

University: The University of Hong Kong (HKU)
Faculty: Dentistry
Title of case study: Promoting child oral health and managing tooth decay in preschool children
<p>1. Summary of the impact (indicative maximum 100 words)</p> <p>We have done tremendous translational research and KE projects in promoting oral health and manage tooth decay in kindergarten children in Hong Kong in the past decades and have achieved significant impacts as follows: i) establish a comprehensive school-based oral health program namely ‘Jockey Club Children Oral Health Project’ funded by Hong Kong Jockey Club Charity Trust (\$HK 55M), ii) <u>implement the first territory-wide, low-budget, high-impact dental outreach service using silver diamine fluoride (SDF) for caries control in kindergarten children</u>, iii) obtain a satisfactory school participation rate (70%) and parental acceptability (80%) towards SDF treatment, iv) improve dental knowledge and awareness among parents and teachers (>90%), v) influence the guidelines and policy regarding the use of SDF for caries control by The American Academy of Paediatric Dentistry and World Health Organisation (WHO), vi) potentially influence the oral health policy for preschool children in Hong Kong.</p>
<p>2. Underpinning research (indicative maximum 500 words)</p> <p>Untreated tooth decay in primary teeth is a significant economic and health burden, affecting over 620,000 million children across the globe (Kassebaum et al. 2015). <u>Although tooth decay (dental caries) is largely preventable, it is still a significant public health problem among preschool children in Hong Kong</u> and many countries. The latest oral health survey conducted by the Hong Kong government in 2011 found that half (51%) of the 5-year-old children had dental caries. Moreover, over 90% of the decayed primary teeth were untreated. Access to dental care services is a problem for preschool children in Hong Kong because there is no public nor subsidized dental care service for them. Despite the recommendations from leading paediatric medical and dental organizations that children should visit the dentist in the early year of life, 75% of the 5-year-old children in Hong Kong never visited a dentist. Untreated caries can lead to pain and infection and affect children’s oral health-related quality of life. This calls for action and strategy to improve child oral health.</p> <p>HKU Faculty of Dentistry pioneered in conducting clinical research and knowledge exchange on how to improve child oral health and the use of SDF for caries control. This non-invasive SDF treatment can be an effective alternative to the traditional therapeutic approach (drill and fill) in managing dental caries in young children.</p> <p>1) Since 2001-present: World leading in SDF research</p> <p>A series of laboratory studies and clinical trials on preschool children were conducted and published in leading scientific dental journals [1-5]. In the randomized controlled clinical trials, SDF solution was painted onto the active carious lesions in the primary teeth of the study children in the test group once every 6 or 12 months. At the follow-up examinations, most (70%) of the SDF-treated lesions had become arrested, i.e., the soft carious dental tissues had turned hard and not progressed. Our clinical studies were the first to discovered that a higher concentration (38%) of SDF solution was more effective than a lower concentration (12%) and the semi-annual application was more effective than the annual application (Fung et al. 2017). No caries removal is needed (Chu et al. 2002).</p> <p>2) Since 2008-present: Translational research and engagement with NGOs and kindergartens</p> <p>Based on the promising research results of SDF in arresting dental caries [2,3,5], we have worked closely with different NGOs and kindergartens to promote child oral health through the HKU preschool oral health promotion programme using SDF for caries control in more than 100 kindergartens in Hong Kong. This large-scale pilot program successfully prevented and controlled tooth decay among preschool children through a cost-effective approach. Two main activities of the programme were: 1) provide an annual oral examination and, if necessary and</p>

with parental consent, topical application of SDF to the children in kindergarten; 2) oral health education for children, parents, and kindergarten teachers.

3) 2019- present: Establishment of territory-wide preschool oral health program

Due to the success of the pilot project, we have successfully received funding from the Hong Kong Jockey Club Charities Trust \$55.75 million to set up an upscale outreach dental program named “Jockey Club Children Oral Health Project (JCCOHP)” <https://www.jccohp.hku.hk> which is a cost-effective, high-impact project to reach all preschool children (\$HK 180 per child for dental screening and caries control) to improve access to dental care for all kindergarten children in 2019-2022.

4) 2017-present: Influence on oral health policy and collaboration with international experts

We developed our work further in consultation with international experts in World Health Organisation (Prof. Lo), International College of Dentists and International Association for Dental Research (Dr. Duangthip) and FDI World Dental Federation (Prof. Chu). For the local impact, due to the feasible and cost-effective program, it potentially influences the oral health policy for preschool children in Hong Kong in the future.

3. References to the research (indicative maximum of six references)

1. **Duangthip D**, Chen KJY, **Gao SS**, **Lo ECM**, **Chu CH**. Early childhood caries among 3- to 5-year-old children in Hong Kong. *Int Dent J*.2019;69:230-236.
2. **Duangthip D**, Wong MCM, **Chu CH**, **Lo ECM**. Caries arrest by topical fluorides in preschool children: 30-month results. *J Dent*. 2018;70:74-79.
3. **Duangthip D**, Fung MHT, Wong MCM, **Chu CH**, **Lo ECM**. Adverse effects of silver diamine fluoride treatment among preschool children. *J Dent Res*. 2018;97(4):395-401.
4. **Duangthip D**, **Gao SS**, Chen KJY **Lo ECM**, **Chu CH**. Oral health-related quality of life of preschool children receiving silver diamine fluoride therapy: a prospective 6- month study. *J Dent*. 2019;81:27-32.
5. Fung MHT, **Duangthip D**, Wong MCM, **Lo ECM**, **Chu CH**: Randomized clinical trial of 12% and 38% silver diamine fluoride treatment. *J Dent Res*. 2017;97(2):171-178.
6. **Gao SS**, Zhao IS, Hiraishi N, **Duangthip D**, Mei ML, **Lo ECM**, **Chu CH**: Clinical trials of silver diamine fluoride in arresting caries among children: a systematic review. *JDR Clinical & Translational Research*. 2016;1(3):201-210.

Key related research grants

1. Principal investigator: **Prof. CH Chu**. Co-investigator: **Prof. ECM Lo** and Prof. CKY Yiu. Title: Outreach Dental Service for Kindergarten Children. Grant amount \$55.75 M from The Hong Kong Jockey Club Charities Trust. (2019-2022)
2. Principal investigators: **Dr. D. Duangthip**. Co-investigator: **Prof. ECM Lo** and Prof. CH Chu: Effectiveness of silver diamine fluoride in preventing occlusal caries in primary teeth of preschool children: a 30-month randomized clinical trial. Grant amount \$ 1,400,464 from Health and Medical Research Fund, The Research Council, Hong Kong (2020-2024)
3. Principal investigator: **Dr. D. Duangthip**, Co-investigators: **Prof ECM Lo** and **Prof. Chu CH**. Title: We-Smile@Kindergarten: promoting oral health in preschool children with effective evidence-based approaches. Grant amount: HK\$ 814,472 from Health and Medical Research Fund (2019-2021)
4. Principal investigator: **Prof. CH Chu**. Co-investigator: Dr. Mei Lei. Title: A mechanistic study of silver diamine fluoride on dentine caries. Grant amount \$741040 from National Natural Science Foundation of China (2019) 81870812
5. Principal investigator: **Prof ECM Lo**, Co-investigators: **Dr CH Chu**, Prof MCM Wong. Title: Randomized clinical trial to compare the use of a non-restorative approach and a minimally invasive restorative approach in treating cavitated tooth decay in young children. Grant amount \$734,295 from RGC General Research Fund (2017) 17120217

6. Principal investigator: **Dr CH Chu**, Co-investigators: **Prof ECM Lo**, Prof MCM Wong.
Title: The effectiveness of the biannual application of silver nitrate solution followed by sodium fluoride varnish in arresting early childhood caries in preschool children: a 30-month, randomised, double-blind, non-inferiority trial. Grant amount \$1,034,997 from RGC General Research Fund (2015)17107315

4. Details of the impact (indicative maximum 750 words)

Low-budget and high-impact project to reach out all kindergarten children

During the pilot program in 2010-2018, more than 100 kindergartens participated in the pilot program. Approximately 229,000 preschool children (>85% participation rate) participated in the program. On average, approximately 19,000 preschool children participated in the oral examination, and 6,000 children with tooth decay received SDF treatment annually (>80% SDF acceptance rate) in 2010-2018.

Due to the success of the pilot program, the JCCOHP project which is a low-cost, high-impact oral health program has been established in 2019-2020. The cost for dental screening plus SDF treatment is approximately \$180 per child. Approximately, 76% of the invited schools (756/989) signed up the project in the year 2020-2021. More than 90% of the parents gave informed consent and allowed their children to participate in the dental examination and 79% of them accepted silver diamine fluoride (SDF) for caries control, if needed. This academic year (2021-2022), the on-going territory-wide project has collaborated with more than 700 kindergartens (>70% participation rate) despite the pandemic.

Major improvements in child oral health in preventing and arresting dental caries

Results of the clinical examinations show that there was a significant reduction in the prevalence of dental caries among the participating children, from 43% in 2010 to 34% in 2019. The success rate of SDF treatment in arresting dental caries was high (70%) (Fung et al. 2017). The use of SDF can maintain the oral health-related quality of life of the children (Duangthip et al. 2019). No significant adverse effects were reported (Duangthip et al. 2018). No cross-infection was observed despite the COVID-19 pandemic.

Raising dental knowledge and awareness and high satisfaction of children, parents and teachers

Besides the clinical outcomes of SDF treatment, the self-reported questionnaires regarding parents' and teachers' dental knowledge and awareness, and their satisfaction with the oral health programme were systematically collected. Overall, over 80% of parents and teachers returned a completed questionnaire. Nearly all (>95%) of the parents and teachers were very satisfied or satisfied with the programme. Over 90% of them reported that the programme helped raise their dental health knowledge and awareness, as well as improving their child's oral health. Approximately, 80% and 83% of the children reported that they felt happy before and after treatment, respectively. Most of the children (96%) had positive or very positive behaviours during the outreach.

Recognition on knowledge exchange and research on SDF treatment for caries management

Our research on caries management by using SDF ranks the top in the world in terms of the number of publications and citations following the web-based analytics solutions (<http://www.scival.com>). The success of our oral health program is recognised internationally. Our team was invited to give over 20 presentations about SDF and caries management in children both locally and internationally, such as in the USA, India, Chinese Mainland, Vietnam, Thailand, Indonesia, Philippines and Malaysia. Several prestigious research awards were obtained: 1) Winner of Cariology Research Award at the 34th IADR-SEA, Thailand, 2020, 2) Best Research (Cariology) Award at the 31st IADR SEA Division meeting, Taiwan in 2017; 3) IADR Cariology Research Group Science Award at the 94th IADR General Session held in Seoul, Korea in 2016; 4) IADR Colgate Research in Prevention Award at the 92nd IADR General Session held in South Africa in 2014. We have also successfully transferred the knowledge regarding the use of SDF for caries control in the communities in Southeast Asia funded by the International College of Dentists (ICD) section XV.

Impact on new guideline of SDF by the American Academy of Paediatric Dentistry and WHO

Our research and KE work on the use of SDF for caries management has drawn the attention of the dental profession internationally. Our clinical research has shown that SDF is highly effective in arresting dental caries and it can be applied in a community setting. Thus, it becomes particularly useful for treating caries in young children with limited access to dental care. Our team was invited to be a working group to support the global oral health policy in the application of the SDF inclusion in the WHO model list of Essential Medicines in 2021. As a result, SDF is recognised as one of the most efficacious, safe and cost-effective dental medicines to tackle the burden of tooth decay. Several systematic reviews concluded that SDF might be a breakthrough dental agent in this century due to its safety, efficiency, feasibility, and effectiveness in preventing and arresting dentine caries [6]. This led to the development of a guideline on the use of SDF for caries management in children by the American Academy of Paediatric Dentistry, which is based on the evidence presented in our systematic review [6] and our previous research work [2-5].

5. Sources to corroborate the impact (indicative maximum of 10 references)

1. American Academy of Pediatric Dentistry. Use of Silver Diamine Fluoride for Dental Caries Management in Children and Adolescents, Including Those with Special Health Care Needs *Pediatr Dent* 2017;39(5):E135-E145. [link](#)
2. World Health Organisation. The Application of SDF for addition of new essential medicines in 2021. https://cdn.who.int/media/docs/default-source/essential-medicines/2021-eml-expert-committee/applications-for-addition-of-new-medicines/a.28_silver-diamine-fluoride.pdf?sfvrsn=e9d947bb_4
3. World Health Organisation. 38% Silver Diamine Fluoride in the WHO model list of essential medicines in 2021 (the 22nd edition) (page 55) <https://www.who.int/publications/i/item/WHO-MHP-HPS-EML-2021.03>
4. Local news Title: Silver diamine fluoride was proved to be effective in stopping cavities by the University of Hong Kong and it is used in the US 【港大證明 1 種溶液可止蛀牙 獲美採用】 , Program: New Broadcast, TVB. Released date: 31 October 2016, Accessed date 1 June 2021. [link](#)
5. Local news Title: Jockey Club Children Oral Health Project offers free dental check-up to kindergarten children 【賽馬會推健齒計劃 為幼稚園學童提供免費牙科檢查】 , Singtao Daily. Released date: 10 November 2020, Accessed date 1 June 2021. [link](#)
6. Local news Title: Jockey Club Children Oral Health Project offers free outreach dental check-up in kindergartens, benefiting 180,000 preschool children 【賽馬會幼童健齒計劃推免費牙科到校檢查 18 萬幼稚園學前兒童受惠】 , HK01. Released date: 10 November 2020, Accessed date 1 June 2021. [link](#)
7. Local news Title: “Jockey Club Children Oral Health Project” provides free dental check-up to 180,000 kindergarten children; Experts: the pandemic worsens children’s tooth decay condition 【「賽馬會幼童健齒計劃」為 18 萬名幼稚園生提供免費護理 專家指疫情令兒童蛀牙機會增加】 , Hong Kong Economic Times. Released date: 10 November 2020, Accessed date 1 June 2021. [link](#)
8. Local news Title: Hong Kong preschool children have dental caries prevalence, Jockey Club funded \$56 million for safeguarding children’s oral health 【港幼童蛀牙比例偏高 賽馬會撥 5600 萬元助幼稚園學童護齒】 , Oriental Daily. Released date: 10 November 2020, Accessed date 1 June 2021. [link](#)
9. Local news Title: Rules to safeguard children’s oral health 【幼童護齒法則】 , Program: Medicine Online, nowTV. Released date: 19 February 2021, Accessed date 1 June 2021. [link](#)
10. Local news Title: Children Oral Health Project 【幼童健齒計劃】 , Program: Healthpedia, RTHK. Released date: 5 April 2021, Accessed date 1 June 2021. [link](#)