



# 1<sup>st</sup> MEDAN INPRO 2012

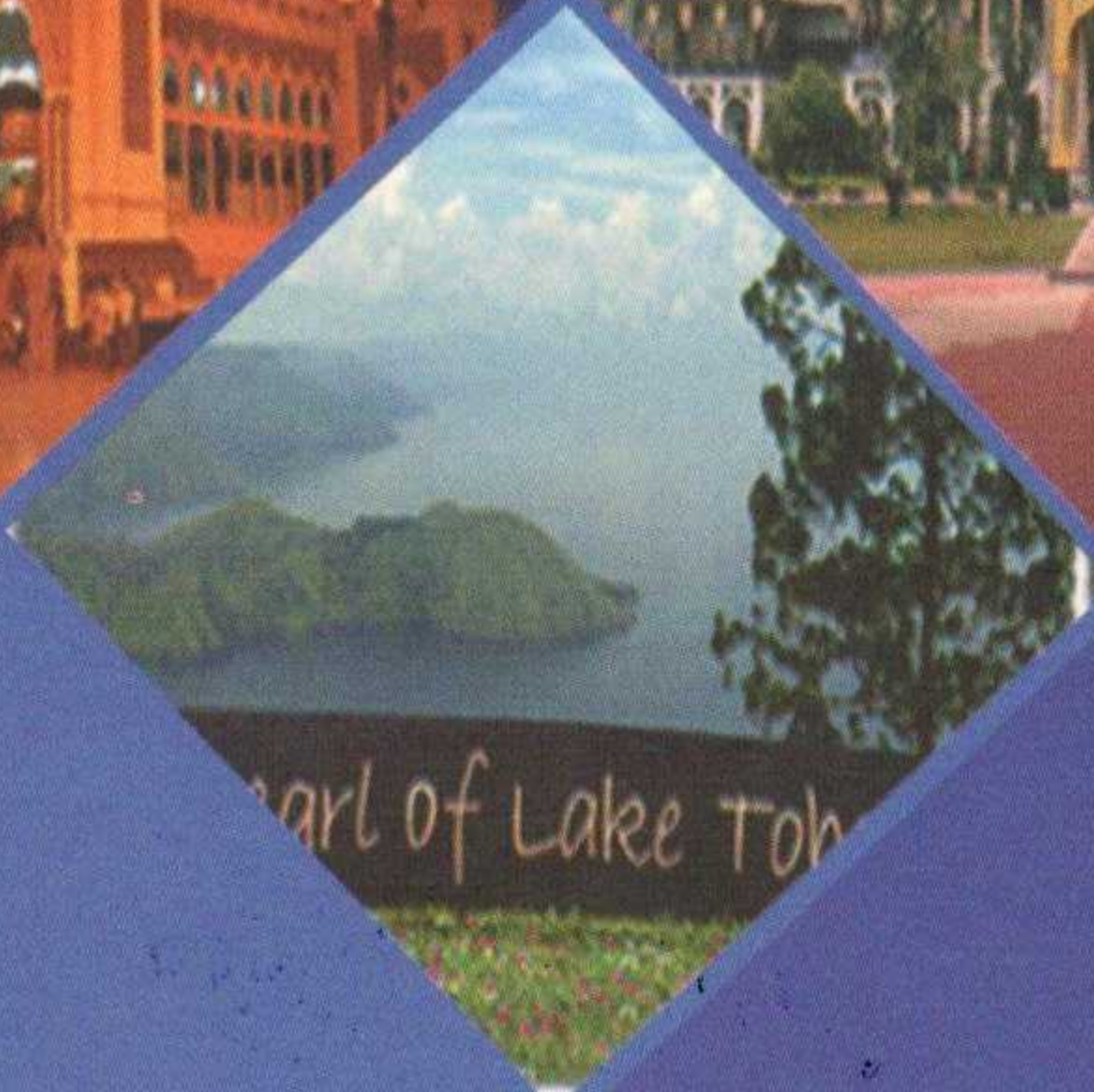
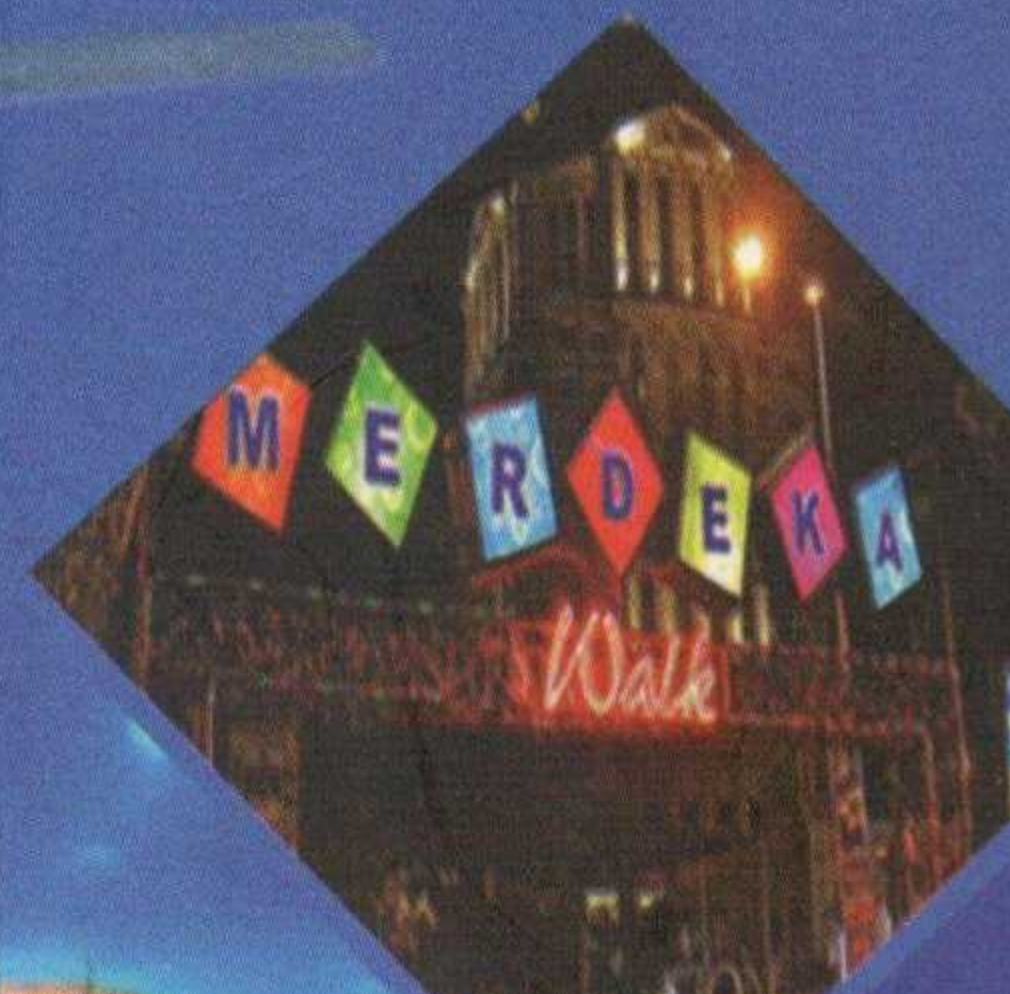
(MEDAN INTERNATIONAL PROSTHODONTIC SCIENTIFIC MEETING)



Theme :

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Dlan

*"Interprofessional Collaboration in Prosthodontic Treatment to Improve Quality of Life"*



30 August – 1 September 2012  
JW Marriott Hotel Medan - Indonesia

*Program Book & Abstract*



**1<sup>st</sup> Medan INPRO Organizing Committee Chairman****Head Department of Prosthodontics, University of Sumatera Utara***Dear Colleagues,*

On behalf of the 1<sup>st</sup> Medan INPRO 2012 Organizing Committee, we would like to extend our gratitude to the local and international speakers, sponsors, organizing committee and to those who have helped organize this event. On the other hand, we would like to extend warm invitation to all colleagues in participating this international scientific meeting which will be held on 30 August – 1 September 2012 at JW Marriott Hotel in Medan, Indonesia.

In 3-day meeting, many innovative conference programs will be held in accordance to new concept and our theme “Interprofessional Collaboration in Prosthodontic Treatment to Improve Quality of Life” to enhance excellence and professionalism in dental practice.

Main Lecture will have 36 speakers from 7 countries: Brazil, Sudan, Iraq, Singapore, Phillipines, Malaysia, and of course Indonesia; and 19 universities: Universidade do SagradoCoração (USC) Brazil, National University of Singapore (NUS), University of Malaya (UM), University of Tikrit Iraq,

International Medical University, Philippine Academy of Implant Dentistry, University of Khartoum Sudan, Kuala Lumpur Metropolitan University College, University of Indonesia, University of Gadjah Mada, University of Padjajaran, University of Airlangga, University of Sumatera Utara, University of Trisakti, University of Hasanuddin, University of Jendral Ahmad Yani, University of Jember, Islamic University of Sultan Agung , University of Jendral Soedirman and Indonesian Defense University.

Short Lectures will have 107 papers presented by dentists and doctors from Dental and Medical Faculties and other institutions from Brazil, Sudan, Iraq, Malaysia and many Universities in Indonesia. Gala dinner and entertainments in Medan INPRO Nite Gathering on 31 August 2012 (second day of conference) will make your days in Medan unforgettable and have a lasting impression.

Looking forward to welcome all colleagues in Medan “Heaven of Culinary” – Indonesia this August.

Sincere regards,

**Syafrinani, drg., Sp.Pros(K)**



**1st Medan INPRO Organizing Committee Patron****Chairman of Indonesian Prosthodontics Association – Medan Branch***Dear Colleagues,*

First of all, I would like to invite everyone present to join me in a moment of silent prayer to appreciate the blessings that Allah SWT has bestowed upon us, making possible the actualization of the 1st Medan International Prosthodontic Scientific Meeting 2012 (Medan Inpro 2012) with the theme 'Interprofessional Collaboration in Prosthodontic Treatment to Improve Quality of Life' as one of IPROSI's programs which will be held from 30<sup>th</sup> August through 1<sup>st</sup> September 2012 in Medan with respect to our individual roles and duties.

As we all know, the development of science, technology and art in various fields which spreads rapidly through a number of resources, especially information technology, has a tremendous impact on the community and their understanding in several aspects. Health is a main factor in human necessities that affects our quality of life. Oral health which constitutes a part of the medical discipline, is also experiencing fast advances.

Based on its rapid development, prosthodontics as one of the branches of dental science also undergoes its development which can be seen from the change of the simple definition of prosthodontics. Initially defined as, replacing missing teeth in the oral cavity, it has now become a wider definition which is, the branch of dentistry pertaining to the restoration and maintenance of oral function, comfort, appearance and health of the patient by the replacement of missing teeth and contiguous tissues with artificial substitutes. The change of the term prostodontia greatly influences the current concept and strategy in dental education and especially in the future development of prosthodontics as well as its treatment areas.

The concept of prosthodontic treatment does not only involve the technical aspects of manufacturing the dental prosthetic, but also requires mutual cooperation with other disciplines in the scope of prosthodontics itself, dental interdisciplinary such as oral surgery, conservative dentistry, periodontics, orthodontics, oral medicine, pediatric dentistry, dental material and technology and oral biology, as well as medical multidisciplinary, transdisciplinary of various other disciplines.

Owing to the above issue, this event will be packaged and conducted through various disciplines of science and it is expected to be able to disclose an understanding and insight of the importance of scientific collaboration, in keeping with the advances of science and up-to-date technology. This concept is needed to enhance the quality of health services, especially dental and oral health through prosthodontic treatment in restoring the function of the stomatognathic system.

We hope that this event will increase our professionalism, not only as educators of dental institutions, but also as practitioners of related sciences in the scope of prosthodontics, dental interdisciplinary, medical multidisciplinary, transdisciplinary and so forth to enhance our competency in this era of Millennium Development Goals (MDGs).

In closing, allow me to extend my deepest gratitude and appreciation to all parties that have contributed to the realization of this event, especially the Organizing Committee of the 1<sup>st</sup> Medan Inpro 2012. Lets all join hands and string together the pearls of our excellent professionalism to fulfil the responsibilities of our profession towards the community.

Sincerely yours,

**Prof. Ismet Danial Nasution, drg., PhD, Sp.Pros(K), FICD**



**1<sup>st</sup> Medan INPRO Organizing Committee Patron**

**Head of Indonesian Prosthodontics Association**



*Dear Friends and Colleagues,*

First of all I would like to welcome you to Medan, Indonesia for attending and participating in the 1st Medan INPRO 2012 which will be held on 30 of August 2012 until 1<sup>st</sup> of September 2012 at the JW Marriott Hotel.

The theme of this International Prosthodontic Scientific Meeting is "Interprofessional Collaboration in Prosthodontic Treatment to Improve Quality of Life". There will be 36 speakers from 19 universities from Brazil, Indonesia, Iraq, Malaysia, Phillipines, Singapore, and Sudan sharing in this meeting. The uniqueness of this meeting is every speaker from multidisciplinary background will be sharing their perspectives and experiences towards prosthodontics based on their field of expertise. This meeting will be gathering prominent person in national and international dentistry, medicine, and other disciplines as our key-note speakers and sectional speakers to share their knowledge, thoughts, skills and information related to their dentistry-related core competences as an integrated part of collaboration in prosthodontic treatment

I hope that this meeting will be beneficial to all participants, as the aim of this meeting is to improve our knowledge on the latest update of prosthodontics in today's world. Not to forget, I would like to thank every participants involved that makes this international event to be a success.

I wish you all have a pleasant meeting and joyful stay in Indonesia, especially in Medan.

Sincere regards,

**Komes.(Pol) Doddy Soemawinata, drg., Sp.Pros**

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Dian 30/8 2012



## 1<sup>st</sup> Medan INPRO Organizing Committee :

### Patron

Chairman of Indonesian Dental Association  
 Chairman of Indonesian Prosthodontic Collegium  
 Chairman of Indonesian Prosthodontic Association

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#### I. Registration and publication

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 Luthfiani, drg.

#### II. Main Lecture

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 Dennis, drg.  
 Hubban Nasution, drg.

#### III. Short Lecture

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 Rika Mayasari A, drg., M.Kes  
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 Armia Syahputra, drg.

#### IV. Short Course

Rehulina Ginting, drg., M.Si  
 Indri Lubis, drg.

#### V. General Panel Discussion

Prof. Sondang Pintauli, drg., PhD

#### VI. Dental Technician Scientific Meeting

Harry Soemawinata, drg.  
 Siti Wahyuni, drg.  
 Hubban Nasution, drg.

#### VII. Gubernur Sumatera Utara - Dental Scientific Award

Prof. Trimurni Abidin, drg., M.Kes., Sp.KG(K)  
 Prof. Lina Natamiharja, drg., SKM  
 Essie Octiara, drg., Sp.KGA  
 Pitu Wulandari, drg., Sp.Perio

#### VIII. Student Poster Competition

Olivia Avriyanti, drg., Sp.BM  
 Gostry Aldica, drg.

#### IX. Opening Ceremony and Medan INPRO Nite Gathering

Putri Welda Utami Ritonga, drg.  
 Nevi Yanti, drg., M.Kes

#### X. Refreshment

Cut Nurliza, drg., M.Kes  
 Sopan Sinamo, drg.

#### XI. Liaison

Emerson, drg.  
 Ika Andryas, drg

#### XII. Exhibition

Eddy Dahar, drg., M.Kes  
 Suryanto Purba, drg.



**Theme :***"Interprofessional Collaboration in Prosthodontic Treatment to Improve Quality of Life"***Date :**

30 August – 1 September 2012

**Venue :**

JW Marriott Hotel  
 Jalan Putri Hijau No.1  
 Medan – Indonesia

**Accreditation :** SK PB PDGI No. SKP-I/265/PB PDGI/VII/2012

Seminar Effective Time : 18 ½ hours

**Credit Points (SKP) :**

Seminar Participant	: 8 SKP
Speaker	: 5 SKP
Participant in Short Course (2 hours)	: 3 SKP
Participant in Short Course (3 hours)	: 5 SKP
Short Course Instructor	: 5 SKP
Moderator	: 3 SKP
Organizing Committee	: 3 SKP
Jury	: 4 SKP

**Programs :****1. Opening Ceremony**

1<sup>st</sup> Medan INPRO will be started with "Batak Welcoming Dance" to welcome all guests, speakers, participants and exhibitors. Then "Nias Lompat Batu Performance" along with "Gondang Sembilan" will give interesting entertainment.

**2. General Panel Discussion**

Theme : "Role of Oral Health in Enhancing Quality of Life (QoL) in Elderly People"

This session will discuss current concepts of care relevant to elderly and preventive strategies that are most effective for preventive oral diseases in elderly to enhance Quality of Life (QoL).

**Speakers :** 1. **Prof. Hiroshi Ogawa, DDS., M.D.Sc.(Sydney), Ph.D(Japan)**

*"Importance of Oral Health Promotion for Elderly : Integration between Oral and General Health"*

- Vice Director at World Health Organization Collaborating Center for Translation of Oral Health Science.
- Technical Officer / External Professional in Global Oral Health Programs, World Health Organization.
- Associate Professor at Department of Oral Health Science, Graduate School of Medical and Dental Sciences, Niigata University, Japan.

2. **dr. Ratna Rosita, MPH**

Secretary General at Indonesian Ministry of Health.

3. **Master of National and International Education**4. **Letjend (Purn) Toni Hartono**

Vice Head of Indonesia National Commission for Elderly

5. **Prof. Ismet Danial Nasution, drg., Ph.D., Sp.Pros(K)**

- Professor at the Department of Prosthodontic, Faculty of Dentistry, University of Sumatera Utara.
- PIC Dental Profession at Health Professional Education Quality (HPEQ) Project, Directorate General of Higher Education, Indonesian Ministry of Education and Culture.
- Former Dean at Faculty of Dentistry University of Sumatera Utara.
- Former Chairman of Indonesian Association of Dentistry Faculties.

**3. Main Lecture**

Main Lecture session will have 36 speakers from 7 countries that will discuss interesting topics with Prosthodontics, Interdisciplinary, Multidisciplinary and Transdisciplinary approach.



**4. Short Lecture**

Short Lecture will have 107 papers presented by dentists and doctors from Dental and Medical Faculties and other institutions from Brazil, Sudan, Iraq, Malaysia and many Universities in Indonesia.

**5. Short Course**

There is 10 sessions of Short Course with professional instructors that participants can join. Credit Points (SKP) of only one Short Course per day that will be available for Credit Point count.

**6. Gubernur Sumatera Utara – Dental Scientific Award**

This award is directly supported by Plt. Governor of North Sumatera, Mr. H. Gatot Pujo Nugroho, ST. All papers that are accepted for Short Lecture presentation will be included in Scientific Award. The juries will choose 3 (three) best papers from each category and winners to get interesting prizes. The winners will be announced during Medan INPRO Nite Gathering. From all Full Papers accepted, the juries chose 9 papers to be published in DENTIKA Dental Journal. The others is published in Proceeding Book.

**7. Student Poster Competition**

Student Poster Competition is held as Pre-Meeting activity on Wednesday, 29 August 2012 at 08.00 until 17.00 in Boston room, 2nd floor, JW Marriott Hotel Medan. In this session, undergraduate dental students will present Literature Review and Research Report in posters. The juries will choose 3 (three) best posters from each category as winners to accept Gubernur Sumatera Utara – Student Poster Award.

**8. Dental Technician Scientific Meeting**

Five professional speakers for Dental Technician Scientific Meeting with the theme "Cooperation among Dentists and Dental Technicians in Improving Quality of Prosthodontic Treatments" will discuss problems among dentists and dental technicians in making a prosthesis and the solutions.

**9. Medan INPRO Nite Gathering**

Medan INPRO Nite Gathering will be held on Friday, 31 August 2012 start from 07.00 pm in Grand Ballroom of JW Marriott Hotel Medan. All colleagues can enjoy Gala Dinner and many entertainment programs that will give unforgettable impression.

**10. Dental Trade Exhibition**

Dental Trade Exhibition will be held concurrently with the scientific meeting. Dental suppliers and companies with displays of latest innovation in dental materials, medicine, equipments and technology will be shown in this two - floors exhibition. Great products with special prices will be available here.

**11. Medan INPRO Painting Gallery**

Exhibition of paintings by Prof. Dr. Hashim Bin Yaacob, FDSRCS (Eng), FDSRCPS (Glasg), FFOP (RCPA) (Aust) from Kuala Lumpur Metropolitan University (Malaysia), Prof. Bambang S Trenggono from University of Trisakti (Jakarta), and Prof. Dr. Rasinta Tarigan, drg., Sp.KG(K) from University of Sumatera Utara (Medan) is held in break out area, 2nd floor, JW Marriott Hotel Medan during scientific meeting.



**Friday, 31 August 2012**

Seq # 007

Presenter	Title	Moderator
Titi Purnami Dewi, drg., M.Kes	Dental Implant or Three Unit Bridge?	<b>Eddy Dahar, drg., M.Kes</b>
Wibwin Ariestania, drg, Sp.Pros	Magnetic Attachment Upper Complete Overdenture for Diabetes Mellitus Patient with Lower Partial Denture	
Isidora KS, drg., MS, Sp.PM	Chronic Traumatic Ulcer Treatment and Aids of Panoramic Photo to Prepare A Suitable Partial Denture	

Seq # 008

Presenter	Title	Moderator
IIG N Bagus Tista, drg., M.Biomed	Comparison of Adhesive Strength Using Glass Ionomer Cement Compared with Resin Cement in Cementation of Composite Resin Inlay with Indirect Technique	<b>I Dewa Ayu Nuraini Sulistiawati, drg., M.Biomed</b>
Putu Rusmiany, drg., M.Biomed	Effectiveness of Alginate Impression (Hydrocolloid Irreversible) Immersion in Glutaraldehyde 2% for 10 Minutes in Prevention of Mycobacterium Tuberculosis Contamination on Stone Cast	
Widaningih Budiman, drg., Sp.Pros	Impact of Heat-Curing Resin Acrylic Soaked In Macerated Nigella Sativa Liquid on Porosity and Color Change	

Seq # 009

Presenter	Title	Moderator
Susanna Halim, drg., FISID	Placement of Four Implants in Anterior Mandible Using Navigator Surgical Guide (Case Report)	<b>Essie Octiara, drg., Sp.KGA</b>
Titi Purnami Dewi, drg., M.Kes	Immunization For Preventing Dental Caries	
Dewa Made Wedagama, drg., Sp.KG	Potency of Chitosan Activity as Protective Biomaterial in Osteoblasts With Adding of Platelet-Rich Plasma	

Seq # 010

Presenter	Title	Moderator
Kesuma Wardani, drg., M.Biomed	Effect of Vitamin E on Estrogen Hormone Level and Histopathology Description of Alveolar Bone in Mice Doing Maximal Physical Exercise	<b>I Gusti Agung Ayu Hartini, drg., M.Biomed</b>
Ali Taqwim, drg., Rinawati Satrio, drg., MS & Rosani Wiogo, drg., MS	Role of Flavonoid from Propolis on Fibroplasia after Gingival Flap Insicion in Rats	
Dian Mulawarmanti, drg.	Effectiveness of Hyperbaric Oxygen Therapy for Edentulous Irradiated Mandible Patients	

Seq # 011

Presenter	Title	Moderator
Susi R. Puspitadewi, drg., Sp. Pros	Management of Problems on Full Denture	<b>Dahlia Sutanto, drg., Sp.Pros</b>
Okmes Fadriyanti, drg., Sp.Pros	Alternative Method in Making Provisional Crown	
Normaliza Binti Ab.Malik, BDS, WCLinDent	Oral Rehabilitation of Hereditary Amelogenesis Imperfecta Patient	

Seq # 012

Presenter	Title	Moderator
dr. Putri Alfaridy	Pro Using Modalities TENS and LASER Combined with Dental Prosthesis for Chronic Facial Pain	<b>Nina Ariani, drg., Sp.Pros</b>
dr. Eriza	Dental Prosthesis and Mandibular Reconstruction after Mandibulectomy in Ameloblastoma Mandible	
Ignatia Wurangian, drg., Sp.Pros	Flabby Ridge Impression Technique	



## XEROSTOMIA IN NASOPHARYNGEAL CANCER PATIENT POST RADIATION

**D P Nasution, M Sutanti, S Tamin**

Otolaryngology Division, Department of Ear Nose Throat – Head and Neck  
Faculty of Medicine, University of Indonesia /  
Dr. Cipto Mangunkusomo General Hospital, Jakarta - Indonesia

Xerostomia is a symptom that usually occurred in post radiation of patient with head and neck malignancy. It can occur transiently or permanently, depend on radiation's area and also dosage of radiation. Quantitative measurements of saliva and Flexible Endoscopic Evaluation of Swallowing can be performed to make diagnosis and to evaluate effect of xerostomia. Preventive treatment for xerostomia such as transfer of submandibular gland to location outside radiation area, choice of unconventional radiation technique for parotid preservation, intravenous amifostine that act as radioprotector, can be given before radiation. Salivary substitutes, cholinergic-parasympathomimetic treatment such as pilocarpin that can be given orally or topically, alternative treatments such as acupuncture or hipnosis treatment are treatments for patient that already complained about xerostomia. This paper present 3 cases of patient with stage IIIB, IVA, IVB nasopharyngeal carcinoma that complained about dysphagia and xerostomia. To describe diagnostic and management patient with xerostomia in nasopharyngeal carcinoma post radiation especially on swallowing function. Xerostomia in addition to causing trouble with swallowing, also may affect the patient's sense of taste and speech, which in turn will affect the quality of life. Examination can be done to diagnose xerostomia include the examination of the saliva flow rate and FEES. A multi-disciplinary approach in the diagnosis and treatment of dysphagia is crucial during these critical treatments to optimize swallow capabilities and oral intake. A strong framework for following patients during Head and Neck Cancer treatment is important for optimizing treatment success.

**Keywords:** xerostomia, post radiation of head and neck, flexible endoscopic evaluation of swallowing, quality of life.

## EFFECTIVENESS OF HYPERBARIC OXYGEN THERAPY FOR EDENTULOUS IRRADIATED MANDIBLE PATIENTS

**Dian Mulawarmanti**

Faculty of Dentistry, Hang Tuah University

Patients who have undergone surgery for orofacial cancer as conventional prosthetic treatment may be difficult if the anatomy is less favorable after surgery. If the patient requires radiotherapy, then dental implant treatment may be compromised. Adjuvant therapy hyperbaric oxygen (HBO) has been advocated in reducing the risk of osteoradionecrosis and a method of potentially maximizing implant osseointegration. The accurate prediction of problems that would challenge osseointegration intervention is from primary importance in the management of the irradiated patient. The purpose of this article was to describe the effectiveness of hyperbaric oxygen therapy for edentulous irradiated mandible patients. This review of several journals related to radiotherapy and hyperbaric oxygen. In conclusions, there were sufficient scientific evidences to show a higher failure rate of osseointegration (OI) implants in irradiated patients. This high failure rate can be reduced by adjunctive HBO. HBO Therapy has been shown to improve angiogenesis and bone metabolism and bone turnover. In relation to radiotherapy, HBO can thus counteract some of the negative effects from irradiation and actually act as a stimulator of osseointegration

**Keywords :** radiotherapy, hyperbaric oxygen, dental implant



# THE EFFECTIVENESS OF HYPERBARIC OXYGEN THERAPY FOR EDENTULOUS IRRADIATED MANDIBLE PATIENTS

(Efektifitas Terapi Oksigen Hiperbarik Pada Penderita Mandibula Edentulous Post Radiasi)

**Dian Mulawarmanti**  
**Laboratorium Oral Biology (Biochemistry)**  
**Faculty of Dentistry, Hangtuah University**

## Abstract

Patients who have undergone surgery for orofacial cancer as conventional prosthetic treatment may be difficult if the anatomy is less favorable after surgery. If the patient requires radiotherapy, then dental implant treatment may be compromised. Adjuvant therapy hyperbaric oxygen (HBO) has been advocated as a reducing the risk of osteoradionecrosis and a method of potentially maximizing implant osseointegration. The accurate prediction of problems that would challenge osseointegration intervention is of primary importance in the management of the irradiated patient. The purpose of this article was to describe the effectiveness of hyperbaric oxygen therapy for edentulous irradiated mandible patients. This review of several journals related to radiotherapy and hyperbaric oxygen. Conclusions are there is sufficient scientific evidence to show a higher failure rate of osseointegration (OI) implants in irradiated patients. This high failure rate can be reduced by adjunctive HBO. HBO therapy has been shown to improve angiogenesis and bone metabolism and bone turnover. In relation to radiotherapy, HBO can thus counteract some of the negative effects from irradiation and actually act as a stimulator of osseointegration

Key words : radiotherapy, hyperbaric oxygen, dental implant

## Introduction

Approximately one million people will develop invasive cancer each year. Of these, 40% will receive curative benefit from surgery, radiation, chemotherapy, or a combination modality. In dealing with patients with cancer of the head and neck a team approach is required for effective management. When radiation therapy is indicated, it is imperative that health of the oral cavity be assessed initially as well as throughout therapy. (Shawa, 2011) Radiation produces its deleterious effects through production of free radicals, which result in mitotic cell death. (Mehta, 2009) The effects will be greatest on rapidly dividing cells such as the mucosa. Remodeling





cells such as fibroblasts, osteoblasts and osteoclasts will show changes when they try to divide, such as during healing. Damage to the microvasculature results in initial hyperemia followed by endarteritis, thrombosis and eventual obliteration (Greenwood, 2005, Kumar, 2011).

One of the first symptoms of radiation complications is mucositis, which occurs 12- 17 days after the initiation of therapy. Mucosal inflammation varies with dosage, target size and duration of therapy. Oral mucositis can present as patchy mild erythema to frank confluent ulceration. Chemotherapeutic agents such as procarbazine, methotrexate, etc., may increase the severity of these symptoms. Currently, there are no drugs available to prevent mucositis, and it is imperative to distinguish these lesions from those caused by infections (Kumar, 2011). Other complication in mandibula is osteoradionecrosis. The incidence of osteoradionecrosis varies widely in the literature ranging from 1% to 37%. Increasing the external beam radiation dose above 50 Gray gives a significantly increased risk for developing osteoradionecrosis (Rayatt, 2007). After radiotherapy (particularly chemoradiotherapy), salivary hypofunction magnifies these effects and often leads to rapid deterioration in the dentition (Shawa, 2011).

Hyperbaric Oxygen Therapy (HBOT) is a medical treatment by which 100% oxygen is administered at greater than normal pressure to a patient in order to treat specific medical indications (Gill, 2004). The use of HBO for the management of irradiation-damaged tissues was introduced in the 1970 (Greenwood, 2005). HBO was used in oral and maxillofacial surgery for the management of osteoradionecrosis in particular, and an reporting the superiority of HBO over antibiotics strengthened the position of HBO as an important therapy. This was followed by a proposed protocol using HBO for irradiated patients requiring osseointegrated implants. HBO therapy is thought to increase the tolerance of the tissue to ischaemia and to improve the survival possibility of ischaemic tissue. The stimulation of osteogenesis by HBO has been reported in



Boyle's law, which states that the volume of gas in an enclosed space is inversely proportional to the pressure exerted on it, governs this process and explains some of the beneficial effects of hyperbaric oxygen in conditions caused by the formation of gas bubbles. At 2.8 atmospheres, bubble volume is reduced by almost two thirds. Hyperbaric oxygen hastens the dissolution of the inert-gas bubble by replacing the inert gas in the bubble with oxygen, which is then rapidly metabolized by the tissues. The use of hyperbaric oxygen also prevents the formation of new bubbles.

### **Biochemical And Cellular Effects HBO**

Local hypoxia predisposes wounds to infection, because the neutrophil-mediated killing of bacteria by free radicals is decreased. Hyperbaric oxygen restores this defense against infection and increases the rate of killing of some common bacteria by phagocytes and suppresses clostridial production of alpha toxin. Adequate oxygen tension is a prerequisite for the formation of collagen matrix, which is essential for angiogenesis. In irradiated tissue, hyperbaric oxygen is more effective than normobaric oxygen in increasing the partial pressure of oxygen to a level that promotes the formation of collagen matrix and angiogenesis. (Gill, 2004, Mehta, 2009, Shawa, 2011 )

Neutrophils have been implicated as the prime endogenous culprit in reperfusion injury. Adhering to the walls of ischemic vessels, they release proteases and produce free radicals, leading to pathologic vasoconstriction and extensive tissue destruction. Hyperbaric oxygen inhibits neutrophil adherence and postischemic vasoconstriction in ischemic rat tissue. (Greenwood, 2005, Mehta, 2009)





### **Clinical Features post irradiated tissues**

Intraorally, the mucosa may be dry with frothy sputum, but these are relatively acute changes following radiotherapy. The patient may have a non-resolving painful mucosal ulcer with evidence of exposed bone or sequestrum. This is usually in the posterior mandibular region. There may be trismus and this usually appears 3-6 months following radiotherapy. There may be exposed bone seen through the skin, in the form of an oro-cutaneous fistula or the patient may present with a pathological fracture. (Rayyat, 2007)

### **Complications of radiotherapy in mandibula**

Radiation therapy impairs cellular proliferation, causing a progressive, obliterative endarteritis which results in hypocellular, hypovascular, and hypoxic tissue. (Gill, 2004) One of the first symptoms of radiation complications is mucositis, which occurs 12- 17 days after the initiation of therapy. Mucosal inflammation varies with dosage, target size and duration of therapy. Oral mucositis can present as patchy mild erythema to frank confluent ulceration. Currently, there are no drugs available to prevent mucositis, and it is imperative to distinguish these lesions from those caused by infections. Lack of saliva and damaged taste buds may alter the sensation of taste during radiotherapy. Clinically observed late or post radiation-induced atrophy (tissue damage) and telangiectasis (blood vessel, spider-like red spots) of the mucosa often increase the risk for pain and/or necrosis. (Rosenbaum, 2002, Kumar, 2012)

The mandible is among the bones most frequently affected by irradiation and has a higher risk than the maxilla. Osteoradionecrosis is one of the more serious complications of head and neck irradiation for cancer. Bone cells and vascularity may be irreversibly injured. If radiation osteonecrosis is progressive, it can lead to intolerable pain or fracture and may necessitate jaw resection. The risk for developing spontaneous osteoradionecrosis is somewhat unpredictable,

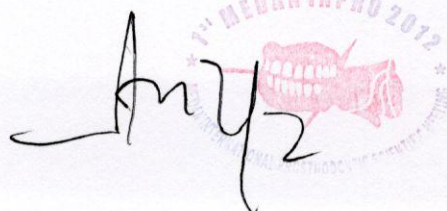


but it is related to the dose of radiation delivered (usually more than 6000 cGy) and bone volume. The risk is increased in patients without dentures and even more if teeth within the treatment field are removed after therapy. Spontaneous bone exposure usually occurs more than one year after radiation is completed. The risk for osteonecrosis continues indefinitely following radiation therapy. (Shawa, 2011)

### **Pathophysiology and Radiotherapy Effects**

Soft tissue radionecrosis results from damage done to non-osseous tissues by ionizing radiation during the course of radiotherapy. The powerful beams destroy some tumor masses, but the new therapy also exacts a toll on the body. Tissues in the path of the radiation beam suffer damage. Once the patient is exposed to the radiation beam, tissue damage begins. The layer of endothelium supplying the irradiated area starts to proliferate, resulting in a proliferative endarteritis. This proliferation, most often noted in the capillaries, continues and interferes with the normal processes of supplying blood to irradiated areas. The tissue begins to manifest ischemic changes, and may become frankly necrotic. (Al-Waili, 2005, Shawa, 2011) Injuries are due to direct and near immediate cellular toxicity caused by free radical-mediated damage to cellular DNA. Many cells suffer a mitotic or reproductive death, i.e. enough damage has been rendered to the DNA that successful subsequent mitosis is prevented (Rayatt, 2007)

In irradiated areas, ischemia and necrosis can occur. Ischemic tissue may survive without adequate blood supply for a long period of time, until a traumatic or infectious incident triggers the events leading to extensive tissue death. There is no spontaneous resolution from the vasculitis and the inflammation progresses after completion of the radiotherapy. Surgeons attempting repair confront numerous complications. The area surrounding the lesion is also





damaged. When attempting to graft to or rotate a flap, surgeons must connect to tissues that are ischemic and hypoxic. Procedures often fail because the tissue does not heal due to ischemia. (Salgadam, 2008, Shawa, 2011)

### **Discussion**

Irradiation can produce both early and late tissue changes. Early effects include those of salivary glands, skin, and oral mucosa, whereas later effects involve bone changes leading to demineralization, fibrosis, increased susceptibility to infection, and finally, avascular necrosis (Greenwood, 2005). Irradiated tissues lose the capacity for restorative cellular proliferation, leading to decreased vascularity, local hypoxia, and eventually, necrosis. This loss manifests itself clinically as edema, ulceration, bone necrosis, increased risk of infection, and poor wound healing, processes that can persist for years treatment. (Rosenbaum, 2002, Kumar, 2011)

Hyperbaric oxygen therapy promotes healing through enhancing white blood cell activity and initiating formation of new peripheral vascular vessels and nerve endings in damaged areas. Pressurized oxygen has healing capabilities. Oxygen expands and gets into the tissues and stimulates formation of new blood vessels, which leads to healing. One hundred percent oxygen at 1 atmosphere produces insufficient tissue oxygen gradients for wound healing in irradiated tissue, but higher arterial partial pressures of oxygen result in new blood-vessel growth and partial healing. Hyperbaric O<sub>2</sub> therapy improves host immune response by increasing leukocyte oxidative killing of bacteria. It is cytotoxic to anaerobes and, therefore, decreases morbidity and mortality in various necrotizing infections. Hyperbaric O<sub>2</sub> therapy enhances the transport of aminoglycosides across the cell wall increasing the efficacy of these antibiotics. It also reduces local tissue edema by arterial vasoconstriction while maintaining higher than normal local oxygen tissue delivery. Decreased edema ensures better penetration of O<sub>2</sub> and nutrients to injured





tissue. Hyperbaric oxygen therapy has known to enhance collagen deposition in hypoxic tissues as well as in increasing angiogenesis. (Greenwood T, 2005)

At the cellular level, these benefits must be mediated by cytokines. Recent data by Mustoe *et al.* demonstrate that HBOT modulates the signal transduction pathway that regulates the gene expression for PDGF \_ receptor. HBOT enhances angiogenesis in ischemic irradiated tissue as reported by Marx *et al.* Kang *et al.* proved experimentally *in vitro* that HBO increases fibroblast formation and Thom *et al.* showed that HBO causes mobilization of stem cells which is crucial for injury repair. (Mehta, 2009)

Before hyperbaric-oxygen therapy was available, reconstruction of previously irradiated mandibular tissue in patients with oropharyngeal and other head and neck tumors was often unsuccessful, with complications, including osteonecrosis, soft-tissue radio necrosis, mucositis, dermatitis, and laryngeal radionecrosis, developing in 50 to 60 percent of patients. With hyperbaric oxygen, success rates of up to 93 percent have been reported among selected patients. In an unblinded, controlled trial, 30 hyperbaric-oxygen treatments were more effective in preventing the development of mandibular osteoradionecrosis than penicillin in 37 previously irradiated patients. In a preliminary analysis of 160 irradiated patients undergoing soft-tissue flap surgery, preoperative therapy with hyperbaric oxygen was superior to routine care in reducing wound dehiscence, infections, and delayed wound healing. (Murphy, 2011) When osteoradionecrosis develops, tissue destruction devolves into breakdown of overlying tissues and symptomatic destruction of bone. During this process, the response to antibiotics can be poor. In many cases, the situation can be improved with the use of HBO therapy. Hyperbaric oxygen has been shown to be more effective than penicillin. Patients being treated with penicillin typically show a significantly higher rate of necrosis than those being treated with hyperbaric oxygen,





with only 5 - 30% of patients able to expect remission of ORN through conservative therapy. Hyperbaric treatment allows more oxygen to reach the damaged areas, and helps prevent tissues from dying from lack of blood and oxygen flow. (Salgadam, 2008, Kumar, 2011) The therapy is painless, and it is capable of producing a wide range of effects, including increased oxygen delivery to injured tissue, greater blood vessel formation, advanced wound healing, improved infection control, preservation of damaged tissue, elimination of toxic substances, and reduced effects from toxic substances. (Kumar, 2011)

The Effects Of Hyperbaric Oxygen On Irradiated Tissues in stimulating angiogenesis is an obvious and important mechanism whereby hyperbaric oxygen is effective in radiation injury. Marx's demonstration of increased cellularity and vascularity in patients who have received hyperbaric oxygen for mandibular osteoradionecrosis. The impact of hyperbaric oxygen in terms of its beneficial effects is likely to involve all three of the above mechanisms in irradiated tissues: 1) to stimulates angiogenesis and secondarily improves tissue oxygenation; 2) to reduces fibrosis; and 3) to mobilize and stimulate an increase of stem cells within irradiated tissues. The third mechanism is at this point putative and remains to be proven in radiation damaged tissues. Treatment with hyperbaric oxygen therapy (HBOT) has remarkably changed the treatment of soft tissue necrosis disease. HBOT allow tissues and vessels to be hyperoxygenated. By providing inhaled 100 percent oxygen under pressure, the arterial  $PO_2$  is raised five to 10 times above normal. This strategy promotes healing. For example, HBOT causes a marked increase in oxygenation of oxygen depleted, and therefore, marginally viable tissue. Due to the very high oxygen concentrations achievable intravascularly with HBOT, the diffusion distance of oxygen into the tissues is increased two to three times. As a result, a much larger volume of tissue becomes oxygenated by the remaining blood vessels. The hyperoxia stimulates fibroblast





proliferation and collagen synthesis, which provide a matrix for the development of new blood vessels into the area at a faster rate than the usual. Conclusion HBOT effective for treatment for edentulous irradiated mandible patients.

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