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Original Article

Comparison of the implementation of extra root canal treatment before and after fee schedule change in the Taiwan National Health Insurance System

Nien-Chieh Lee ^a, Yen-Hsiang Chang ^{a,b}, Hui-Tzu Tu ^c,
Chang-Fu Kuo ^d, Kuang-Hui Yu ^d, Lai-Chu See ^{c,d,e*}

^a Department of General Dentistry, Chang Gung Memorial Hospital, Taoyuan, Taiwan

^b Graduate Institute of Dental and Craniofacial Science, Chang Gung University, Taoyuan, Taiwan

^c Department of Public Health, College of Medicine, Chang Gung University, Taoyuan, Taiwan

^d Division of Rheumatology, Allergy and Immunology, Department of Internal Medicine, Chang Gung Memorial Hospital, Linkou, Taoyuan 33305, Taiwan

^e Biostatistics Core Laboratory, Molecular Medicine Research Center, Chang Gung University, Taoyuan 33302, Taiwan

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KEYWORDS

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Abstract *Background/purpose:* Endodontic treatment success depends on treatment of all root canals, but the implementation status is affected by various factors. We examined whether the fee payment change affected the extra root canal endodontic treatment (EXRCT) in adult teeth in the National Health Insurance (NHI) system of Taiwan since 2008. The effect of hospital level, sex, and age on EXRCT was also examined.

Materials and methods: Two longitudinal health insurance databases for 2005 and 2010 were used. Excluding third molars and endodontic retreatment, the EXRCT rate in permanent dentition were compared for different tooth positions, hospital levels, sex and age between 2005 and 2010.

Results: In total, 80,995 teeth in 2005 and 76,018 in 2010 underwent root canal filling. The rate of EXRCT increased markedly from 2005 to 2010, particularly for the upper first molar (1.84% to 3.18%), lower first premolar (3.45% to 4.58%), lower first molar (12.4% to 18%), and lower second molar (0.95% to 1.87%). The difference between 2005 and 2010 remained statistically significant after adjustment for hospital level, sex, and age. The lower second molar had the highest adjusted odds ratio for the difference between 2005 and 2010 (1.99; CI: 1.49–2.66),

* Corresponding author. Department of Public Health, Chang Gung University, 259 Wen-Hwa 1st Rd., Kweisan, Taoyuan 333, Taiwan. Fax: +886 3 211 8363.

E-mail address: lichu@mail.cgu.edu.tw (L.-C. See).

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followed by the upper first molar (1.91; CI: 1.55–2.35), lower first molar (1.60; CI: 1.47–1.75), and lower first premolar (1.38; CI: 1.11–1.72).

Conclusion: The payment change of Taiwan NHI seems to encourage the use of EXRCT in molars. Hospital level, sex, and age also affected the rate of EXRCT.

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Introduction

The success of endodontic treatment is dependent on the complete examination, cleaning, shaping, and obturation of all root canals present in the affected tooth.¹ Any undetected root canal may pose a major risk for endodontic failure.² Teeth with a missing canal were reported to be 4.38 times more likely to be associated with an apical lesion.³ In the USA, the incidence of missing canals was shown to be 23.04% and 42% in two previous studies.^{3,4} The incidence of missing canals was found to be highest in the upper first molar and lowest in the upper premolars.³ Previous in vivo and in vitro studies have shown that the incidence of a second mesiobuccal canal (MB2) in the maxillary first molar ranges from 56.9% to 96.0%.⁵ The detection of an MB2 canal in the maxillary second molar varied between 29% and 100% in vitro studies and between 19.7% and 51.1% in in vivo studies.⁶ Understanding each tooth's anatomy facilitates detection of canals by the endodontist.⁴ Other factors, such as access cavity design, retreatment, and magnification were also found to affect the number of canals discovered.⁷

When considering predictors related to the detection of root canals, the payment system may also affect the results. In Taiwan, endodontic treatment is covered by the National Health Insurance (NHI). In 2008, the NHI started to reimburse extra root canal endodontic treatment (EXRCT) for four-canal and five-canal systems. The purpose of the present study was to examine whether the fee payment change in the National Health Insurance affected the rate of EXRCT in adult teeth. The effect of age, sex, and hospital level on EXRCT was also examined.

Material and methods

Data source

The primary data source of this study comprised the two longitudinal health insurance databases of 2005 (LHID2005) and 2010 (LHID2010) of the Taiwan NHI. In 1995, Taiwan launched a compulsory single-payer NHI system, which covered 99.6% of the population as of 2014.⁸ For the LHID2005 and LHID2010, two separate cohorts of 1,000,000 individuals were randomly sampled from all beneficiaries of the NHI program in 2005 and in 2010, respectively. All data on registration, outpatient claims, and inpatient claims for these two samples of one million individuals—from their registration in the NHI program until 2013—were included in the LHID2005 and LHID2010. There were no significant

differences in sex distribution between patients in the LHID and those in the original data.

This study was approved by the Institutional Review Board of Chang Gung Memorial Hospital, Taiwan (IRB). The need for informed patient consent was waived, as all data were completely anonymized.

Ascertainment of root canal treatment

We only used the data of 2005 in the LHID2005 and 2010 in LHID2010 because the data in these two years are representative of the population in 2005 and 2010, respectively. Next, we excluded individuals who had the same anonymized ID number on the LHID2010 as the number on the LHID2005 ($n = 74,926$, 7.49%), to avoid double-counting of patients in the two LHIDs. In this study, the study unit was permanent teeth that required root canal treatment, rather than patients.

Extra canals were simply defined as more than one canal for anterior teeth (#11 #21, #12 #22, #13 #23, #31 #41, #32 #42, #33 #43) and lower premolars (#34 #44, #35 #45), more than two canals for upper premolars (#14 #24, #15 #25), and more than three canals for molars (#16 #26, #17 #27, #36 #46, #37 #47). The treatment codes in 2005 were 90001C for 1-canal system; 90002C for 2-canal system; 90003C for 3-or-more canal system, 90092C for extra-canal system. In 2008, the NHI started to reimburse four-root canal endodontic treatment (90019C) and five-root canal treatment (90020C). The treatment codes in 2010 were 90001C for a one-canal system; 90002C for a two-canal system; 90003C for a three-canal system; 90019C for a four-canal system; 90020C for a five-or-more canal system, 90092C for extra-canal system. Note that the retreatment cases (treatment code 90094C) and third molars (#18 #28, #38 #48) were excluded.

Covariates

Other than the two time-points (calendar years 2005, 2010), tooth position, hospital level, sex and age were potential factors for EXRCT. Hospital was grouped into four levels (medical center, regional hospital, local hospital, and dental clinic). Age in years was grouped into eight categories (6–19, 20–29, 30–39, 40–49, 50–59, 60–69, 70–79, and ≥ 80).

Statistical analysis

To explore which factors affected EXRCT, generalized estimating equation (GEE) with an exchangeable

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