

**Comparison between the Efficacy of Novamin™ and Pro-argin™ Toothpastes  
in Dentin Permeability**

**การเปรียบเทียบประสิทธิผลของยาสีฟันที่มี Novamin™ และ Pro-Argin™ ต่อ  
การซึมผ่านของของเหลวทางท่อเนื้อฟัน**

Kullanun Lertpimonchai (กุลนันทน เลิศพิมลชัย)\* Chantrakorn Champaiboon (จันทร์กร แจ่มไพบุญ)\*\*

**ABSTRACT**

**Aims:** To compare the efficacy of Novamin™ and Pro-Argin™ toothpastes on dentin permeability. **Material and Methods:** Sixty dentin discs from third molars were etched with EDTA for 24 hours, then brushed with toothpastes containing fluoride, Novamin™ or Pro-argin™. Dentin permeability was measured before and after brushing. Other 5 discs were used to determine dentinal tubule occlusion using SEM. **Results:** Dentin treated with 3 toothpastes created tubule occlusion. The percentage reduction of dentin permeability were 39.26, 32.27 and 21.71 for groups of Pro-argin™, Novamin™ and fluoride, respectively. Only the difference in percentage reduction between Pro-argin™ and fluoride groups was significant. **Conclusion:** All 3 products occluded dentinal tubules and reduced dentin permeability. The single-use of Pro-argin™ toothpaste was more effective in reducing dentin permeability than fluoride toothpaste.

**บทคัดย่อ**

**วัตถุประสงค์:** เพื่อเปรียบเทียบประสิทธิผลของยาสีฟันที่มี Novamin™ และ Pro-Argin™ เป็นส่วนประกอบในการลดการซึมผ่านของของเหลวผ่านท่อเนื้อฟัน **วัสดุและวิธีการ:** นำแผ่นเนื้อฟัน 60 ชิ้นจากฟันกรามซี่ที่สาม แช่ในสารละลายเอ็ดทีเอ 24 ชั่วโมง และแปรงด้วยยาสีฟันที่มีฟลูออไรด์ Novamin™ หรือ Pro-Argin™ แล้ววัดการซึมผ่านของของเหลวก่อนและหลังแปรง แผ่นเนื้อฟันอีก 5 ชิ้น วัดการอุดตันของท่อเนื้อฟันด้วยกล้องจุลทรรศน์อิเล็กตรอนแบบส่องกราด ผล: ผลึกกันทั้ง 3 ชนิดอุดตันท่อเนื้อฟันและร้อยละของการลดการซึมผ่านของของเหลวคือ 39.26, 32.27 และ 21.71 ในกลุ่ม Pro-Argin™ Novamin™ และฟลูออไรด์ตามลำดับ โดยยาสีฟันที่มี Pro-Argin™ ลดการซึมผ่านของของเหลวได้มากกว่ายาสีฟันฟลูออไรด์อย่างมีนัยสำคัญ สรุป: ยาสีฟันทั้ง 3 ชนิดสามารถอุดตันและการลดการซึมผ่านของของเหลวได้ โดยยาสีฟันที่มี Pro-Argin™ มีประสิทธิผลมากกว่ายาสีฟันที่มีฟลูออไรด์หลังแปรงเพียง 1 ครั้ง

**Keywords:** Dentin hypersensitivity, Novamin™, Pro-Argin™

**คำสำคัญ:** อาการเสียวฟัน โนวามิน™ โปร-อาร์จิน™

\* Student, Residency Training Program in Periodontology, Faculty of Dentistry, Chulalongkorn University

\*\* Assistant Professor, Department of Periodontology, Faculty of Dentistry, Chulalongkorn University

## Introduction

Dentin hypersensitivity is most common complaints of individuals seeking for dental treatments. The prevalence of dentin hypersensitivity ranges from 4% to 57% (Cummins, 2010) and increases to 62.5% to 90% following periodontal therapy (Lin and Gillam, 2012). It is characterized by short and sharp pain which responds to external stimuli on exposed dentin typically thermal, air spray, tactile, osmotic or chemical stimuli which cannot be recognized by any other forms of dental defects or diseases. The common causes of exposed dentin are gingival recession and enamel loss from improper tooth brushing or periodontal disease progression and its treatment (Addy, 2002; Canadian Advisory Board on Dentin Hypersensitivity, 2003; Markowitz and Pashley, 2008).

The mechanism of dentin hypersensitivity was described by Brännström (Brännström, 1966). Starting from, external stimuli on exposed dentin induce movement of dentinal fluid, change pressure across dentin which activates intra-pulpal nerve fibers then causes pain (Addy, 2002; West, 2006). The finding from scanning electron microscopy (SEM) showed that higher numbers as well as larger sizes of dentinal tubules were detected in sensitivity teeth which consequently elevate fluid flow rate in sensitivity teeth (Absi et al., 1987; Absi et al., 1989; Addy, 2002).

For treating dentin hypersensitivity, a number of dental products were developed basically based on two distinct approaches: (i) Interruption of neural response to pain stimulus or (ii) Occlusion of exposed and open dentinal tubules to block hydrodynamic mechanism of pain stimulation.

Recently, new materials have been developed to induce the formation of a dentin-like layer which resists to mechanical and chemical stimuli by sealing and blocking exposed tubules. So far, this method shows more effective in reducing dentin hypersensitivity than neural interrupting method.

Calcium sodium phosphosilicate, commercially called “Novamin™” was first introduced for in-office use in mid-1990s. When calcium sodium phosphosilicate contacts with saliva, it releases calcium and phosphate ions then form hydroxyapatite crystals to seal and block exposed dentinal tubules. Moreover, residual calcium sodium phosphosilicate particles can block tubules as well (Rajesh et al., 2012). An *in-vitro* study showed Novamin™ containing toothpaste can create a hydroxyapatite-like layer to seal dentinal tubules of a dentin disc (Earl et al., 2011) and the blockade is more stable than that of silica-containing toothpaste. Furthermore, the Novamin™ toothpaste also reduce dentin permeability (Wang et al., 2010). A clinical study showed that the Novamin™ toothpaste was more effective than strontium-based and placebo toothpastes in reducing dentin hypersensitivity following the 6-week use. (Du et al., 2008).

The later, arginine calcium carbonate which is commercially called “Pro-argin™” is a new substance developed in mid-1990s similarly to Novamin™. Arginine and calcium which have positive charges in physiologic pH bind to dentin surfaces in turn form a calcium-rich layer for sealing and blocking exposed dentinal tubules (Kleinberg, 2002). An *in-vitro* study showed that the Pro-argin™ toothpaste blocked or narrowed dentinal tubules of a dentin disc after brushing for 2 minutes and the

blockade was more stable than that of strontium chloride-containing toothpaste (Li et al., 2012). Moreover, Pro-argin™ toothpaste reduced dentin permeability more effective than strontium acetate toothpaste did (Patel et al., 2011). Clinical studies also showed similar results on reducing dentin hypersensitivity after use for 2-, 4- and 8-weeks (Ayad et al., 2009a; Docimo et al., 2009). Furthermore, an instant relief of dentin hypersensitivity after single application Pro-argin™ on sensitive dentin has been reported (Ayad et al., 2009b).

Until now, the evidence in the comparison between the efficacy of Novamin™ and Pro-Argin™ on dentin hypersensitivity is still limit. Mostly, several studies focused on the efficacy of dentinal tubule occlusion but lack of data to support the effect of these two products on dentin permeability. Therefore, this study aimed to compare the efficacy of Novamin™ and Pro-Argin™ containing toothpastes on dentin permeability and dentinal tubule occlusion which may contribute to further develop guideline on the use of these products in treating dentin hypersensitivity.

### **Objectives of the study**

1. To compare between the efficacy of Novamin™ and Pro-Argin™ toothpastes in dentinal tubule occlusion.
2. To compare between the efficacy of Novamin™ and Pro-Argin™ toothpastes in dentinal permeability.

### **Methodology**

#### *Dentin sample preparation*

Sixty-five extracted third molars were collected after the study protocol approved by the

Human Research Ethics Committee of the Faculty of Dentistry, Chulalongkorn University (HREC-DCU2015-054). Teeth were cleaned and stored in 1% thymol.

Dentin specimens were cut perpendicular to long axis above the cemento-enamel junction to create 1 mm-thick dentin disc by a low-speed water cooled diamond saw (Isomet®1000). Each dentin disc was prepared and examined to assure that the specimen was free of coronal enamel and no pulpal exposure.

#### *SEM analysis*

Five dentin discs were used to evaluate dentinal tubule occlusion. Each dentin disc was etched with 0.5 M ethylenediamine tetra-acetic acid (EDTA) for 24 hours, then split into 4 pieces for:

- No treatment (as baseline).
- Brush with the fluoride toothpaste for 1 minute.
- Brush with the Novamin™ toothpaste for 1 minute.
- Brush with the Pro-Argin™ toothpaste for 1 minute.

After that, each specimen was air-dried at room temperature. A scanning electron microscope was used to examine dentin disc morphology.

#### *Experimental design*

Sixty dentin discs were soaked in 0.5 M EDTA for 24 hours to remove the smear layer and smear plug. The etched disc was rinsed and kept moist to evaluate the maximum permeability (100% permeability). Next, dentin discs were randomly assigned to 3 groups of 20 dentin discs. The dentin disc was then soaked with artificial saliva and brushed with fluoride toothpaste for 1 minute as a

control. While test groups were brushed with either NovaMin™ or Pro-Argin™ toothpastes.

The permeability of each dentin disc was re-measured and results were presented as the percentages of maximum EDTA-etched permeability. (Wang et al., 2011)

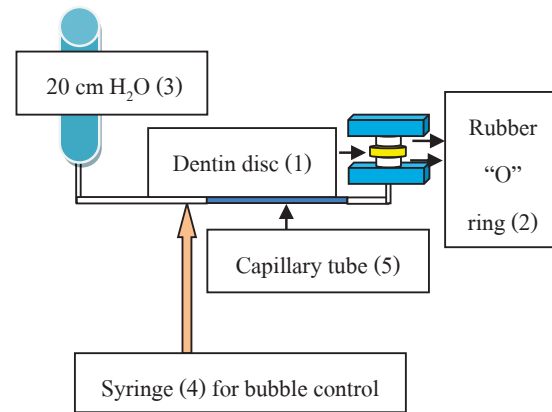
#### Dentin permeability measurement

Dentin permeability measurement system was set as shown in Figure 1. A dentin disc (1) was placed tightly between double rubber “O” rings (2), which had surface area approximately 0.78 cm<sup>2</sup> for filtration of water. The upper “O” ring was covered with the glass slab to seal the system and the lower “O” ring was connected to the water-filled system at 20 cm H<sub>2</sub>O (3), which mimics the pulpal pressure. An air bubble was introduced into the water-filled system by a syringe (4). Then, the dentin permeability of a dentin disc was determined by measuring the duration of the movement of air bubble through the capillary tube (5). The duration of the movement of bubble was converted to hydraulic conductance (L<sub>p</sub>) for each dentin disc, by dividing the fluid flow (J<sub>v</sub>) by the exposed dentin surface area (A) and water pressure (P) (Pashley et al., 1996).

$$L_p = J_v/A(P)$$

J<sub>v</sub>; fluid flow (μL/min), A; surface area for fluid filtration (cm<sup>2</sup>) and P; pressure (cm H<sub>2</sub>O)

The percentages (%L<sub>p</sub>) of dentin permeability were calculated. The mean percentage reduction (%L<sub>p</sub>) between before and following brushing on the same disc was considered as the efficacy in reducing dentin permeability of each group.



**Figure 1** Dentin permeability measurement system.

#### Statistical analysis

The data were analyzed using SPSS version 17.0 (SPSS Inc., Chicago, IL, USA). Results were presented in median (range). The non-parametric Kruskal-Wallis test was used to determine the difference of percent reduction of dentin permeability among 3 groups. A p-value less than 0.05 was considered as statistically significant.

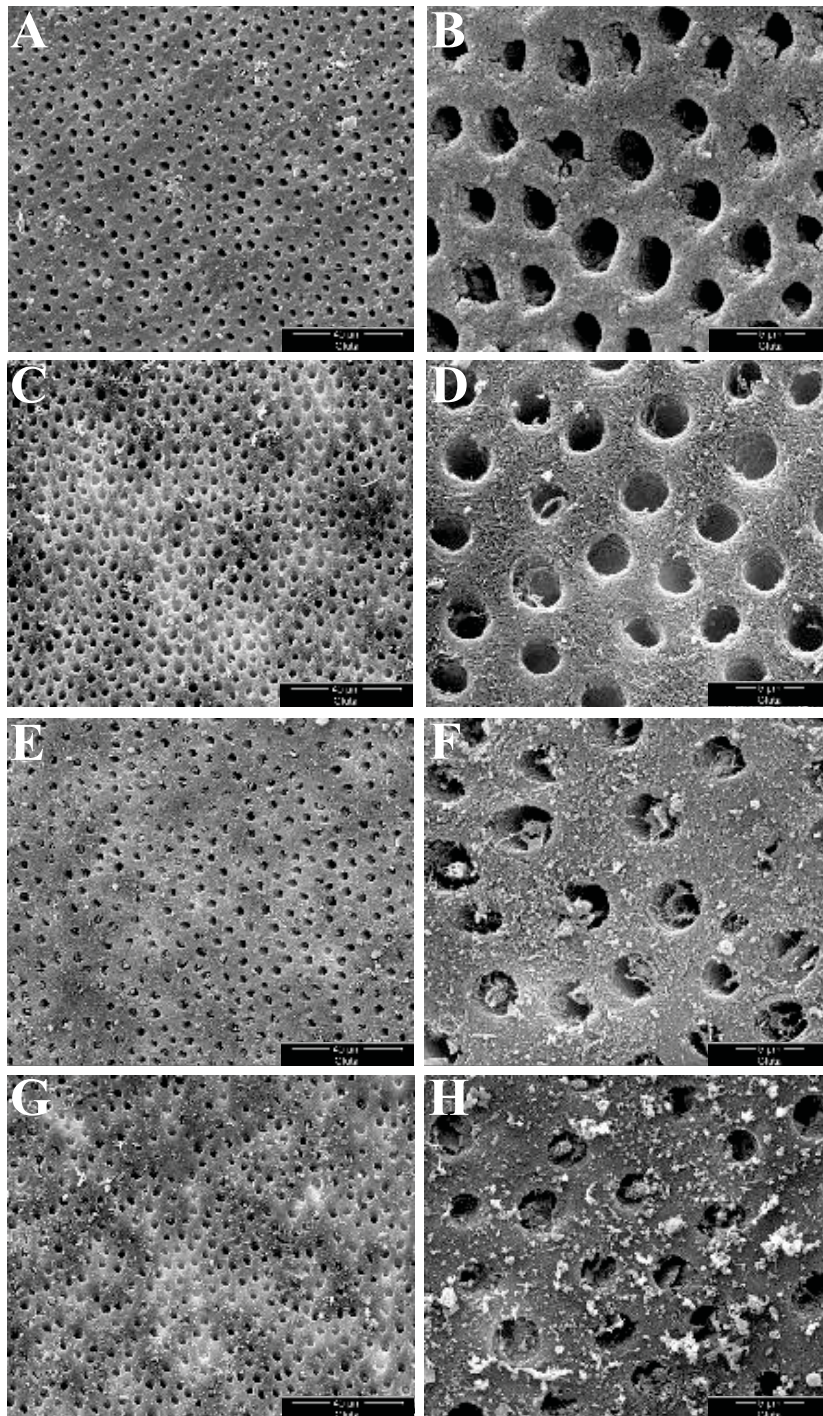
## Results

#### SEM evaluation

SEM results showed in Figure 2. The left panel showed dentin surfaces at 2000X and the right panel showed dentinal tubule orifices in higher magnification (10000X).

After EDTA etched for 24 hours, dentin surfaces were free from the smear layer and smear plug (Fig. 2A). Most of dentinal tubules were completely open (Fig. 2B). Dentin treated with fluoride toothpaste exhibited fine debris on dentin surfaces however most of tubules were still open (Fig. 2C, D). Dentin treated with Novamin™ toothpaste showed a large amount of deposits on both dentin surfaces and orifices of dentinal tubules (Fig. 2E, F). Dentin treated with Pro-argin™ toothpaste seemed to show larger amount of deposits on dentin surfaces





**Figure 2** SEM images of dentin surface morphology at 2000X (left) and 10000X (right). Each dentin disc was etched with EDTA for 24 hours (Fig. 2A and B) and then brushed for 1 minute with fluoride (Fig. 2C and D), Novamin™ (Fig. 2E and F) or Pro-argin™ (Fig. 2G and H) toothpastes.

and orifices of dentinal tubules than Novamin™ and fluoride toothpastes. In addition, at a high magnification, complete occlusion was observed in Pro-argin™ group (Fig. 2G, H).

*Dentin permeability measurement*

The decreased hydraulic conductance (Lp) following brushing in all 3 groups indicated the reduction of dentin permeability (Table 1). In addition, the differences of Lp values before and following brushing with fluoride, Novamin, Pro-argin toothpastes were statistically significant.

**Table 1** Lp data before (Pre Tx) and following brushing (Post Tx) dentin discs with fluoride, Novamin™, Pro-argin™ containing toothpastes. Values were shown in median (range).

	Pre Tx	Post Tx	p-value
<b>Fluoride</b>	0.17 (0.02-1.46)	0.10 (0.01-0.93)	0.0001*
<b>NovaMin™</b>	0.14 (0.01-1.91)	0.12 (0.01-0.95)	0.0001*
<b>Pro-argin™</b>	0.18 (0.02-0.96)	0.11 (0.01-0.50)	0.0001*

\* Compared between pre- and post- treatment of each group.

The percentage reduction of dentin permeability after using 3 different toothpastes were calculated from reduction of 100% permeability of EDTA-etched showed in table 2. After brushing for 1 minute, Pro-argin™ seemed to show the highest potential reduction of dentin permeability (Lp ~39.26%). Novamin™ and fluoride toothpaste uses were able to reduce dentin permeability but the degrees of reduction (32.27% and 21.71%,

respectively) were probably inferior to that of Pro-argin™. The difference in percentage reduction of dentin permeability among 3 toothpastes was statistically significant. Furthermore, when compared between groups, Pro-argin™ exhibited more effective in reducing dentin permeability than fluoride toothpaste (p = 0.0119). However, the differences on the percentage reduction of dentin permeability between fluoride and NovaMin™ groups as well as between NovaMin™ and Pro-argin™ groups were not statistically significant (Table 2, Figure 3).

**Table 2** Dentin permeability reductions. Values (expressed as %) were shown in median (range).

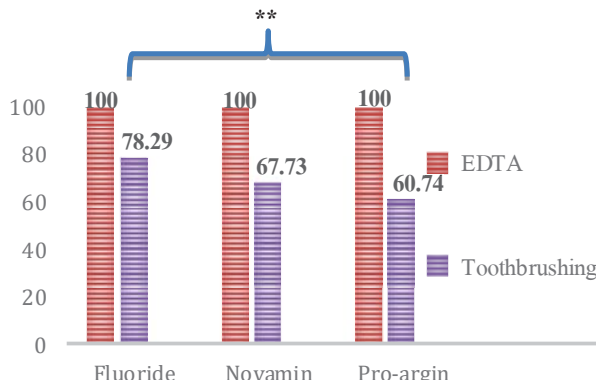
	Fluoride	Novamin™	Pro-argin™
<b>EDTA</b>	100	100	100
<b>Tooth brushing</b>	78.29 (48.49-99.46)	67.73 (10.10-88.23)	60.74 (19.17-91.78)
<b>%reduction</b>	21.71** (0.54-51.51)	32.27 (11.77-89.90)	39.26** (8.22- 80.83)

\*\* Compared the reduction of dentin permeability between groups.

**Discussion**

Nowadays, several methods have been introduced for treating dentin hypersensitivity. The traditional approach is to occlude dentinal tubules then block pain mechanism following hydrodynamic concept. The uses of Novamin™ and Pro-Argin™ are current technologies that have been developed to induce the formation of dentin-like layers for sealing and blocking exposed dentinal tubules in turn reduce dentin hypersensitivity. This

study aimed to compare the efficacy in reducing dentin permeability and dentinal tubule occlusion following Novamin™ and Pro-Argin™ containing toothpaste use.



**Figure 3** Percentage reduction of dentin permeability following treatments.

\*\* Compared percentage reduction of dentin permeability between fluoride and Pro-argin™ groups.

The SEM results was in agreement with previous studies which showed tooth brushing can create dentinal tubule occlusion. However, the degrees of tubule occlusion depend on active ingredients available in each toothpaste (Rajesh et al., 2012; Earl et al., 2011; Wang et al., 2010; Kleinberg, 2002; Li et al., 2012; Patel et al., 2011). Markowitz and Pashley described that hydraulic conductance depended on numbers and diameters of dentinal tubules, therefore the reduction of patent dentinal tubules could decrease dentin permeability (Markowitz and Pashley, 2008). This finding implies that the more tubules are occluded, the more dentin permeability are possibly reduced.

The evidence from both *in-vitro* and *in-vivo* confirmed that Novamin™ and Pro-argin™ have higher ability in blocking dentinal tubules as well as reducing dentin permeability than other available

desensitizing agents (Earl et al., 2011; Li et al., 2012). Our study showed that fluoride toothpaste may have the lowest effect on blocking of dentinal tubules and reducing dentin permeability similarly to previous report.

The percentage reduction of dentin permeability were 39.26, 32.27 and 21.71% following using Pro-argin™, Novamin™ and fluoride toothpastes, respectively. Even though, the difference in percentage reduction of dentin permeability n between Novamin™ and Pro-argin™ groups was not statistically significant, our study is the first report in the comparison between the efficacy of Novamin™ and Pro-argin™ usages.

Even though, our SEM results shows some deposits and occluded dentinal tubules following Novamin™ and Pro-argin™ treatments, the amount of deposits and occluded tubules were lesser than those of previous studies (Wang et al., 2010; Li et al., 2012). Wang and colleagues showed almost completely occluded dentinal tubules after a single use of Novamin™ toothpaste (Wang et al., 2010). While Li and colleagues showed the same result after applied Pro-argin™ twice daily for 4 days (Li et al., 2012). The differences of degree of dentinal tubule occlusion may be explained by different treatment protocols. Our protocol was brushing 1 minute with soft brush while the former protocol was brushing 2 minutes with medium hardness brush (Wang et al., 2010). The increasing time of brushing is possibly increasing chance for Novamin™ to react with saliva then create dentin-like structure for blocking tubules. Similarly, increased exposure time of Pro-argin™ for 4 days also induced more dentin-like structure on the dentin disc. (Li et al., 2012).



Our dentin permeability result also showed lesser percentage reduction of dentin permeability following Novamin™ (Wang et al., 2010) and Pro-argin™ use (Patel et al., 2011). The reason is probably due to distinct of brushing protocols as describe earlier. However, no previous evidence reported on the comparison between the efficacy of Novamin™ and Pro-argin™ toothpastes in reducing dentin permeability.

A clinical study showed no difference in reduction of dentin hypersensitivity between Novamin™ and Pro-argin™ toothpastes after single use (Rao et al., 2014). However, Novamin™ showed significantly more reduction of dentin hypersensitivity after 15-day follow up when compared with Pro-argin™ (Rao et al., 2014). In contrast, another study showed that Pro-Argin™ was more effective in reducing dentin hypersensitivity than that of Novamin™ after 2-, 4- and 8- weeks use (Docimo et al., 2011). Since this study evaluated the efficacy of these toothpastes following single-use, a further study on longer term used of these toothpastes needs to be conducted.

### Conclusion

All 3 toothpastes including Pro-argin™, Novamin™ and fluoride containing toothpastes, occluded dentinal tubules and reduced dentin permeability. Among three toothpastes, only Pro-argin™ containing toothpaste had a superior effect on reducing dentin permeability to fluoride toothpaste.

### Acknowledgements

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# FULLPAPERS

# NIGRC2016

The National and International Graduate Research Conference 2016  
Graduate School, Khon Kaen University, Thailand and  
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January 15, 2016

Venue: Pote Sarasin Building, Khon Kaen University

Graduate School, Khon Kaen University, Thailand



# The National and International Graduate Research Conference 2016

Graduate School, Khon Kaen University, Thailand and  
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## Conference Schedule

The National and International Graduate Research Conference 2016

January 15, 2016

at Pote Sarasin Building, Khon Kaen University

08.15 – 09.00 am	Registration (in front of the room no. GL 315, 3 <sup>rd</sup> Floor)
09.00 – 09.10 am	Graduate School Video Presentation
09.10 – 09.50 am	<p>Opening Ceremony (Room no. GL 315, 3<sup>rd</sup> Floor)</p> <ul style="list-style-type: none"> <li>- Report Address by Assoc. Prof. Dr. Surasakdi Wongratanacheewin, Dean of Graduate School</li> <li>- Welcome Speech by Administrator of Universitas Muhammadiyah Yogyakarta, Indonesia</li> <li>- Opening Remarks by Assoc. Prof. Dr. Kittichai Triratanasirichai, President of Khon Kaen University</li> <li>- Outstanding Alumni Awards</li> </ul>
09.50 – 10.20 am	<ul style="list-style-type: none"> <li>- Video Presentation of the 2014 Prof. Dr. Kanok Wongtrangan Excellent Dissertation Award</li> </ul> <p>The award was given to Dr. Sampan Thinwiangthong, a student of Doctor of Philosophy Program in Mathematics Education, and the advisor, Assoc. Prof. Dr. Suladda Loipha, Faculty of Education. The research is on the topic of “Small-group Mathematical Communication in Classroom in Lesson Study and Open Approach Context”.</p>
10.25 – 11.30 am	<p>Keynote Speaker on “Graduates : Global &amp; Citizens”</p> <p>Assist. Prof. Surakit Nathisuwan, Deputy Dean for Planning and Quality Development, Faculty of Pharmacy, Mahidol University</p>
12.00 – 01.00 pm	Lunch
11.00 am – 03.30 pm	<ul style="list-style-type: none"> <li>- National Oral Presentation</li> </ul> <p>Room no. GL 212-219, 2<sup>nd</sup> Floor, Pote Sarasin Building, Khon Kaen University</p> <p>Doctoral Degree</p> <ul style="list-style-type: none"> <li>● Humanities and Social Sciences (Room no. GL 219, 2<sup>nd</sup> Floor)</li> </ul> <p>Master’s Degree</p> <ul style="list-style-type: none"> <li>● Humanities and Social Sciences (Room no. GL 218 and GL 217, 2<sup>nd</sup> Floor)</li> <li>● Physical Science (Room no. GL 212 and GL 213, 2<sup>nd</sup> Floor)</li> <li>● Health Science 1 (Room no. GL 216, 2<sup>nd</sup> Floor)</li> <li>● Health Science 2 and Biological Science (Room no. GL 214, 2<sup>nd</sup> Floor)</li> </ul>
11.00 am – 03.30 pm	<ul style="list-style-type: none"> <li>-International Oral Presentation</li> </ul> <p>Room no. GL 112, 119, 141, and 149, 1<sup>st</sup> Floor, Pote Sarasin Building, Khon Kaen University</p> <p>Doctoral Degree</p> <ul style="list-style-type: none"> <li>● Humanities and Social Sciences (Room no. GL 112, 1<sup>st</sup> Floor)</li> <li>● Science and Technology (Room no. GL 119, 1<sup>st</sup> Floor)</li> </ul> <p>Master’s Degree</p> <ul style="list-style-type: none"> <li>● Humanities and Social Sciences (Room no. GL 149, 1<sup>st</sup> Floor)</li> <li>● Biological Science and Physical Science (Room no. GL 141, 1<sup>st</sup> Floor)</li> <li>● Health Science (Room no. GL 119, 1<sup>st</sup> Floor)</li> </ul>
01.00 – 02.30 pm	<p>National and International Poster Presentation (all fields)</p> <p>at Room no. GL 314, 3<sup>rd</sup> Floor, Pote Sarasin Building, Khon Kaen University</p>
04.30 -06.00 pm	<p>Certificate Awarding Ceremony at GL 315, 3<sup>rd</sup> Floor</p> <ul style="list-style-type: none"> <li>-Awarding the 2015 Outstanding Khon Kaen University Dissertation</li> <li>-Awarding the 2015 Distinguished Research Presentation (National and International Presentation)</li> <li>-Certificate for Outstanding Presentation NIGRC2016</li> </ul>

National Oral Presentation Schedule

Health Science 1 (Master's Degree)

at Room no. GL 216, 2<sup>nd</sup> Floor, Pote Sarasin Building

No.	Code	Time	Name - Surname	University	Program Study	Title	Page
	MMO1	11.00-11.15 am	Miss Suthasinee Sapsang	Naresuan University	Public Health	The Effect of the Innovation of Data Providing Combined with Pictogram for Antibiotic Dry Syrup Utilization towards the Understanding of Parents Having Children with Upper Respiratory Tract Infection Disease in Kongkrailas Hospital, Kongrailas District, Sukhothai Province	587
2	MMO2	11.15-11.30 am	Mr.Sut Buntho	Naresuan University	Public Health	Effectiveness of Community Waste Management Using 5 Rs. Program: A Case Study of Thung Sai Sub-district, Kamphaeng Phet Province	594
3	MMO3	11.30-11.45 am	Mrs.Naiyarat Krongchon	Burapha University	Health Promotion	Effectiveness of Tai Chi Exercise Program on Pulmonary Function among COPD Patients in Panatnikom Hospital, Chon Buri	601
4	MMO4	11.45 am-12.00 pm	Mr.Chaiwat Tawarungreung	Khon Kaen University	Biostatistics	Returning to Nursing Career among Exited Nurses: Evidence from Health and Working Life of Registered Nurses in Thailand – Thai Nurse Cohort Study	614
12.00 – 01.00 pm Lunch							



No.	Code	Time	Name - Surname	University	Program Study	Title	Page
5	MMO5	01.00-01.15 pm	Mr.Palakorn Sripoonthong	Mahidol University	Clinical Psychology	Attitude, Knowledge, Self-awareness and Tobacco Smoking Behavior among Patients with Cancer Receiving Chemotherapy at Siriraj Hospital	622
6	MMO6	01.15-01.30 pm	Mr.Theeraphon Lopradit	Naresuan University	Public Health	Effect of Smoking Prevention Program among Students who Attended Secondary Extended Opportunities School in Khirimas District Sukhothai Province	634
7	MMO7	01.30-01.45 pm	Mr.Suksanti Ngamgam	Khon Kaen University	Adult Nursing	Buddhist Monks' Perceptions Concerning Good Death	645
8	MMO8	01.45-02.00 pm	Miss Chitchawan Kongkasem	Mahidol University	Public Health Nursing	A Program Enhancing Adaptation of Patients with End Stage Renal Disease Treatment by Continuous Ambulatory Peritoneal Dialysis	-, *

National Oral Presentation Schedule

Health Science 2 (Master's Degree)

at Room no. GL 214, 2<sup>nd</sup> Floor, Pote Sarasin Building

No.	Code	Time	Name - Surname	University	Program Study	Title	Page
9	MMO9	01.00-01.15 pm	Mr.Surat Kamsuk	Khon Kaen University	Adult Nursing	The Prevalence and Factors Related to Intracranial Hemorrhage in the Mild Traumatic Brain Injuries of Patients Admitted to the Emergency Room of Maharat Nakhon Ratchasima Hospital	656

No.	Code	Time	Name - Surname	University	Program Study	Title	Page
10	MMO10	01.15-01.30 pm	Mrs.Arunrat Utaisang	Khon Kaen University	Adult Nursing	Factors Associated with Severity Level of Post-Concussion Syndrome in Patients with Mild Traumatic Brain Injury	668
11	MMO11	01.30-01.45 pm	Mr.Kritsada Pruksaphon	Chiang Mai University	Microbiology	Rapid Diagnosis of <i>Penicillium marneffeii</i> Infection by Using Yeast Specific Monoclonal Antibody 4D1	678
12	MMO12	01.45-02.00 pm	Miss Jeerapar Noiseeluang	Khon Kaen University	Medical Sciences	Phenotype and Genotype of <i>Cryptococcus neoformans</i> in Khon Kaen Province, Thailand	690
13	MMO13	02.00-02.15 pm	Miss Nattaya Wano	Chulalongkorn University	Physiology	Effects of Whole Body Vibration on the Healing of Pressure Ulcers in Mice	699
14	MMO14	02.15-02.30 pm	Miss Tawanchai Punyakom	Chiang Mai University	Microbiology	Generation and Preliminary Characterization of DENV-4/2 EDIII Chimeric Virus-like Particles	708
15	MMO15	02.30-02.45 pm	Mr.Akarachai Tubsakul	Khon Kaen University	Medical Physiology	Curcumin Mitigates Hypertension, Endothelial Dysfunction and Oxidative Stress in Rats Chronically Exposed to Lead	718

National Poster Presentation Schedule

Health Science 1 (Master's Degree)

at Room no. GL 314, 3<sup>rd</sup> Floor, Pote Sarasin Building

No.	Code	Time	Name - Surname	University	Program Study	Title	Page
1	MMP1	01.00-02.30 pm	Miss Malinee Saelim	Chiang Mai University	Microbiology	Generation and Characterization of DENV-1/2 EDIII Chimeric Virus like-Particles	726
2	MMP2	01.00-02.30 pm	Miss Lalita Khuna	Khon Kaen University	Physical Therapy	Ability of Lower Extremity Weight-bearing during Sit-to-stand in Patients with Spinal Cord Injury at Various Levels of Walking Ability	736
3	MMP3	01.00-02.30 pm	Mr.Nurdeen Bueraheng	Prince of Songkla University	Anatomy	Effects of Young Coconut Juice on Increasing Skin Thickness, Collagen Size and Number of Hair Follicle in Ovariectomized Rats	742
4	MMP4	01.00-02.30 pm	Mr.Phongpanot Ruamkaew	Khon Kaen University	Toxicology	Screening for Anti-inflammatory and Wound Healing Activities of Extract from Litsea glutinosa (Lour.) C.B. Rob. Leaves	751
5	MMP5	01.00-02.30 pm	Miss Parinyaporn Khonhan	Khon Kaen University	Pathology	Anal Cancer Screening by Cytology and HPV Testing in HIV-infected Patients Using Modified-LBC as Fixative	762
6	MMP6	01.00-02.30 pm	Miss Patcharee Saelin	Chulalongkorn University	Medical Science	Generation and Characterization of a Chimeric Viral Like Particle (VLP)-based Vaccine Candidate against Dengue Virus Serotype 2	768

No.	Code	Time	Name - Surname	University	Program Study	Title	Page
7	MMP7	01.00-02.30 pm	Miss Sutthida Kaewmoongkun	Khon Kaen University	Pharmacology	Clinical and Environmental Factors Affecting the Stable Dose of Warfarin Therapy	775
8	MMP8	01.00-02.30 pm	Miss Sopida Maneemart	Khon Kaen University	Physical Therapy	The Effect of Coconut Shell Stepping Exercise on Waking Speed in Type 2 Diabetes Mellitus Patients with Peripheral Neuropathy	784
9	MMP9	01.00-02.30 pm	Mr.Supakorn Pontham	Khon Kaen University	Medical Science	Effect of Extracted Compound from Bacterial Strains Isolated from Environmental Against Pythium insidiosum	793
10	MMP10	01.00-02.30 pm	Mr.Phichaya Suthivanich	Mahidol University	Physiology	The Correlation of CIP4 Expression with Glioma Cell Migration and Invasion	799
11	MMP11	01.00-02.30 pm	Miss Patraporn Tangkiratichai	Khon Kaen University	Obstetrics and Gynecology	Maternal Serum Angiogenic Growth Factors in Intrauterine Growth Restriction versus Normal Pregnancies	-, *
12	MMP12	01.00-02.30 pm	Miss Chutamas Wunpathe	Khon Kaen University	Medical Physiology	Carthamus tinctorius Extract Reduces Blood Pressure, Vascular Superoxide Production and Plasma Malondialdehyde in 2K-1C Hypertensive Rats	-, *

National Poster Presentation Schedule

Health Science 2 (Master's Degree)

at Room no. GL 314, 3<sup>rd</sup> Floor, Pote Sarasin Building

No.	Code	Time	Name - Surname	University	Program Study	Title	Page
13	MMP13	01.00-02.30 pm	Miss Paklekha Saenghuttawattana	Chiang Mai University	General Dentistry	Dental Patients' Perspectives in Aspects of Medical Humanities	805
14	MMP14	01.00-02.30 pm	Miss Kullananun Lertpimonchai	Chulalongkorn University	Periodontology	Comparison between the Efficacy of Novamin™ and Pro-argin™ Toothpastes in Dentin Permeability	815
15	MMP15	01.00-02.30 pm	Miss Prapussara Nonsung	Khon Kaen University	Restorative Dentistry	The Comparison of the Micro Push-out bond Strength in the MTA based Sealer the Bioceramic based Sealer and the Epoxy Resin based Sealer	825
16	MMP16	01.00-02.30 pm	Miss Chamchuri Sakchuchawan	Khon Kaen University	Restorative Dentistry	In vitro Comparison of Microleakage of Bulk- fill Resin Composites	833
17	MMP17	01.00-02.30 pm	Miss Wanida Piyawirojkul	Prince of Songkla University	Oral Health Sciences	Acid Production and Growth by Oral Bifidobacteria in vitro	842
18	MMP18	01.00-02.30 pm	Miss Attaporn Prueksakorn	Khon Kaen University	Restorative Dentistry	Effect of Thai Propolis Crude Extracts to Preserve the Viability of Human Periodontal Ligament Cells	848



No.	Code	Time	Name - Surname	University	Program Study	Title	Page
19	MMP19	01.00-02.30 pm	Miss Parima Nantarakchaikul	Prince of Songkla University	Oral Health Sciences	Effect of Yogurt Contained Probiotic Lactobacillus fermentum SD11 on Mutans Streptococci and Yeasts in Human Volunteers	858
20	MMP20	01.00-02.30 pm	Mrs.Neophachanh Syhavong	Khon Kaen University	Adult Nursing	Relationship between Knowledge, Risk Factors Perceived and Selected Factors to Prevention Behaviors Relating Pneumonia Infection among Adult People in Lao PDR	866
21	MMP21	01.00-02.30 pm	Mrs.Papitchaya Pukdeerach	Khon Kaen University	Community Health Development	Estimation of Cannabis Users in Udon Thani Province	878, **
22	MMP22	01.00-02.30 pm	Miss Kamonwan Sara	Khon Kaen University	Clinical Pharmacy	Prevalence and Factors Associated with Chronic Kidney Disease Stages 3-5 in Trakan Phuet Phon Hospital, Ubon Ratchathani	887, **

\* No Publication

\*\* Independent Study