

# Certificate of Attendance

This is to certify that

**Sirijit Pothiraksanont**

has participated as an

**Presenter**

in

**The 11<sup>th</sup> Dental Faculty Consortium of Thailand  
Academic Meeting and Research Presentation (DFCT 2013)  
and 30<sup>th</sup> Anniversary of the Dental Faculty Consortium of Thailand**

**7 - 9 May 2013**

**at Pullman Pattaya Hotel, Chonburi, Thailand**



A handwritten signature in black ink, reading "Sittichai Koontongkaew".

**Prof.Dr. Sittichai Koontongkaew**

Dean, Faculty of Dentistry, Thammasat University

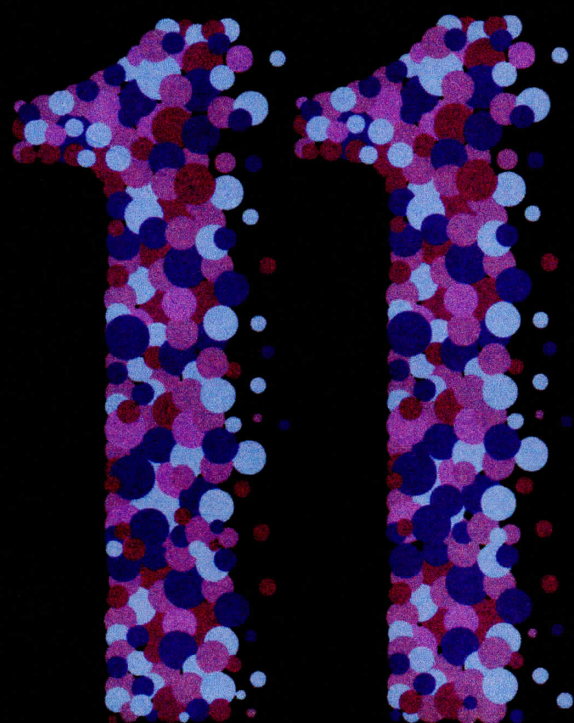
Conference Chair



# 30<sup>th</sup> Anniversary

# DFCT

The Dental Faculty Consortium of Thailand



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**Dental Faculty  
Consortium  
of Thailand  
Academic Meeting  
and Research  
Presentation  
(DFCT2013)**



**7-9 May, 2013**

Pullman Pattaya Hotel, Chonburi, Thailand

The Dental Faculty Consortium of Thailand  
Faculty of Dentistry, Thammasat University



## คำสั่งมหาวิทยาลัยธรรมศาสตร์

ที่ ๗๘๐/๒๕๕๖

เรื่อง แต่งตั้งคณะกรรมการดำเนินการจัดประชุมวิชาการ  
องค์กรผู้บริหารคณะทันตแพทยศาสตร์แห่งประเทศไทย ครั้งที่ ๑๑

ตามที่องค์กรผู้บริหารคณะทันตแพทยศาสตร์แห่งประเทศไทย มีมติให้คณะทันตแพทยศาสตร์ มหาวิทยาลัยธรรมศาสตร์ จัดประชุมวิชาการ องค์กรผู้บริหารคณะทันตแพทยศาสตร์แห่งประเทศไทย ครั้งที่ ๑๑ เพื่อให้การจัดงานเป็นไปด้วยความเรียบร้อย อาศัยอำนาจตามความในมาตรา ๒๕ แห่งพระราชบัญญัติมหาวิทยาลัยธรรมศาสตร์ พ.ศ. ๒๕๓๑ จึงขอแต่งตั้งคณะกรรมการ ดำเนินการจัดประชุม ดังรายนามต่อไปนี้

## คณะกรรมการอำนวยการ

- |   |                            |
|---|----------------------------|
| ๑. ศาสตราจารย์ ทันตแพทย์ ดร.สิทธิชัย ขุนทองแก้ว<br>คณบดีคณะทันตแพทยศาสตร์ มหาวิทยาลัยธรรมศาสตร์             | ประธานกรรมการ              |
| ๒. ผู้ช่วยศาสตราจารย์ ทันตแพทย์ ดร.สุจิต พูลทอง<br>คณบดีคณะทันตแพทยศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย             | กรรมการ                    |
| ๓. รองศาสตราจารย์ พาสน์ศิริ นิสาลักษณ์<br>คณบดีคณะทันตแพทยศาสตร์ มหาวิทยาลัยมหิดล                           | กรรมการ                    |
| ๔. รองศาสตราจารย์ ทันตแพทย์ ดร.ณรงค์ศักดิ์ เหล่าศรีสิน<br>คณบดีคณะทันตแพทยศาสตร์ มหาวิทยาลัยศรีนครินทรวิโรฒ | กรรมการ                    |
| ๕. รองศาสตราจารย์ ทันตแพทย์ ทองนารถ คำใจ<br>คณบดีคณะทันตแพทยศาสตร์ มหาวิทยาลัยเชียงใหม่                     | กรรมการ                    |
| ๖. รองศาสตราจารย์ ทันตแพทย์ ดร.ทศพล ปิยะปัทมินทร์<br>คณบดีคณะทันตแพทยศาสตร์ มหาวิทยาลัยนเรศวร               | กรรมการ                    |
| ๗. รองศาสตราจารย์ ทันตแพทย์หญิง ดร.นวิรัตน์ วราอัศวปติ เจริญ<br>คณบดีคณะทันตแพทยศาสตร์ มหาวิทยาลัยขอนแก่น   | กรรมการ                    |
| ๘. รองศาสตราจารย์ ทันตแพทย์ ดร.ไชรัตน์ เฉลิมรัตน์โรจน์<br>คณบดีคณะทันตแพทยศาสตร์ มหาวิทยาลัยสงขลานครินทร์   | กรรมการ                    |
| ๙. อาจารย์ ทันตแพทย์หญิง ดร.ภัคพร ภัทรพรนันท์   | กรรมการและเลขานุการ        |
| ๑๐. นางกนกกรดา ศรวารี   | กรรมการและผู้ช่วยเลขานุการ |

## โดยให้ปฏิบัติหน้าที่ดังต่อไปนี้

๑. กำกับดูแล ควบคุม ตรวจสอบ และส่งเสริมการประชุมวิชาการให้เป็นไปตามมติที่ประชุม อ.บ.ท.ท. ครั้งที่ 11
๒. ให้คำปรึกษาหารือ เสนอแนะการดำเนินการประชุม
๓. สรุปผลการประชุม การดำเนินงานเพื่อเสนอที่ประชุมองค์กรผู้บริหารฯ



**โดยให้ปฏิบัติหน้าที่ดังต่อไปนี้**

๑. รับลงทะเบียน ตรวจสอบการเข้าพัก
๒. ประสานงาน ติดตาม การลงทะเบียน การเข้าพัก การเข้าร่วมประชุม
๓. ดำเนินการอื่น ๆ ที่เกี่ยวข้อง

**คณะอนุกรรมการฝ่ายจัดเลี้ยง นันทนาการ**

- |   |                  |
|---|------------------|
| ๑. อาจารย์ ทันตแพทย์ ดร.ธนาศักดิ์ รัชชมณี   | ประธานอนุกรรมการ |
| ๒. อาจารย์ ทันตแพทย์หญิง นันทวรรณ กระจ่างตา | อนุกรรมการ       |
| ๓. อาจารย์ ทันตแพทย์หญิง ดร.กมลพรรณ ภัคดี   | อนุกรรมการ       |
| ๔. นางสาวทัศนวิวรรณ กันตรง                  | อนุกรรมการและ    |
| เลขานุการ                                   |                  |

**โดยให้ปฏิบัติหน้าที่ดังต่อไปนี้**

๑. จัดกิจกรรม การแสดง การจัดพิธีการต่าง ๆ
๒. ติดตาม กำกับดูแล ผู้ร่วมประชุมในงานเลี้ยงรับรอง
๓. ดำเนินการอื่น ๆ ที่เกี่ยวข้อง

**คณะอนุกรรมการฝ่ายพิธีการ จัดการประชุม**

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| ๑. ผู้ช่วยศาสตราจารย์ ทันตแพทย์ ดร.เลิศฤทธิ์ ศรีนภากร | ประธานอนุกรรมการ |
| ๒. อาจารย์ ทันตแพทย์หญิง ดร.พรรณมาภา สินธุประเสริฐ    | อนุกรรมการ       |
| ๓. นางสาวเพาพงา มณฑนะพิศุทธิ์                         | อนุกรรมการ       |
| ๔. นางสุภาวรรณ ตีร์ราภิ                               | อนุกรรมการ       |
| ๕. นางกนกธดา ศรवारี                                   | อนุกรรมการและ    |
| เลขานุการ   |                  |

**โดยให้ปฏิบัติหน้าที่ดังต่อไปนี้**

๑. ดำเนินการ กำกับดูแล และตรวจสอบการประชุมให้เป็นไปตามกำหนดการ
๒. ประสานงาน ติดตาม การขอลงทะเบียน การเข้าพัก
๓. ดำเนินการอื่น ๆ ที่เกี่ยวข้อง

**คณะอนุกรรมการฝ่ายโสตทัศนอุปกรณ์และการประเมินผล**

- |  |                  |
|--|------------------|
| ๑. อาจารย์ ทันตแพทย์หญิง ดร.วิสาขา อุปพงศ์ | ประธานอนุกรรมการ |
| ๒. นายสุริยะ ตีร์ราภิ                      | อนุกรรมการ       |
| ๓. นายพิชญ มลิชัยศรี                       | อนุกรรมการและ    |
| เลขานุการ                                  |                  |

**โดยให้ปฏิบัติหน้าที่ดังต่อไปนี้**

๑. ติดตั้ง ควบคุม กำกับดูแล ระบบเครื่องเสียง ระบบคอมพิวเตอร์
๒. ประสานงาน ติดตาม แจกแบบสอบถาม ประมวลผล สรุปรายงานผลการประเมิน
๓. ดำเนินการอื่น ๆ ที่เกี่ยวข้อง

**คณะอนุกรรมการฝ่ายอาคารสถานที่**

๑. ผู้ช่วยศาสตราจารย์ ทันตแพทย์หญิง ดร.ทิพวัลย์ เตชะนิธิสวัสดิ์
๒. นางสาวธัญนิษา ดวงจิตศิริ
๓. นางทิพวรรณ สังวร

ประธานอนุกรรมการ  
อนุกรรมการ  
อนุกรรมการและเลขานุการ

**โดยให้ปฏิบัติหน้าที่ดังต่อไปนี้**

๑. กำกับดูแล ตรวจสอบสถานที่จัดประชุม
๒. ประสานงาน ติดตาม การลงทะเบียน การเข้าพัก การเข้าร่วมประชุม
๓. ดำเนินการอื่น ๆ ที่เกี่ยวข้อง

**คณะอนุกรรมการฝ่ายสารานุกรม เอกสาร และประชาสัมพันธ์**

๑. ผู้ช่วยศาสตราจารย์ ทันตแพทย์ ยสนันท์ จันทรวิน
๒. อาจารย์ ทันตแพทย์หญิง วิสากานต์ บุญไพศาลเสรี
๓. นางสาวเขมจิรา เกรอด

ประธานอนุกรรมการ  
อนุกรรมการ  
อนุกรรมการและเลขานุการ

**โดยให้ปฏิบัติหน้าที่ดังต่อไปนี้**

๑. ดำเนินการจัดทำหนังสือ คู่มือ การประชาสัมพันธ์ แผ่นพับ ประกาศนียบัตร วุฒิบัตร
๒. ประสานงาน ติดตาม ควบคุมดูแล การจัดเอกสารเข้าร่วมประชุม
๓. ดำเนินการอื่น ๆ ที่เกี่ยวข้อง

ทั้งนี้ตั้งแต่บัดนี้เป็นต้นไป จนกว่าการดำเนินงานจะแล้วเสร็จ  
สั่ง ณ วันที่ ๒๓ เมษายน พ.ศ. ๒๕๕๖

(ศาสตราจารย์ ดร.สมคิด เลิศไพฑูรย์)  
อธิการบดีมหาวิทยาลัยธรรมศาสตร์

## Scientific Presentation Program

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### 7 May 2013

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- 13.45 – 14.30  
**KS01** Teaching and Research in 21st century.....26  
 Professor Dr. Vicharn Panich
- 14.30 – 15.00  
**IS02** The Metastatic Niche and Oral Cancer Progression.....28  
 Professor Dr. Sittichai Koontongkaew
- 15.15 – 15.45  
**IS03** Aloe vera: It is not just for skin anymore.....29  
 Associate Professor Dr. Pasutha Thunyakitpisal
- 15.45 – 16.15  
**IS04** Neurophysiology of the Intra-Dental Nerves and Sensory .....30  
 Mechanism of Dentine in Normal and Inflamed Pulp  
 Associate Professor Dr. Noppakun Vongsavan

### 8 May 2013

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- 09.00 – 09.30  
**IS02** Fluoride-Antibacterial Approaches to Improve Caries Control .....27  
 Professor J.M. (Bob) Ten Cate
- 09.30 – 10.00  
**IS05** Effect of Probiotics on Oral Health .....31  
 Professor Dr. Rawee Teanpaisan
- 10.00 – 10.30  
**IS06** Development of Thai Herbs for Oral Health .....32  
 Associate Professor Dr. Suwimol Taweekhaisupapong
- 10.45 – 11.15  
**IS07** Writing Case reports in Order to Understand Human Biology.....33  
 Dr. Piranit Kantaputra

**13.00 – 14.15 Oral Presentation****Session 1 Group 1****Chair Person: Asst.Prof.Dr. Nirada Dhanesuan**

- OP01** ADAM8 Up-regulation in Human Gingival Epithelial Cells .....37  
by *Fusobacterium nucleatum*  
*Suttichai Krisanaprakornkit\**, *Pattanin Montreekachon*,  
*Supansa Pata*, *Pareena Chotjumlong*, *Anupong Makeudom* and  
*Watchara Kasinrerak*
- OP02** Growth inhibitory effect of *Lactobacillus paracasei* SD1 on .....38  
*Candida* species: an In vitro study  
*Kanokporn Kampoo\** and *Rawee Teanpaisan*
- OP03** The antimicrobial efficacy of different pH values of sodium .....39  
hypochlorite on simulated *Enterococcus faecalis* biofilm  
*Chareerat Jitrong*, *Peraya Surapipongpuntr\** and *Visaka Limwongse*
- OP04** The effect of Poly (4-styrenesulfonic acid-co-maleic acid) .....40  
sodium salt polyelectrolyte multilayer films coated surface on in  
vitro mineralization and bone formation in rat model.  
*Prasit Pavasant\**, *Thidarat Angwarawong*, *Watchawadee Hoonwichit* and  
*Pornpen Jittivarangkool*
- OP05** The effects of Gelatin/eggshell's hydroxyapatite composite sheet .....41  
on MC3T3-E1 cells for bone tissue engineering  
*Nisakorn Pornsomchai\**, *Wanwisa Kongsong*, *Nanirat Suttipattarakorn*,  
*Suphunnarat Boonniyom*, *Pongsak Saleedaeng* and  
*Boontharika Chuenjittakuntaworn*

**Session 1 Group 2****Chair Person: Asst.Prof.Dr. Kanokporn Bhalang**

- OP06** Xerostomia, Hyposalivation and Oral Microbiota in Hypertensive Patients .....42  
*Vimonpun Nonzee*, *Somchai Manopatanakul* and *Siribang-on Khovidhunkit\**
- OP07** Oral hyperkeratosis in association with bacterial infection: a case report .....43  
*Chanwit Prapinjumrune\**, *Jinkyu Sakurai*, *Yusuke Nakajima*,  
*Norihiko Okada* and *Ken Omura*
- OP08** Effectiveness of acemannan in the treatment of oral aphthous ulceration .....44  
*Kanokporn Bhalang\** and *Pasutha Thanyakitpisal*
- OP09** Oral health and human papillomavirus colonization in HIV-infected patients.....45  
*Piamkamon Vacharotayangul\**, *Sorasun Rungsiyanont*,  
*Aroonwan Lam-Ubol*, *Tippawan Pankam*, *Piyanee Rodbamrung* and  
*Nittaya Phanuphak*
- OP10** Daily variation of oral malodour and related factors in .....46  
community-dwelling elderly Thai  
*Patcharaphol Samnieng\**



**Session 1 Group 3****Chair Person: Asst.Prof. Dr.Apirum Janhom**

- OP11** Corticotomy-assisted orthodontic tooth movement into recent .....47  
and healed extraction sites  
*Kaviya Kanokpongsak\* and Bancha Samruajbenjakun*
- OP12** An evaluation of the selection of extracted tooth in orthodontists .....48  
and a group of Thai people  
*Chidsanu Changsiripun\*, Chompunuch Tiyawongmana,  
Petchpailin Phusantisampan and Hathaiwan Ngamsukonthapusit*
- OP13** Root resorption after palatal expansion: a pilot study.....49  
*Syrina Tantidhnazet\* and Peerapong Santiwong*
- OP14** Associations of periodontitis and oral manifestations with CD4 .....50  
counts in HIV-pregnant women in Thailand  
*Pakkaporn Pattrapornnan\* and Timothy Derouen*
- OP15** Effect of Initial Periodontal Therapy Plus Air Polishing on .....51  
VEGF Level in Gingival Crevicular Fluid in Chronic Periodontitis  
*Thanasak Rakmanee\*, Kunasan Yonsakthanakul,  
Nithinun Sutam and Chutapa Talungjit*

**Session 2 Group 1****Chair Person: Assoc.Prof.Dr. Soisiri Thaweboon**

- OP16** MxA expression induced by  $\alpha$ -defensin in healthy human periodontal tissue .....52  
*Rangsini Mahanonda\*, N Sa-Ard-Iam, P Rerkyen,  
A Thitithanyanont, K Subbalekha and S Pichyangkul*
- OP17** Structural analysis of reactionary dentin formed in response to .....53  
polymicrobial invasion  
*Nattida Charadram\*, Christine Austin, Patrick Trimby,  
Mary Simonian, Michael Swain and Neil Hunter*
- OP18** Effect of Zingiber cassumunar-extract on CCL20 production .....54  
in LPS-induced fibroblasts  
*Kamolparn Pugdee\* and Sittichai Koontongkaew*
- OP19** Trigona sirindhornea propolis reduces progression of head .....55  
and neck cancer cell lines  
*Kusumawadee Utispan\* and Sittichai Koontongkaew*
- OP20** Effect of Eupatorium odoratum leaves extract on the viability .....56  
of primary human gingival fibroblasts  
*Paweena Kongkon, Jitrekha Samphantharat, Phonphanit Sivavetpikul,  
Siwaporn Nimit and Suwimon Jettanacheawchankit\**

**Session 2 Group 2****Chair Person: Asst.Prof. Dr.Yosananda Chantravekin**

- OP21** Alveolar ridge preservation with Platelet-rich fibrin compared .....57  
to epithelialized palatal free graft for implant site development:  
an experimental study in minipigs.  
*Srisurang Suttapreyasri\**, *Kantheera Buasod*, *Narit Leepong* and *Prisana Pripatnanont*
- OP22** Inoculation Injuries in Thammasat University Dental Students .....58  
*Yosananda Chantravekin\**, *Narissaporn Chaiprakit* and *Siripatra Patchanee*
- OP23** Evaluation of Collagen from Pericoronal Tissue of Impacted Third Molar .....59  
*Sorasun Rungsiyanont\**, *Marnisa Sricholpech* and *Siriwan Songwattana*
- OP24** Microbial decontamination of bone particles collected from osseous collector.....60  
*Krongporn Kongkrongtong\** and *Srisurang Suttapreyasri*
- OP25** Evaluation for obstructive sleep apnea using upright CBCT and .....61  
sleep questionnaire  
*Pongsatorn Kangvansurakit\**, *Onanong Silkosessak*,  
*Patita Bhuridej* and *Naricha Chirakalwasan*

**Session 2 Group 3****Chair Person: Asst.Prof.Dr. Lertrit Sarinnaphakorn**

- OP26** Comparison of Internal Gap between CAD/CAM Zirconia .....62  
MTEC and Lava  
*Lertrit Sarinnaphakorn\**, *Thitirat Chatchalermpan*,  
*Patarawin Arannart*, *Parichat Triwit* and *Nantawan Krajangta*
- OP27** A novel glass ionomer cement containing MgCO<sub>3</sub> apatite induced .....63  
the increased proliferation and differentiation of human pulp cells in vitro.  
*Arunee Laiteerapong\**, *Y Lochaiwatana* and *Suchit Poolthong*
- OP28** Satisfaction and Efficacy of a Novel Edible Gel-based Artificial Saliva.....64  
*Aroonwan Lamubol\**, *Buakhao Hongsachum*, *Worawalun Hirunwidchayarat*,  
*Worayut Kongkeaw*, *Panitnart Kanchanatiwat*, *Rudee Surarit*,  
*Visit Chavasit*, *Piamkamon Vacharotayangul*, *Tanadej Sinthusek* and  
*Dunyaporn Trachootham*
- OP29** Nutri-jelly improves QOL and decreases hospitalization in.....65  
H&N cancer patients.  
*Dunyaporn Trachootham\**, *Wasinee Songkaew*, *Buakhao Hongsachum*,  
*Jandane Karapoch*, *Wantanee Kriangsinyos*, *Chodchoi Wattana*,  
*Tanadej Sinthusek* and *Aroonwan Lam-Ubol*
- OP30** Development of new dental ceramics .....66  
*Pannapa Sinthuprasirt\**

## Poster Presentation

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### Group 1: Oral biology

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- PP01** Notch and Basic-Fibroblast-Growth-Factor Signaling in Mineralization of Mesenchymal Stem Cells .....67  
*Thanaphum Osathanon\**, *Nunthawan Nowwarote*, *Jeeranan Chamnannidiadha* and *Prasit Pavasant*
- PP02** RPS6 phosphorylation in oral epithelial dysplasia and squamous cell carcinoma .....68  
*Risa Chaisuparat\**, *S Rojanawatsirivej* and *S Yodsanga*
- PP03** Mechanical stress-induced IL-1 $\beta$  expression via ATP/P2X7 receptor-dependent pathway in human periodontal ligament cells .....69  
*Kavita Kanjanamekanant\**, *Pimporn Luckprom* and *Prasit Pavasant*
- PP04** Identification of Potential Bacterial Effectors from *Tannerella forsythia* in a Yeast Model .....70  
*Oranart Matangkasombut\**, *Peeraporn Punchai*, *Ratiboot Salapan* and *Skorn Mongkolsuk*
- PP05** Antibacterial activity of crofton weed (*Eupatorium adenophorum* Spreng) oil against caries-related bacteria .....71  
*K Koolkaew*, *J Brahmsakha Na Sakolnakorn* and *Panida Thanyasrisung\**
- PP06** Effect of Zingiber cassumunar-extract on CCL20 production in LPS-induced THP-1 .....72  
*Pantip Henprasert\**, *Apisada Chanwattanachote*, *Sasi Chantaramanee* and *Kamolparn Pugdee*
- PP07** Overexpression and Post-translational Modification of Akt2 in Oral Cancer Cells .....73  
*Prakasit Archewa\**, *Supansa Pata*, *Chayarop Supanchart*, *Suttichai Krisanaprakornkit* and *Anak Iamaroon*
- PP08** Antibacterial effect of propolis against *Streptococcus mutans* in vitro .....74  
*Sroisiri Thaweboon\**, *Boonyanit Thaweboon*, *Rattiporn Kaypetch* and *Thaniya Muadcheingka*
- PP09** Antimicrobial activity of Thai medicinal plant extracts against oral microorganisms .....75  
*Pajaree Kawsud\**, *Jindaporn Puripattanavong* and *Rawee Teanpaisan*
- PP10** In vitro inhibition of oral yeasts by vanillin .....76  
*Boonyanit Thaweboon\** and *Sroisiri Thaweboon*

- PP11** Aggregation and hydrophobicity properties of selected *Lactobacillus* spp.....77  
*Benchamat Sophatha\* and Rawee Teanpaisan*
- PP12** Antifungal and antibiofilm activity of *Artocarpus lakoocha* extract .....78  
against *Candida* spp.  
*Sukunlaya Senapong\*, Jindaporn Puripattanavong and Rawee Teanpaisan*
- PP13** Characteristics of *Clinacanthus nutans* Based on Extraction Methods .....79  
*Moehamad Orliando Roeslan\*, Thaweephol Dechatiwongse Na Ayudhya and Sittichai Koontongkaew*
- PP14** Aggregation abilities and cell surface characteristics of oral *Lactobacillus* .....80  
*fermentum* and *Lactobacillus salivarius*  
*Kamonchanok Pongpanit, Supatcharin Piwat\*, Rawee Teanpaisan and Nuchnaree Akkarachaneeyakorn*
- PP15** TLR2 and TLR4 expression in primary human hip and alveolar .....81  
bone cells during an in vitro differentiation  
*Supalak Phongprasertsakul\*, Indra Wongyaofa, Jaruma Sakdee, Prasit Pavasant and Nirada Dhanesuan*
- PP16** In vitro Antifungal Effect of Crude Royal Jelly Extract on *Candida albicans*.....82  
*Peeraphorn Wanapirom\*, Noppanant Trakiattikul, Thanyaphon Leesomprasong and Duangporn Srisuparbh*
- PP17** *Kaempferia parviflora* extracts promotes proliferation of human .....83  
dental pulp cells, in vitro.  
*Uthaiwan Arayatrakoollikit\* and Ariya Rattanathongkam*
- PP18** *Zingiber cassumunar* inhibits iNOS expression through suppression of NF- $\kappa$ B.....84  
*Paopa-Nga Monthanapisut\*, Sittichai Koontongkaew and Orapan Poachamukoon*
- PP19** Cytotoxicity and wound healing property of .....85  
*clinacanthus nutans* lindau extract on oral cells  
*Azima Imerbsin\* and Rudee Surarit*

**Group 2: Clinical study**

- PP20** In vivo biocompatibility of porous BCP in two different ratios .....86  
*Pongsakorn Praserttham\**, *Prisana Pripatnanont*, *Srisurang Suttapreyasri*,  
*Narit Leepong*, *Naruporn Monmaturapoj*
- PP21** Single Nucleotide Polymorphism Study of Occlusal Relationship .....87  
in a Group of Thai Population  
*Narubhorn Ongprakobkul*, *Virunpat Nitipong* and *Jaijam Suwanwela\**
- PP22** Tongue lesions: a retrospective study from Faculty of Dentistry, .....88  
Prince of Songkla University  
*Thanyaluk Saengtummakul*, *Tanchanok Bureesri*, *Pawinee Wiriyasatiankun*,  
*Ravivan Iemsaengchairat*, *Sureerat Tanwatana* and *Sompid Kintarak\**
- PP23** Reduced LL-37 Levels in GCF of Patients with Aggressive Periodontitis.....89  
*Samakorn Kulpawaropas\**, *Anupong Makeudom*,  
*Pattarin Montreekachon*, *Sakornrat Khongkhunthian*,  
*Thanapat Sastraruji* and *Suttichai Krisanaprakornkit*
- PP24** One visit subgingival ultrasonic debridement for periodontitis-diabetes patients.....90  
*Supanee Damrongkosit\**, *Serena Sakulnamanka* and *Narongsak Laosrisin*
- PP25** Laboratory evaluation of alpha-mangostin when used as root canal irrigant.....91  
*Ruchadaporn Kaomongkolgit\**, *Kusuma Jamdee*, *Jittima Pumklin* and *Prasit Pavasant*
- PP26** Genetic association study of dental caries in a group of Thai population.....92  
*Soranun Chantarangsu\**
- PP27** Physical factors associated to the occurrence of dental caries in child-patients.....93  
*Nathawut Kaewsutha\**, *Konvuth Laungrungrong*, *Chavarot Mapaisansin*,  
*Thananat Boon-In* and *Jarinya Chaiwiriya*
- PP28** Acemannan sponges stimulate alveolar bone, cementum, and .....94  
periodontal ligament regeneration in a canine class II furcation defect model  
*Pintu-On Chantarawaratit\**, *Pasutha Thunyakitpibal*, *Wijit Banlunara*,  
*Kumpanart Soontornvipart* and *Polkit Sangvanich*
- PP29** Openbite severity in a group of Thai skeletal Class III.....95  
*Pornnaree Suktongchaikul\**, *Phanpaporn Piriyayothin* and *Phawika Rungtamrat*
- PP30** The comparison of bacterial contamination ratio on examination .....96  
gloves from freshly opened boxes versus 14-day opened boxes in a dental clinic  
*Chaivut Prunkngarmpun\**
- PP31** Success and Failure of endodontic treatment by undergraduate .....97  
dental students  
*Wisakarn Boonpaisanseree\**, *Pim Kokanutaporn*,  
*Wannamart Srivichien* and *Panit Preeyaphat*

- PP32** Cortical bone thickness of posterior maxilla for orthodontic miniscrews.....98  
*K Nimcharoensuk, C Wongwittayapanit,  
N Chamnannidiadha and Soontra Panmekiate\**
- PP33** Effect of periosteal distraction by a new design of hyrax .....99  
device on bone formation in rabbit's model  
*Faisal Balabid\*, Prisana Pripatnanont, Settakorn Pongpanich and  
Surapong Vongvatcharanon*
- PP34** Effectiveness of a light sensor for distraction force measurement.....100  
*Lili Yang\*, Eduardo Yugo Suzuki and Boonsiva Suzuki*
- Group 3: Dental materials, Techniques** \_\_\_\_\_
- PP035** In vitro microleakage evaluation of a new two-step self-etch adhesive.....101  
*Nantawan Krajangta\*, Tongjai Chotitanmapong,  
Thipradi Phattharasophachai and Pear Bangsuwan*
- PP36** Physical properties of GIC containing monocalcium silicate .....102  
compared with MTA  
*Sirijit Pothiraksanont\*, Jaruma Sakdee and Punnama Siriphannon*
- PP37** Biocompatibility of monocalcium silicate – glass ionomer cement compound.....103  
*Wiroj Sangsawatpong\*, Jaruma Sakdee, Punnama Siriphannon and Suwit Wimonchit*
- PP38** Comparisons of wear resistance on acrylic denture teeth.....104  
*Hathairat Lekatana\*, Aphiwat Sedtasuppana, Lam Dorji,  
Yosatorn Ruenmarkkeo, Chatchawal Nedpokeaw and Sumet Korgpradit*
- PP39** Shaping Ability of Single-File Nickel-Titanium instruments in .....105  
Reciprocating Motion.  
*Paweenthas Wongsuwan and Chinalai Piyachon\**
- PP40** Microtensile bond strength of Vertise flow® composite; Use as pits .....106  
and fissures sealant.  
*Pongsiri Jaikumpun\*, Keerati Kiattang, Tawan Sangsue and  
Tuangrat Lertbusayanukul*
- PP41** Effect of surface treatments on bond strength of repaired .....107  
nanocomposite  
*Pavinee Padipatvuthikul Didron\**
- PP42** Effect of acidic drinks on erosive resistance of artificial white spot .....108  
enamel lesions infiltrated with resin  
*J Pornchottaweesus, Lochaiwatana Y and Suchit Poolthong\**

**Group 4: Public health, education, etc.**

- PP43** Musculoskeletal disorders in clinical dental students, Khon Kaen University.....109  
*Suwadee Aerarunchot\**, *Konpacha Sianglam*, *Thanapat Sripontong*,  
*Thanaporn Thonglert*, *Chananya Tangsirivoragarn* and *Subin Puasiri*
- PP44** A two-step flow model to stop bottle feeding among pre-schoolers.....110  
*Serena S Sakoolnamarka\**, *Phatanaphongse Chatiket*,  
*Orasa Krittayapipong*, *Vasavat Soontornvatin*,  
*Panchaluk Chatkaewboonruang*, *Chollathid Sukrakarn*,  
*Rungwarin Laohakanchanasiri*, *Jukkrapun Thongmalee*,  
*Chayanee Prakongsantikul*, *Attaporn La-Aithuk*,  
*Patamaporn Boonkleing* and *Chatchana Dedhome*
- PP45** Evaluation of reliability and validity of Professionalism .....111  
mini-evaluation exercise – Thai version  
*Chompunut Auisui\**, *Nomjit Vidhyaphum*, *Nantararat Winij* and *Chanchai Hosanguan*
- PP46** The evaluation of graduates of elective in dentistry subject of .....112  
oral surgery, Faculty of Dentistry, Naresuan University  
*Siras Sungkapreecha\**, *Phiangfah Kongkiatkool*,  
*Parissara Sortrakul* and *Peeraya Warasit*
- PP47** A system for predicting musculoskeletal disorders among dental students.....113  
*Bhornasawan Thanathornwong\**, *Siriwan Suebnukarn* and *Kan Ouivirach*
- PP48** Health-oriented Electronic Oral Health Record for Health Surveillance.....114  
*Mansuang Wongsapai\**, *Siriwan Suebnukarn* and *Sunsanee Rajchagool*
- PP49** Study of Health Literacy Level in Food - Venders at Bangluang .....115  
Market, Banglen, Nakhon Pathom  
*Pornpon Sampanyawai\**, *Jessada Nuchpruang*,  
*Tossaporn Rodchueajeen* and *Piya Siriphant*
- PP50** Health-oriented Electronic Oral Health Record: Evaluation using .....116  
Cognitive Task Analysis  
*Kwanwong Boonpitak\**, *Pawornwan Rittipakorn*,  
*Budsara Thongyoi* and *Siriwan Suebnukarn*

**9 May 2013** 

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09.00 - 09.30

- IS08** Interventions for Treating Oral Lichen Planus.....34  
Professor Dr. Kobkan Thongprasom

09.30 - 10.00

- IS09** Force Magnitudes for  
Orthodontic Tooth Movement: Clinical Research@CMU.....35  
Professor Dr. Dhirawat Jotikasthira

10.00 - 10.30

- IS10** Virtual Reality Dental Simulator .....36  
Associate Professor Dr. Siriwan Suebnukarn

**Full Paper** 

---

**117**

- FP01** In vivo biocompatibility of porous BCP in two different ratios.....118  
Pongsakorn Praserttham, Prisana Pripatnanont, Srisurang Suttapreyasri,  
Narit Leepong, Naruporn Monmaturapoj
- FP02** Antimicrobial activity of Thai medicinal plant extracts against .....124  
oral microorganisms  
Pajaree Kawsud, Jindaporn Puripattanavong and Rawee Teanpaisan
- FP03** One visit subgingival ultrasonic debridement for .....127  
periodontitis-diabetes patients  
Supanee Damrongkosit, Serena Sakulnamanka and Narongsak Laosrisin
- FP04** Reduced LL-37 Levels in GCF of Patients with Aggressive Periodontitis.....132  
Samakorn Kulpawaropas, Anupong Makeudom, Pattanin Montreekachon,  
Sakornrat Khongkhunthian, Thanapat Sastraruji and Suttichai Krisanaprakornkit
- FP05** Antifungal and antibiofilm activity of Artocarpus lakoocha .....138  
extract against Candida spp.  
Sukunlaya Senapong, Jindaporn Puripattanavong and Rawee Teanpaisan
- FP06** Evaluation for obstructive sleep apnea using upright CBCT .....142  
and sleep questionnaire  
Pongsatorn Kangvansurakit, Onanong Silkosessak,  
Patita Bhuridej and Naricha Chirakalwasan



- FP07** Overexpression and Post-translational Modification of Akt2 in .....146  
Oral Cancer Cells  
Prakasit Archewa, Supansa Pata, Chayarop Supanchart,  
Suttichai Krisanaprakornkit and Anak Iamaroon
- FP08** Biocompatibility of monocalcium silicate – glass ionomer cement compound .....150  
Wiroj Sangsawatpong, Jaruma Sakdee,  
Punnama Siriphannon and Suwit Wimonchit
- FP09** Root resorption after palatal expansion: a pilot study.....154  
Syrina Tantidhnazet and Peerapong Santiwong
- FP10** Microbial decontamination of bone particles collected from osseous collector.....157  
Krongporn Kongkrongtong and Srisurang Suttapreyasri
- FP11** Aggregation abilities and cell surface characteristics of oral .....161  
Lactobacillus fermentum and Lactobacillus salivarius  
Kamonchanok Pongpanit, Supatcharin Piwat,  
Rawee Teanpaisan and Nuchnaree Akkarachaneeyakorn
- FP12** Physical properties of GIC containing monocalcium silicate .....165  
compared with MTA  
Sirijit Pothiraksanont, Jaruma Sakdee and Punnama Siriphannon
- FP13** Effect of periosteal distraction by a new design of hyrax .....169  
device on bone formation in rabbit's model  
Faisal Balabid, Prisana Pripatnanont, Settakorn Pongpanich and  
Surapong Vongvatcharanon
- FP14** TLR2 and TLR4 expression in primary human hip and alveolar .....174  
bone cells during an in vitro differentiation  
Supalak Phongprasertsakul, Indra Wongyaofa, Jaruma Sakdee,  
Prasit Pavasant and Nirada Dhanesuan
- FP15** Effectiveness of a light sensor for distraction force measurement.....178  
Lili Yang, Eduardo Yugo Suzuki and Boonsiva Suzuki
- FP16** Health-oriented Electronic Oral Health Record for Health Surveillance .....183  
Mansuang Wongsapai, Siriwan Suebnukarn and Sunsanee Rajchagool

## Physical properties of GIC containing monocalcium silicate compared with mineral trioxide aggregate(MTA).

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### Abstract

Mineral trioxide aggregate(MTA) is currently a material of choice for many endodontic treatments but its prolong setting time and difficult handling characteristics prompted researcher to find an alternative. This study compared the setting time and compressive strength of ProRoot MTA(MTA) with GIC (Ketac™ Molar) and GIC containing monocalcium silicate(GIC-CS) 30% by weight. Methods: Six specimens in each group were prepared following manufacturer's instruction. The initial and final setting times were tested using Gilmore apparatus in the temperature and humidity control chamber. Compressive strength was measured using a universal testing machine at 1,3,7,21,28 days periods. The results showed that both initial and final setting times of the GIC-CS group were significantly less than that of MTA( $p < 0.05$ ). GIC-CS group showed significantly higher in compressive strength to MTA at 1 day period( $p < 0.05$ ) and no significant different at 3 and 7 days periods( $p > .05$ ). Conclusion: By adding of 30% CS into GIC shortened setting time and increased compressive strength at 1 days period when compared with MTA. This material could potentially used as a root-end filling or pulp capping material.

Keywords: Glass Ionomer Cements, MTA cement, calcium silicate ( $\text{CaSiO}_3$ ), Compressive Strength, Setting Time

### Introduction

Calcium silicate-based cements, such as mineral trioxide aggregate (MTA), have been shown to be biocompatible and bioactive[1]. Nowadays, MTA is successfully utilized for various endodontic therapies such as pulp capping, root-end filling, repair of perforations, apical barrier formation, and a root canal filling material[1-3]. However, MTA still has some disadvantages including its handling difficulty, prolong setting time [2, 3] and relatively high cost.

MTA consists primarily of tricalcium silicate ( $\text{Ca}_3\text{SiO}_5$ ) and dicalcium silicate ( $\text{Ca}_2\text{SiO}_4$ ), which are the major constituents contributes to its strength and bioactivity after hydration[4]. Several studies have investigated the properties of both calcium silicates modified by many methods in order to overcome MTA's drawbacks [5, 6]. None of the developed materials has yet to correct the issues. Recently, Siriphannon *et al.* [7-9] has synthesized monocalcium silicate ( $\text{CS}/\text{CaSiO}_3$ ) / pseudo-Wollastonite (ps-W) ceramics. This material is found to potentially form an apatite-like layer on their surface when come into contact with simulated body fluids faster than other forms of calcium silicate[7-9]. Shi *et al.* [10] in 2012 also found that the higher ratio of silicate/calcium content in calcium silicate cement to promote the more expression of cell attachment and proliferation. In this study, monocalcium sili-

cate is added to GIC in order to benefit from its self-setting through an acid-base reaction.

Glass ionomer cements(GICs) are currently used for various dental applications including root perforation repair and root-end filling materials[11]. GICs are composed of fluoroaluminosilicate glass and polyalkenoic acids, which are set by an acid-base reaction between the components. The advantages of glass ionomer cements over other materials are their ability to chemically bond to tooth structure and its cariostatic effect from released fluoride[12]. However, these materials are limited in their applications due to low wear resistance, brittleness and low compressive strength. [13] They also project more cytotoxicity to PDL cell than MTA in cell culture technique[11]. Costa *et al.* [14] found that conventional glass-ionomer cement (Ketac™ Molar) was the least cytotoxic material among other types of GICs.

Modification of GICs by adding of bioactive particles to improve biocompatibility and physical strength has been in the field of interest[12, 15-17]. For this reason, the new material; GIC containing monocalcium silicate compound (GIC-CS) has been developed in this study in order to combine the good characteristics of both materials together to yield a better result.

Therefore, this study aims to compare the physical properties of GIC-CS with conventional Ketac™ Molar. ( 3M ESPE ) (LOT 486812) and ProRoot MTA. (Dentsply Tulsa Dental) (LOT 11004374) *in vitro*.

### Materials and Methods

#### Preparation of monocalcium silicate (CS)

Monocalcium silicate (CS) was donated by Siriphannon *et al.* [7, 18] Briefly,  $\text{CaSiO}_3$  powders were prepared by coprecipitation using NaOH as the precipitant. The starting materials,  $\text{Ca}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$  and  $\text{Si}(\text{OC}_2\text{H}_5)_4$ , were dissolved in 500 mL of ethanol, stirred for 2 h, and their concentration adjusted to 0.2 mol/L. A precipitate was obtained by rapidly adding 300 mL of 0.33 mol/L NaOH to the solution. The precipitate was filtered, washed with distilled water, and oven-dried at 100°C overnight. The dried powder was calcined at 500° and 900°C to crystallize the  $\beta$ - $\text{CaSiO}_3$  phase. The chemical composition of the calcined powder was analyzed by X-ray fluorescence (XRF; RIX3000, Rigaku Co., Tokyo, Japan).

#### Preparation of the composites glass/cements (table 1)

##### • GIC(Ketac™Molar EasyMix)

To prepare GIC cement, GIC powder was manually mixed with the polyacrylic-tartaric acid, using plastic spatula, at powder:liquid ratio of 3:1 (mg/mL).

Table1- Experimental groups and composition of composites glass prepared.

Group	Cement types	CS powder (% wt)	GIC powder (% wt)
1	GIC (positive control)	-	100
2	CS 30	30	70
3	MTA (negative control)	MTA 100%	

**GIC-CS compound**

To prepare GIC-CS compound, CS powder 30% by weight [15] was uniformly mixed with GIC powder (table1) and then the compound was manually mixed with the polyacrylic-tartaric acid, using plastic spatula, at powder:liquid ratio of 3:1(mg/mL) for Ketac Molar and 2.5:1 (mg/mL) for CS.

**ProRoot MTA**

To prepare ProRoot MTA cement, ProRoot MTA powder was mixed with the supplied deionized water (powder:liquid ratio of 3:1 or 0.33 mL/g) on a glass slab with a stainless steel spatula [19].

**Setting time measurement**

Six samples of material in each group were tested. The Gilmore apparatus and cylindrical stainless steel molds (2.0 mm height with a 10.0 mm diameter) are used in this study by the recommendation of the ISO 6876:2001 [2, 20]. The experimental and control materials are mixed with different concentrations of CS and GIC for 40 seconds at room temperature (23°C ± 1°C). The initial and final setting time are measured indentation into materials with Gilmore-type needle. A Gilmore-type needle with a weight of 100±0.5g with a flat end of 2.0±0.1 mm in diameter is used to determine the initial setting time. Another Gilmore-type needle with a weight of 400±0.5g with a flat end of 1±0.1mm in diameter is used to determine a final setting time. The methodology was recommended by Bortoluzzi *et al.* in 2009 [21]. Then, the indenter tip is cleaned and repeated every 15 seconds. The setting time is determined when no indentation could be seen. All experiments are carried out in a temperature- and humidity-controlled chamber (37°C±1°C and 95% relative humidity) (Medical & Environmental Equipment Research Laboratory, Bangkok, Thailand). The mean values and standard deviations were recorded for all measurements. Statistical analyses were carried out using one-way ANOVA and Scheffe (P<0.05).

**Compressive strength**

The compressive strengths of test materials are determined according to the method recommended by the ISO 9917-1: 2007 specification for dentistry-water-based cement. [22, 23] Each material is mixed and placed in split stainless steel molds. (Cylindrical specimens 4 ± 0.1 mm in diameter and 6 ± 0.1 mm high). Each mold is packed to excess and compressed gently with glass plates on the mold. The whole assembly is transferred to an oven with a constant temperature of 37 ± 1 °C for 1 h after mixing. The specimens are ground with wet 400-grit silicon carbide paper. The specimens are removed from the molds and examined for voids and chipped edges. Defective specimens are discarded, and six acceptable samples are prepared for each test material for each time interval. The specimens are immersed in distilled water for 1 d, 3d, 7d, 21d and 28 days after mixing. The compressive strengths was measured using a universal testing machine (Lloyd LRX, Lloyd Instru-

ments, Fareham, UK) with cross-head speed of 1mm/min<sup>-1</sup>. The maximum load require to fracture each specimen is noted, and the compressive strength (C) is calculated in Megapascals (MPa) using the formula

$$C = 4P / \pi D^2$$

P = the maximum load applied (Newton) and D = the diameter of the specimen ( millimeter). Statistical analyses were carried out using one-way ANOVA and Scheffe (P<0.05).

**Results**

**Setting Time**

Table2 listed the setting times of test materials. There were significant differences in the setting times between the test groups (P < .05). Both initial and final setting times of the GIC-CS groups were significantly less than that of MTA. The addition of 30%CS to GIC increased the setting time of GIC.

Table2- Setting Times of Different Cement Types(n=6)

Cement types	setting time(min)	
	Initial	Final
GIC	4.42±0.20 <sup>a</sup>	5.50±0.35 <sup>a</sup>
CS30	6.58±0.52 <sup>a</sup>	8.38±0.34 <sup>b</sup>
MTA	63.67±2.42 <sup>b</sup>	121.50±2.66 <sup>c</sup>

Values are reported as mean ± standard deviation. The different superscript letters mean significant difference between the groups (P < .05) according to Scheffé *post hoc* multiple comparisons.

**Compressive Strength**

Table3 showed the compressive strength of the test materials for 28 days. The compressive strength of GIC-CS cement group was significantly lower than that of GIC ( P<.05) at all time points. The compressive strength of GIC-CS was significantly higher than that of MTA (P<.05) at 1 day periods then there were no significant different (P>.05) at 3 and 7days time points. However, the compressive strength of each cement tends to increase with time. (Fig.1)

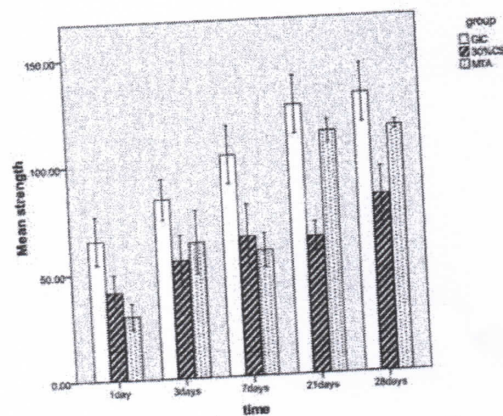


Figure1-Compressive Strength of different cement types.

Table 3- Compressive strength of Different Cement Types.(n=6)

Cement type	Compressive strength (MPa)				
	1day	3days	7days	21d	28d
GIC	65.42±11.12 <sup>a</sup>	83.77±9.44 <sup>a</sup>	103.73±13.72 <sup>a</sup>	126.00±13.56 <sup>a</sup>	130.67±13.68 <sup>a</sup>
GIC-CS	41.30±8.29 <sup>b</sup>	55.40±11.72 <sup>b</sup>	67.17±11.83 <sup>b</sup>	64.25±6.81 <sup>b</sup>	82.58±12.89 <sup>b</sup>
MTA	29.93±6.03 <sup>c</sup>	57.98±13.26 <sup>b</sup>	60.45±9.96 <sup>b</sup>	113.33±5.35 <sup>a</sup>	115.00±2.21 <sup>a</sup>

Values are reported as mean ± standard deviation. The different superscript letters mean significant difference between the groups ( $P < .05$ ) according to Scheffe *post hoc* multiple comparisons

## Discussion

There are several variables affecting the physical properties of cements such as the particle size, chemical composition, sintering temperatures of the powders, powder to liquid ratio, temperature/pH of the environment and mixing method[24]. Some of these factors cannot be controlled easily; therefore, variation from the previous studies might be expected during a study on physical properties of cements. For these reasons, our present study tried to control these factors by using only one operator and making of pilot study before collecting the results.

A number of investigations have been carried out to assess the mechanical properties of MTA [25] as a root-end filling material. This current study also found its setting time and compressive strength corroborated with the findings reported in these earlier studies [2]. GIC are composed of fluoroaluminosilicate glass and polyalkenoic acids, which are set by an acid-base reaction between the components. Even if it contains both calcium and phosphate, it does not show any bioactivity.<sup>[1,2]</sup> This acid-base setting reaction allowed addition of monocalcium silicate into the GIC-CS mixture to enhance its bioactivity. However, none of these studies were conducted using GIC-CS so far, our present study compared GIC-CS 30% with MTA and conventional GIC (Ketac™ Molar). Since monocalcium silicate (CS) has been studied as a potential bioactive material that can induce hard tissue formation in quite fast reaction.[7, 26] Therefore, adding CS glass enhanced bioactivity of GIC proportionately. However, this mixtures should allowed an acceptable physical properties.

The results showed that GIC-CS group gave an improvement for setting time and compressive strength when compared with MTA in 24 hours period. On the other hand, GIC-CS showed impaired in the compressive strength especially in the 21 and 28 days period. This implies that monocalcium silicate particles are not homogeneously incorporated into GIC composites, which is partially attributed to large particle sizes of monocalcium silicate (~63µm) compared to fluoroaluminosilicate particles (2.8-9.6 µm)[27]. Furthermore, GIC set product contained Aluminum cross-linking in both polyacrylate and silicate networks (aluminum carboxylate salt and aluminum polyacrylate), which had a higher compressive strength[28] than hydroxyapatite of CS. However, as a root-end filling material, it does not need to withstand for high pressure because it is not placed in the weight bearing area.

The present mixture GIC-CS exhibited distinctly shortened setting times (6-9mins) as compared with the setting time of MTA (>2 hours)[1]. This fast set reduces the risk of dislodgement and contamination when cements are used as root-end filling and pulp capping material. On the contrary, GIC-CS prolonged working (4.42 mins) and setting time (5.5mins) of GIC which is beneficial for use as a root-end filling material that need long time enough for placement and adjustment[29]. This prolonged setting time is due to the presence of Ca ion that retard with normal acid-base reaction and cross linking of

GIC. Furthermore, the working time and setting time of GIC-CS were adversely proportional to Si/Ca molar ratio, in agreement with a previous study of calcium silicate cements [10, 24]. Despite from a shorter setting time when compared to MTA, GIC-CS also possess a better handling characteristics which is similar to Ketac™ Molar. This putty consistency would allow easy manipulation and adaptation of the material without any special instrument. Additional studies by making of the smaller particle sizes of CS may elucidate the better compressive strength and other physical properties of the GIC-CS mixtures.

## Conclusion

The setting time of GIC-CS was less than 9 minutes, which were significantly lower than that of MTA (124 mins). The compressive strength of GIC-CS group (41.30±8.29 MPa) was significantly higher than that of MTA (29.93±6.03MPa) at 1 day time point. On the basis of the results, the adding of 30%CS into GIC displayed an advantageous shorten setting time and acceptable compressive strength then may have the potential to be a root-end filling or pulp capping material.

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