samples were measured using digital spectrophotometer (VITA Easyshade) (9) Both samples in control and treatment groups were then immersed within 24 hours for 7 days (assumed for 2 year consumption) and then the samples were rinsed with water, dried with tissue paper and the color changes were recorded using a digital spectrophotometer and named as "after 7 days immersion" (10) The second immersion was then performed for additional 7 days (assumed for 4 year consumption) and then the samples were rinsed with water, dried with tissue paper and the color changes were recorded using a digital spectrophotometer and named as "after additional 7 days immersion" (11) Compare color changes in control group and treatment group and performed data processing presentation and analysis.

4. RESULTS

The aim of this research is to study and explain the effect of immersion time of rosella flower tea on the changes of color plates of heat cured acrylic resin for 7 days and additional 7 days immersion. This research was carried out in an experimental laboratory using 32 samples of cured acrylic resin plate. First group was immersed distilled water as a control group, while the second group was immersed in rosella flower tea as a treatment group. Each groups contains 16 samples. All of the samples were immersed in distilled water and rosella flower tea for 7 days and additional 7 days immersion time. The results of the study can be seen from the following table.

Table 1. Mean Rank of Value Rosella Flower tea

	Mean rank
Value (L) Rosella tea before immersion	2.44
Value (L) Rosella Tea 7 days after immersion	2.16
Value (L) Rosella Tea after add 7 days immersion	1.41

Table 2. Friedman test

N	16

ISBN 978-623-7054-43-6

Chi-Square	9.700
Df	2
Asymp.Sig.	.0008

Table 1 showed a difference on the value of value before the study, after 7 days of immersion, and after addition 7 days of immersion. This was supported by the results of the Friedman test (table.2) which showed p = 0.008 (p <0.05), which means that there was a statistically significant difference on the value in the acrylic resin plate before the immersion, after 7 days of immersion, and after addition 7 days of immersion rosella flower tea.

Table 3. Mean Rank of Chrome Rosella Flower tea

Mean Rank	
Chrome (C) Rosella tea before immersion	2.88
Chrome (C) Rosella Tea 7 days after immersion	1.97
Chrome (C) Rosella Tea after add 7 days immersion	1.16

Table 4. Friedman test

N	16
Chi-Square	16.484
Df	2
Asymp.Sig.	.0000

Table 3 showed the results of measurements of Chrome that there was a difference in the Chrome values before the study, after 7 days of immersion, and after additional 7 days of immersion. Table 4 also showed the results of the Friedman test which showed the results of p = 0.000 (p <0.05), which means that there was a statistically significant difference in the Chrome value in the acrylic resin plate before the immersion, after 7 days of immersion, and after additional 7 days of immersion rosella flower tea.

Table 5. Mean Rank of Value Aquadest

	Mean Rank
Value (L) Aquadest before immersion	2.25
Value (L) Aquadest 7 days after immersion	2.31
Value (L) Aquadest add 7 days after immersion	1.44

Table 6. Friedman test

N	16
Chi-Square	7.871
Df	2
Asymp.Sig.	.0200

Table 5 showed a difference on the value of value before the immersion, after 7 days of immersion, and after additional 7 days of immersion. In table 6, the Friedman test results showed the results of p = 0.020 (p <0.05), which means that there was a statistically significant difference on the value in the acrylic resin plate before the immersioan, after 7 days of immersion, and additional 7 days of immersion with distilled water.

Table 7. Mean Rank of Chrome Aquadest

Mean Rank	
Chrome (C) Aquadest before immersion	2.78
Chrome (C) Aquadest 7 days after immersion	1.41
Chrome (C) Aquadest after add 7 days immersion	1.81

Table 8. Friedman test

N	16
Chi-Square	16.484
Df	2
Asymp.Sig.	.0000

Table 7 showed a difference in the Chrome values before the immersion, after 7 days of immersion, and after additional 7 days of immersion. Table 8 showed the results of the Friedman test p = 0.000 (p <0.05) which means that there is a statistically significant difference in the Chrome value in the acrylic resin plate before the study, after 7 days of immersion, and after additional 7 days of immersion with distilled water.

Table 9. Mann-Whitney result between Aquadest and Rosella Flower tea before immersion

Value (L)		Chrome (C)	
Mann-Whitney U	90.500	Mann-WhitneyU	123..500
Wilcoxon W	226.500	Wilcoxon W	259.500
Z	-1.416		
Asymp. Sig. (2-tailed)	.157	Asymp. Sig. (2-tailed)	.865
Exact Sig. [2*(1-tailed Sig.)]	.160	Exact Sig. [2*(1-tailed Sig.)]	.867

Table 9 showed the results of the Mann-Whitney test on the Value (L) and Chrome (C) values on the acrylic resin plate in the control group with distilled water and the treatment group with rosella flower tea before the immersion. The Mann-Whitney test results for the value (L) showed p = 0.157 (p> 0.05) and the Mann-Whitney test results for the value (C) showed p = 0.865 (p> 0.05). Both of these indicated that there was no statistically significant difference in L and C values between the acrylic resin plate in the aquades group and the resin plate in the rosella flower tea group before the immersion.

Table 10. Mann-Whitney result between Aquadest and Rosella Flower tea after 7 days of immersion

Value (L)		Chrome (C)	
Mann-Whitney U	122.500	Mann-WhitneyU	30.500
Wilcoxon W	258.500	Wilcoxon W	166.500
Z	-207	Z	-3.682
Asymp. Sig. (2-tailed)	.836	Asymp. Sig. (2-tailed)	.000
Exact Sig. [2*(1-tailed Sig.)]	.838	Exact Sig. [2*(1-tailed Sig.)]	.000

Table 10 showed the results of the Mann-Whitney test on the Value (L) and Chrome (C) values on acrylic resin

ISBN 978-623-7054-43-6

plates in the control group with distilled water and the treatment group with rosella flower tea after 7 days of the immersion. The Mann-Whitney test results for the value (L) showed p = 0.836 (p> 0.05) and the Mann-Whitney test results for the value (C) showed p = 0.00 (p <0.05). This indicated that there was no statistically significant difference in L value but at C value there was a statistically significant difference between the acrylic resin plate in the aquades group and the resin plate in the rosella flower tea group after additional 7 days of immersion.

Table 11. Mann-Whitney result between Aquadest and Rosella Flower tea after additional 7 days of the immersion

Value (L)		Chrome (C)	
Mann-Whitney U	118.000	Mann-WhitneyU	29.500
Wilcoxon W	254.000	Wilcoxon W	166.500
Z	-377	Z	-3.721
Asymp. Sig. (2-tailed)	.706	Asymp. Sig. (2-tailed)	.000
Exact Sig. [2*(1-tailed Sig.)]	.724	Exact Sig. [2*(1-tailed Sig.)]	.000

Table 11 showed the results of the Mann-Whitney test on Value (L) and Chrome (C) on acrylic resin plates in the control group with distilled water and the treatment group with rosella flower tea after additional 7 days of the immersion. In the Mann-Whitney test results for the L value showed p = 0.706 (p> 0.05) where there was no statistically significant difference in the L value and the Mann-Whitney test results for the Chrome value showed p = 0.00 (p <0.05) this is showed that at the Chrome value there was a statistically significant difference between the acrylic resin plate in the aquades group and the resin plate in the rosella flower tea group after additional 7 days of the immersion

5. DISCUSSION

This research was conducted to determine the effect of immersion rosella flower tea on the change in color of the heat cured acrylic resin plates for 7 days and additional 7 day immersion. The study was conducted on 32 samples divided into 2 groups: the control group and the treatment group. The results of this study obtained that average value of value control group was no difference but after soaking were significant differences. The average value of chrome control group was no difference but after soaking were significant differences. Friedman test results showed that rosella flower tea for additional 7 days had more effect on the discoloration of the heat cured acrylic resin plate than immersion for 7 days. This means that the greater the change in the color of the acrylic resin heat cured polymerization heat, the greater the color change of the acrylic resin.

The discoloration of the acrylic resin plate can be caused by two factors, intrinsic and extrinsic. Extrinsically, these changes can be caused by anthocyanin compounds, found in roselle petals, which contain delfinidin-3-siloglucoside, delfinidin-3-glucoside, and cyanidin-3-siloglucoside, which produce strong pigments, such as red, orange, purple, and blue, when dissolved in water. [9] [11]. Intrinsically, one of the properties of acrylic resins is to absorb water slowly over a certain period of time, with the diffusion absorption mechanism of water molecules according to the diffusion law. The absorption of liquid dyes in acrylic resin is one of the factors causing the discoloration of acrylic resin. [15] Rosella flower tea solution contains several acidic chemical compounds, namely a mixture of citric acid and malic acid, anthocyanin hydroxyflavone and hibiscin, vitamin C and amino acids. [2] According to Anusavice, acrylic resin absorbs relatively more water when placed in an acidic environment.7 this allows the accumulation of more anthocyanin dye absorption into the acrylic resin plate. The physical properties of hot polymerized acrylic resin are porosity. Porosity determines the sticking of the porous color particles. The more porosity, the more accumulation of dyes absorbed through the diffusion process will also increase. The length of contact between the resin material and the colored substance as contained in the roselle flower tea solution can affect the color change, this is because the longer the resin material is soaked, the more major color change that occurs. In addition, color stability and surface roughness are closely related to each other. The rougher the surface, the easier it is to accumulate stain, causing discoloration of the restoration material.[2]

The same result was also obtained by Zulkarnain et al. (2017) which uses 40% rosella flower extract as a natural disinfectant. This study proved that there was a significant color difference in the immersion of hot polymerized acrylic resin in rosella flower extract solution within 61 hours (1 year of use), 122 hours (2 years of use), and 183 hours (3 years of use) with p = 0.025. (p <0.05) .13 However, the difference from this study was the shape and size of the acrylic resin used, the plate size used by Zulkarnain was cylindrical with a diameter of 50 ± 0.1 mm and a thickness of 0.5 ± 0.1 mm. Whereas in this study an acrylic resin plate was used with a size of 20 x 10 mm and a thickness of 1 mm. According to Anusavice, the color changes that occur in resins can vary, this is due to several factors, including sample size, sample microporosity and duration of contact between materials. The wider the sample size, the greater the physical changes in the material can occur. [2] This study is also in line with the results of the study of Tunggal et al. (2015) who used a roselle denture cleaning paste (2.5%) which was used by 5 denture wearers every day and the changes were calculated every 3rd, 6th, and 9th months. The results showed a change in the color of the acrylic base. statistically significant after using the paste for 6 and 9 months. [18] However, the difference from this study was that this study was conducted in vitro, whereas Tunggal et al. conducted an in vivo study where subjects used acrylic-based dentures and used rosella cleaning paste daily for 9 months. Exposure to roselle dye, anthocyanin, continuously for a long period of time allows this dye to enter the pores created by the micro-porosity nature of acrylic, causing the acrylic plates to turn redder after using the paste every day for 9 months. [18]

Different research results obtained by Thalib et al. (2013) who immersed hot polymerized acrylic resin in roselle petals extract with a concentration of 40% with 6 test

ISBN 978-623-7054-43-6

groups, namely: immersion group 5 minutes, 10 minutes, and 15 minutes once a week, and 5 minutes, 10 minutes, and 15 minutes twice a week. Soaking is carried out for 4 weeks. It can be said that the longest immersion time is 15 minutes twice a week for 4 weeks, which is 120 minutes or equal to 2 hours of immersion (15 minutes x 2 x 4), while the immersion in this study was carried out for 24 hours in 7 days and after additional 7 days.

The absence of this significant color change could be due to the not too long contact time so that the natural dyes in the roselle petal extract, namely anthocyanins, have not diffused into acrylic and cause significant color changes in acrylic resin. [19] Diffusion of liquid into acrylic resin is also one of the disadvantages of acrylic resin because the process of slow absorption of liquid over a long period of time not only affects the color stability of the acrylic, but also the mechanical properties and dimensions of the polymer. Rough or porous surfaces can also affect the color stability of the acrylic as this can lead to greater absorption of water and food coloring. Porosity can occur as a result of the evaporation of unreacted monomers and low molecular weight polymers, when the resin temperature reaches or exceeds the boiling point of the material, but this type of porosity does not occur uniformly along the affected resin segments. [2]

6. CONCLUSION

Based on the results of research that has been done, it was concluded that there were changes in the color of the heat cured acrylic resin plates after immersing in rosella flower tea solution for 7 days and additional 7 days. The color change after additional 7 day immersion was more significant than 7 day immersion. The longer the immersing time, the greater the potential for color change. Things that can be done to progress this research going forward are conducting research with a larger amount of samples and do a longer immersion time trial in order to get a more accurate final result.

REFERENCES

[1] Billmeyer. FW, Textbook of Polimer Science,3rd Ed. New York: Internasional John Wiley and Sons, 1984, pp. 409–11.

[2] Anusavice. KJ, Phillips: Science of Dental Materials, 11th Ed, Louis: Elsevier Science, 2003, pp 723, 739-46, 724-30.

[3] Singh. P, Khan. M, Hailemariam. H, "Nutritional and Health Importance of Hibiscus Sabdariffa: A Review and Indication for Research Needs", J.Nutr Health Food Eng, 2017, 6(5): pp 125-128 .

[4] Olusola AO," Evaluation of the Antioxidant Effects of Hibiscus Sabdariffa Calyx Extracts on 2, 4-Dinitrophenylhydrazine-Induced Oxidative Damage in Rabbits", Webmed Central Biochemistry,,2011; 2(10):WMC002283 .

[5] Diansari. V, Fitriyani.. S, Gustya AD, "Pengaruh Durasi Perendaman Resin Akrilik Heat-cured Dalam Minuman Teh Rosella (Hibiscus sabdariffa) Terhadap Perubahan Dimensi ", Cakradonya Dent J, 2015, 7(2): pp 807-868 .

[6] Phillips. RW, Skinner's Science of Dental Materials, 9th ed. Philladelphia, WB Saunder Co, 1991, pp 199-204.

[7] Kumar. VM, Bhagath. S, Jei B,"Historical Interest of Denture Base Material", SRM University Journal of Dental Sciences,2010, 1(1): pp 103-5

[8] Sari. Sawtell. RM, Downes. S, Patel. MP, Clarke. RL, Braden. M. "Heterocyclic Methacrylates for Clinical Applications-Further Studies of Water Sorption", J Mater Sci Mater Med, 1997, 8(1) pp 667–74.

[9] Hayati. EK, Budi. US, Hermawan. R,"Konsentrasi Total Senyawa Antosianin Ekstrak Kelopak Bunga Rosella (*Hibiscus sabdariffa L.*): Pengaruh Temperatur dan pH", Jurnal Kimia, 2012,6(2) pp 138-147.

[10] Padiyar. N, Kaurani. P,"Colour Stability: an Important Physical Property of Esthetic Restorative Materials, IJCDS, 2010; 1(1) pp 81-4.

[11] Direktorat OAI BPOM RI, Serial Data Ilmiah Terkini Tumbuhan Obat: Rosela (Hibiscus sabdariffa L.), Jakarta,,Badan POM RI. 2010, pp 1-4, 10

[12] Marx. J.L, "Oxygen Free Radicals Linked to Many Disease", Science, 1985, 235 pp 529-531

[13] Corciolani. G, "A Study of dental Color Matching, Color Selection and Color Reproduction" [Thesis], Siena, 2009 pp 8-13.

[14] Anonimus, *Defining Color Systems for Precise Color Validation.* Munsell Color. Michigan: X-Rite World Headquarters, 2007. https://www.pantone.com/downloads/articles/pdfs/L10_315_Defining_Color_Munsell_en.pdf, diakses tanggal 27 September 2018

[15] Maryani. H, Kristiana. L, Khasiat dan Manfaat Rosella, Jakarta, PT Agromedia Pustaka, 2008, pp 1–9, 23–34.

[16] Lestari. WA, Pengaruh Lama Perendaman Plat Gigitiruan Akrilik dalam Ekstrak Bunga Rosella Terhadap Kekuatan Transversal Plat Gigitiruan [Skripsi], Makassar, PPDGS Prostodonsia FKG Unhas, 2013 pp 47

[17] Zulkarnain. M, Angelyna. P,"The Effect of Immersed Heat Cured Acrylic Resin Denture Base in Clorhexidin and Extract of Roselle Flower towards Color Stability", Advances in Health Science Research, 2018, 8 pp 177-179

[18] Tunggal. EG, Dharmautama. M, Jubhari. EH, "Perubahan Warna Basis Akrilik setelah Penggunaan Pasta Pembersih Gigi Tiruan Rosella (The Changes of Acrylic Base Color after Using Roselle Pasta Denture Cleanser)", Dentofasial, 2015, 14(1), pp 25-28.

[19] Thalib. B, "Warna Plat Resin Akrilik Setelah Direndam Dengan Ekstrak Bunga Rosella (Hibiscus Sabdariffa Linn) Sebagai Pembersih Gigi Tiruan", Prosiding: Bridging Sciences in Stomatognatic System, Surabaya, FKG Universitas Airlangga, 2013 pp 77-84 .

ISBN 978-623-7054-43-6

Management of Dental Mobility with Combinations of Splinting And Jacket Crown

Hartanti[1,*]

[1]*Department of Dentistry Faculty of Medicine and Health Science Universitas Muhammadiyah Yogyakarta,*
[*]*Corresponding author. Email:* hartanti@umy.ac.id

ABSTRACT

Patients with periodontitis who have experienced damage to the periodontal tissue, especially to the alveolar bone where resorption is already present, typically experience dental oscillation. The patient starts feeling the disruption of the chewing system and pain. Because of his front teeth, the patient does not want to have his teeth pulled and wanted treatment to save them. A 62-year-old male patient complained that his teeth had rocked a year ago. The clinical examination consisted of grade II mobility in tooth 21 and severe inflammation in tooth 21. The clinical examination had a pocket depth of 7 mm, bleeding on probing of 43%, and alveolar bone resorption radiographic features. Patients were instructed on how to maintain oral hygiene, followed by root scaling and curettage. A week later, the patient needed to check the results of the curettage treatment. His gingival inflammation had decreased a lot. One of the tooth mobility treatments was a modified jacket crown splint attached to tooth 21. It was a splinting of cast metal in the lingual joints with the crown of the tooth 21. Evaluation of 2 weeks later, splinting combined with a jacket crown seemed comfortable for the patient, and tooth sway was gone. Chronic periodontitis with grade II mobility can still be maintained with aesthetic and curettage inflammation in periodontal pockets. Splinting of the cast metal of jacket crown combination has been performed.

Keywords: *chronic periodontitis, jacket crown, splinting, tooth mobility*

1. INTRODUCTION

Periodontitis is an inflammatory disease induced by bacterial biofilms accumulated in the gingival margins and is characterized by gingival inflammation, loss of adherence to connective tissue, and alveolar bone. [1] Periodontitis is a form of continuation of the periodontal disease that causes damage to the soft and hard tissue, which is a component of the teeth-supporting tissues leading to tooth mobility [2]. Tooth mobility is usually classified into grades 1, 2, and 3 using the Miller index to determine treatment and prognosis prediction. Score 1 shows more substantial mobility than physiology. Mobility up to 1 mm in the direction of buccolingual is rated as grade 2. The mobility that is more substantial than 1 mm in the direction of buccolingual, combined with the ability of dental suppression, is rated as grade 3 [3]. Tooth mobility can also be a consequence of occlusal trauma in addition to periodontal inflammation and attachment loss. Based on a clinical point of view, it is essential to clarify the factors of an increase in tooth mobility due to ligament dilation, reduced alveolar bone, or a combination of both [4]. The mechanism conducted for periodontitis, which results in tooth mobility, includes inflammatory periodontal tissue disorder, widening of the periodontal ligament, loss of attachment, loss of alveolar bone, and traumatic occlusal [5].

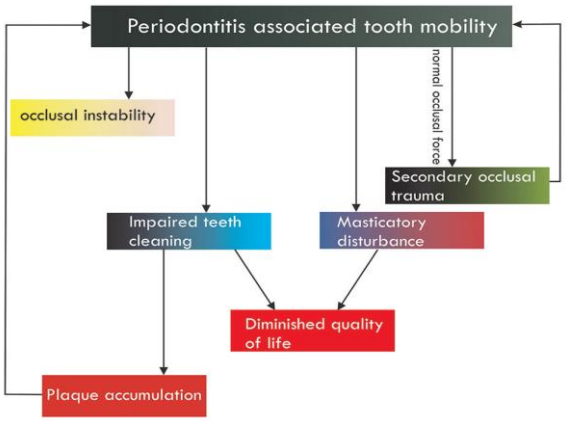

Figure 1: Effects of periodontitis associated with tooth mobility [6]

Rehabilitation of the mouth cavity for patients with periodontal disease is required for the dentin defects, tooth defects, tooth mobility, a decrease in occlusal function, mastication, and aesthetics. This treatment is essential for restoring masticatory and aesthetic functions, maintaining long-term periodontal stabilization and function, and avoiding the induction of inflammation or occlusal trauma in the periodontal tissue [7].

Splinting is a critical component of the periodontal treatment plan due to its ability to provide stability to

ISBN 978-623-7054-43-6

the teeth and help increase the result and prognosis of the tooth affected by periodontitis[8].

Many restoration materials and techniques have been used in splinting. Before the dental adhesive restorative materials were introduced, the optimal choice for tooth splinting was to place a full crown over each tooth and fuse it [9]. There are many tooth splinting techniques. They can be classified based on the purpose and the duration of the use, the tooth's location, and the splinting procedure [10].

2. CASE REPORT

A 62-year-old male patient came to the RSGM UMY with rocking teeth complaints, and it felt painful when used for chewing. Clinical examination, as in figure 1, showed that the debris and plaque accumulation was found in the displacement tooth 21 grade II, the color of the gingival was redness and slightly enlarged, and the depth of pockets was 7 mm. The patient felt anxious to clean his teeth, resulting in high debris and plaque accumulation. The patient wanted the teeth to be maintained as the position of the teeth was in front. Enforcement of determining diagnosis was chronic periodontitis along with displacement teeth grade II of Miller classification.

Fig 1.Early condition

Fig 2. Jacket crown preparation on tooth 21

At the first visit, the patient explained the disease and the procedure to be carried out and maintained daily oral hygiene. Due to the bad oral hygiene condition at the first visit, the patient was given a scaling root planning and curettage action on elements 12, 11, 21, and 22. The goal was to eliminate the calculus, a tissue experiencing inflammation, and then the granulation tissue located in the pocket of the teeth that were going to be splinted was taken. The actions were conducted under local anesthesia.

On the next visit, the control action and the selection of a splinting method were conducted. The splinting method selected was a combination of cast metal splinting in lingual and jacket crown on element 21. The preparation of the jacket crown was conducted on tooth 21. Furthermore, it was formed by using double impression and sent to the laboratory to create a jacket crown on tooth 21 modified by cast metal splinting on the lingual tooth 12, 11, 22.

Fig 3. A combination of cast metal splinting and jacket crown appears on the lingual

Fig 4. Installation of splinting and Jacket crown combination

3. DISCUSSION

The bone loss allows the teeth' movement, increasing irritation on supporting tissue and the possibility of tooth malposition. The tooth's movement experiencing constant displacement during the oral function increasingly damages periodontium and accelerates the disease progression that then causes loss of tooth [11]. In this patient's case, he came with complaints of rocking teeth that felt disturbed at the time of chewing. He felt worried about the tooth loss. The front teeth are the ones that play a vital role in the aesthetic appearance of the patient. Thus, the patient wanted the teeth to be maintained. At the first visit of the patient's condition (picture 1), there was debris and plaque accumulation and a lack of oral cavity hygiene in which there were a supra calculus and sub-gingival. The determined diagnosis was chronic periodontitis with tooth displacement grade 2 Miller based on anamnesis and the patient's medical history. Periodontitis is an advanced form of periodontal disease that causes damage to the soft and hard tissue of the teeth-supporting structure component towards tooth mobility. Tooth mobility causes occlusal instability, chewing disruption, and quality of life disruption [2].

At the first hospital visit, the patient was explained about the treatment that would be conducted. Furthermore, to eliminate the case's factors and predisposition, actions such as scaling root planing and curettage were carried out. The tooth mobility treatment associated with periodontitis disease usually involves a combination of etiology medication, surgical and non-surgical periodontal treatment, occlusal adjustment, and splinting [12, 13]. As an initial treatment plan, instructions on oral hygiene, scaling and root planning, and splinting were carried out in the non-surgical phase to immobilize the tooth displacement of grade 2. Localized periodontal inflammation will cause damage to supporting tissue if it is not well-addressed. Therefore, the removal of plaque and calculus subgingival is a procedure that should be done for successful periodontal treatment. The initial phase or non-surgical treatment of periodontal therapy usually results in significant clinical improvement and changes in flora microbial subgingival [14,15]. The second visit was to determine the splinting that would be conducted. In this case, since the patient was not willing his tooth 21 to be

ISBN 978-623-7054-43-6

removed even though it experienced that the tooth displacement grade 2, a combination of the jacket crown and cast metal splinting in the lingual was performed. Since the jacket crown would be conducted in tooth 21, the tooth's preparation was first carried out [picture 2]. Furthermore, it is formed by using a double impression and sent to the laboratory. In addition to the periodontal and occlusal adjustment treatment, splinting is needed in the case of tooth mobility grade 2. Splinting is sometimes indicated in the case of tooth mobility of Miller Grade 3 in which the tooth retraction is unacceptable and cannot be contraindicated [16]. The appropriate selection of splinting procedures was performed based on both disadvantages and advantages of the splinting use. Selection of splinting with a combination between jacket crown and cast metal on the lingual gives the advantage of the health of a better periodontal tissue as the jacket crown restores the normal function of the tooth 21, which was initially traumatic as a substitute for an occlusal adjustment. Besides, cast metal splints on the lingual side increase retention and prevent the development of mobility of the adjacent teeth [Figure 3]. There are various materials used for the extra coronal splinting, such as stainless steel wire (most commonly used), composites reinforced by fiber, typical composites, and cast splints. The production of the crown, bridge, onlay preparat with veneer is part of extra-coronal splinting. The joint splinting of prostheses or crowns is created in the laboratory [17].

The third visit was the installation of a splinting combination of jacket crowns by using adhesive resin cement (Metabond C & B) [Figure 4].

There are many techniques for tooth splinting classified based on the purpose and the duration of the use, the tooth splinted location, and the procedures [18]. Ferencz classified splinting into long-term splinting, temporary splinting, a long-term splinting based on the term expected [19]. In this case, the long-term splinting was used based on the consideration of the severe condition of the tooth and the periodontal tissue in which tooth 21 experienced displacement grade 2. The patient wanted the teeth to be maintained as long as possible in the oral cavity, and he wanted the comfort in doing mastication. At the control period, the patient did not complain and started feeling convenience in mastication. Many restoration materials and techniques have been used in splinting. The splinting technique with a jacket crown is a technique ever used in the beginning before the modification of splinting materials was found. Before the material restoration of adhesive dental was introduced, the optimal selection for the splinting technique was to install a full jacket crown on each tooth, and then they were put together [9]. In this case, the cast metal splinting was created for teeth 12, 11, and 22 to add retention and prevent further damage to the periodontal tissue of tooth 21, which experienced displacement due to mastication disruption. The production cast metal splint in the laboratory has a more significant inherent strength than composite splint created with an intra-oral [20].

Furthermore, the patient was given instructions on maintaining oral hygiene and was asked to control every 3 or 6 months to remove calculus and monitor the splinting condition to create a regeneration process and preserve the teeth in the cavity. The splinting frequently complicated the patient to have an appropriate control plaque, and that it could create a predisposition of further periodontal damage [21].

4. CONCLUSION

If the splinting method is appropriately used based on the case, it can increase convenience and prognosis for the patient with severe periodontal illness. The purpose of splinting is to create a condition in which the tooth movement can be controlled within physiology limits and that it can increase inconvenience in patients and the function healing process.

REFERENCES

[1] Pihlstrom BL, Michalowicz BS, Johnson NW. Periodontal diseases. Lancet 2005;(19):1809-1820.

[2] Dombret J, Marcos E. Tooth mobility and containment. Rev Belge M Dent (1984) 1989;44:98-109

[3] Miller SC. Textbook of Periodontia, Philadelphia, Blakiston Company 1938, p. 92.

[4] Nyman S. & Lindhe.J. Persistent tooth hypermobility following completion of periodontal treatment. J Clin Periodontol. 1976;(2):81-93

[5] Serio FG. Clinical rationale for tooth stabilization and splinting. DentnClin North Am 1999;43:1-6

[6] Azodo CC, Erhabor P. Management of tooth mobility in the periodontology clinic: An overview and experience from a tertiary healthcare setting. Afr J Med Health Sci 2016;15:50-7.

[7] Kato H: Latest periodontology. Ishiyaku Publishers, Inc., Tokyo, 1994.

[8] Forabosco A, Grandi T, Cotti B. The importance of splinting of teeth in the therapy of periodontitis. Minerva Stomatol 2006;55:87-97.

[9] Amsterdam M. Periodontal prosthesis. Twenty-five years in retrospect. Alpha Omegan 1974;67: 8-52.

[10] Baruch H, Ehrlich J, Yaffe A. Splinting – A review of the literature. Refuat Hapeh Vehashinayim (1993) 2001;18:29-40, 76

[11] Davies SJ, Gray RJ, Linden GJ, James JA. Occlusal considerations in periodontics. Br Dent J 2001;191:597-604.

[12] .Serio FG, Hawley CE. Periodontal trauma and mobility. Diagnosis and treatment planning. Dent Clin North Am 1999;43:37-44.

[13] Nyman SR, Lang NP. Tooth mobility and the biological rationale for splinting teeth. Periodontol 2000 1994;4:15-22.

[14] M. A. Cugini, A. D. Haffajee, C. Smith, R. L. Kent Jr., and S. S. Socransky, "The effect of scaling and root planing on the clinical and microbiological parameters of periodontal diseases: 12- month results," Journal of Clinical Perio- dontology, vol. 27, no. 1, pp. 30–36, 2000.

[15] C. M. Cobb and J. Jeffcoat, "Clinical significance of non-surgical periodontal therapy: an evidence-based perspective of scaling and root planing," Journal of Clinical Periodontology, vol. 29, supplement 2, pp. 6–16, 2002

[16] Cole EG. To splint or not to splint: Treating periodontally compromised teeth by improving occlusion. Dent Update 2000;27:278-85.

[17] Kathariya et al.: To Splint or Not to Splint: The Current Status of Periodontal Splinting, Journal of the International Academy of Periodontology 2016 18/2: 45–56

[18] Baruch H, Ehrlich J, Yaffe A. Splinting – A review of the literature. Refuat Hapeh Vehashinayim (1993) 2001;18:29-40, 76.

[19] Ferencz JL. Splinting. Dent Clin North Am 1987;31:383-93.

[20] Barzilay I. Splinting teeth – A review of methodology and clinical case reports. J Can Dent Assoc 2000;66:440-3.

[21] Pollock R.P. (1999): Non-crown and bridge stabilization of severly mobile periodontally involved teeth : A 25 years perspective: Dent clin North Am;43(1):77-103.