



The Impact of Medical Institutions on the Treatment Decisions and Outcome of Root-Resected Molars: A Retrospective Claims Analysis from a Representative Database

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Background: This study analyzes the prognostic factors affecting the survival rate of root-resected molars by using a representative population-based dataset. **Materials and Methods:** A total of 635,216 eligible patients were enrolled from a representative cohort composed of one million of Taiwan's population. The tooth-related factors influencing the survival rates of root-resected teeth were examined on 516 molars, in 492 patients. Cox regression was performed to statistically analyze the factors. **Results:** The overall survival rate for the root-resected molars was 91.7%. Of the analyzed factors with respect to root-resection procedures, whether or not concomitant flap surgery was performed in the medical institutions, the dental arch and tooth location demonstrated a considerable influence on the treatment and decision-making. The main reasons and results of root-resected molars receiving root-resection therapy in hospitals were the periodontal-compromised conditions, whereas, the root-resected molars that received root-resection therapy in private practice clinics were caused by caries/endodontic reasons. After adjusting for other factors, in the outcome of root-resected molars, a higher risk of extraction occurrence was seen in hospitals than in private practice clinics (hazard ratio = 2.03; 95% CI = 1.04 to 3.98; $P = 0.039$). **Conclusions:** Of the analyzed prognostic factors, medical institutions significantly affect the treatment decision and survival of root-resected molars. Therefore, a comprehensive evaluation, risk assessment, and treatment plan should be executed before the root-resection procedure is performed.

Key words: Molar, furcation defects, treatment outcome, prognosis

INTRODUCTION

Root-resection therapy is a procedure that has been utilized for multirooted molars for over a 100 years.¹ Numerous factors contribute to advanced disease progression in multirooted teeth, including carious lesion, endodontic causes, periodontal status, trauma, and others.^{2,3} Successful performance of this procedure requires a comprehensive assessment and diagnostic process, because treatment of these condition-compromised multirooted teeth generally results in less favorable responses

than single-rooted teeth.³ Therefore, a well-constructed treatment plan is crucial for the success of this root resection procedure.^{2,3}

The treatment outcomes of root-resected teeth can be assessed by case-controlled or follow-up epidemiological studies. However, a series of case-controlled studies evaluating a relatively small number of cases, and the success rate of root resection has been reported to have a broad range, because there is no consensus as to the inclusion criteria defined by the various authors.⁴⁻¹⁵ On the contrary, a follow-up epidemiological study from the general population, performed by analyzing a population-based database, is still absent.

To investigate the survival rate and prognostic factors affecting the survival rate of root-resected molars, an epidemiological study assessing a large number of root-resected molars performed by both general practitioners and periodontists, with a high follow-up rate is required, and its success rate may reflect the outcomes in the general population.

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The purpose of this study is to investigate the survival rates retrospectively and analyze the prognostic factors influencing the treatment decisions and outcomes of root-resected molars, using Claim Analysis from the representative database.

MATERIALS AND METHODS

Data source

This study analyzes the 'Longitudinal Health Insurance Database 2005 (LHID2005)', a cohort dataset composed of one million, randomly sampled people from the National Health Insurance Research Database (NHIRD), released and maintained by the National Health Research Institute (NHRI), Miaoli, Taiwan (http://nhird.nhri.org.tw/en/Data_Subsets.html#S3). NHIRD contains 26 million administered insurants, accumulated between January 1996 and December 2011. These random samples were confirmed by the NHRI to be representative of the Taiwanese population. A distinctive characteristic of the NHIRD is its comprehensive coverage of 99% of the population, for whom the National Health Insurance Program (NHIP) has provided universal medical coverage, comprehensive benefits, and unrestricted access to any medical institution of the patient's choice.¹⁶⁻¹⁸ This therefore enhances the completeness and accuracy of identifying furcation-involved molars, especially for those that did not occur immediately post the operation, so follow-up would not be affected by patients seeking medical services across institutions. As it is almost impossible to randomly extract a sample of patients from all beneficiaries of the NHIRD, the NHRI released the LHID2005 to the scientists for research purposes.

The LHID2005 used in this study contains all the claims data, including the demographic data, dates of clinical visits, diagnostic codes, prescription details, expenditures, registration files, and original claims for the enrollees of 1,000,000 beneficiaries, under the NHIP. These 1,000,000 beneficiaries were randomly selected from the year 2005 Registry of Beneficiaries ($n = 25.68$ million) of the National Health Insurance (NHI). There is no significant difference in gender- and age-distribution, or average insured payroll-related amount between these 1,000,000 beneficiaries in the LHID2005.

Validity of database

The NHIRD data is generally accurate, because regular justifications and claims of the medical charts are performed by the Bureau of National Health Insurance (BNHI) of Taiwan, to ensure that the fidelity of the coding system in the database is reliable. Moreover, to facilitate the validity of LHID2005, the NHIP in Taiwan has incorporated a cross-checking system

with a full review of the clinical information by specialists. Therefore, it is generally believed that the accuracy of the LHID2005 represents the general population, as a whole nation's population.¹⁶⁻¹⁸

The quality of LHID2005 provides a good statistical representation for analyzing the epidemiological profiles of the entire population in Taiwan. Supporting its strong validity, several high-quality studies have been published based on the LHID2005.¹⁶⁻¹⁸

In this cohort dataset, the patients' original identification numbers are de-identified and encrypted to protect privacy before their release to the public for research purposes. The encrypting procedure is consistent, so the linkage of claims belonging to the same patient is feasible within the NHIRD datasets. Similar to other studies, this study was exempted from full review by the Institutional Review Board.¹⁶⁻¹⁹

Study sample and identification of the treatment groups

The coverage of LHID2005 provided all medical claims, including outpatient service, inpatient care, Western medicine, dental services, Chinese medicine, childbirth, physical therapy, preventive health care, home care, rehabilitation, and prescription drugs for illness. A total of 635,216 eligible patients, who visited ambulatory care centers (including the Outpatient Departments of hospitals or private clinics) for receiving a dental service were enrolled. Of these patients, a total of 492 eligible persons (516 molars), who were receiving root-resection procedures (specific health insurance procedure code 92033c) were selected from the 635,216 sampling dataset [Figure 1]. These patients' first ambulatory care visits for root-resection treatment between January 1, 2006, and December 31, 2008, were assigned as the index date for use of health care, and the clinical history was tracked to ensure that no previous root-resection or extraction (specific health insurance procedure code 92013, 92014c, 92015c, 92016c) had been performed.

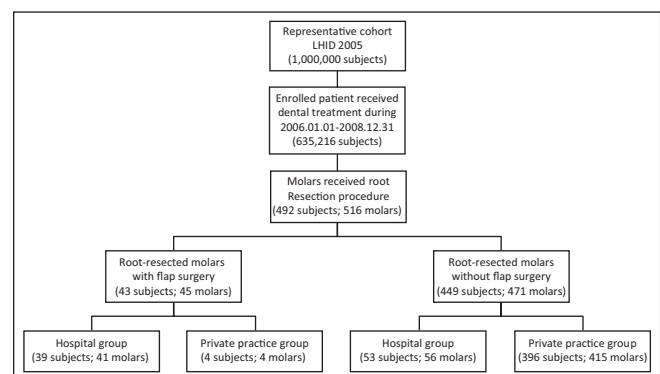


Figure 1. Flow diagram of data processing

To ensure the criteria of indication and quality of root-resection therapy, the NHI set a serious guideline to Board Registered dentists to execute the procedure. All claims records including the root-resection procedure code from the NHI system are subject to a quality control process, in which the actual medical charts are spot checked by qualified record review teams. The patients' outcomes had been applied blindly, because the dentists submitting their claims were not aware the data would be used for future outcome analysis. Furthermore, at the end of the follow-up period, all eligible patients remained in the same NHI plan, indicating no loss from the patient pool.

All root-resection molars were further divided into two groups: Survival group and extraction group. Patients who received root-resection therapy at different medical institutions were subdivided into a hospital group (those institutes that provided Outpatient and Inpatient Services) and private practice group (those institutes that only provided Outpatient Service). The cohort study censored follow-up only for the following conditions: When the molar was extracted, on the dates of outcome incidence, or at the end of this cohort (December 31, 2008) [Figure 1]. All the original claims data of the enrolled subjects/molars were analyzed.

Statistical Analyses

All statistical analyses were carried out using the SAS system (SAS system for Windows, Version 9.2. SAS Institute Inc. Cary, NC) and the PASW software package (PASW statistics 18.0, SPSS Inc., Munich, Germany). The failure rates of the resected molars were tested using the Chi-squared test, Fisher's exact test, and log-rank test. The statistical techniques for survival analysis were carried out to analyze the survival of the root-resected molars over time and to identify the factors affecting the survival of the resected molars. The Kaplan-Meier estimation method was used for survival analysis. The Cox proportional hazard regression test was used to determine whether age and the remaining dentition affected the survival time. A *P*-value < 0.05 was considered statistically significant.

RESULTS

A flow chart of data processing is illustrated in Figure 1. Of the identified patients, 492 eligible subjects (250 males and 242 females; mean age: 51.38 ± 13.12 years [range, 13 to 84 years]) received root-resection therapy on 516 molars [Table 1]. Four hundred and seventy-one molars received the root-resection procedure, without flap surgery (NFS), whereas, 45 molars underwent the root-resection procedure with flap surgery (FS) [Figure 1]. These selected molars could be further categorized according to the medical institutions that performed the

Table 1. Demographic characteristics of patients/molars who received root-resection therapy according to the 'Longitudinal Health Insurance Database 2005 (LHID2005)' during the period January 2006 to December 2008 in Taiwan

Parameters/Groups	Male		Female		<i>P</i>
	<i>n</i>	%	<i>n</i>	%	
Subject					
Gender	250	50.8	242	49.2	
Age (years)					
Mean±SD	51.7±12.8		51.0±13.5		
Minimum–maximum	18–84		13–83		
<45	70	28.0	72	29.8	0.788
45–64	143	57.2	131	54.1	
>65	37	14.8	39	16.1	
Tooth					
Medical institution					0.231
Hospital	56	21.0	41	16.5	
Private practice	211	79.0	208	83.5	
Arch					0.838
Upper molar	116	43.3	105	42.2	
Lower molar	151	56.7	144	57.8	
Side					0.398
Right molar	145	54.3	125	50.2	
Left molar	122	45.7	124	49.8	
Type					0.007**
First molar	206	77.2	216	86.7	
Second molar	61	22.8	33	13.3	
Location					0.025*
First molar, upper	88	33.0	86	34.5	
Second molar, upper	28	10.5	19	7.6	
First molar, lower	118	44.2	130	52.2	
Second molar, lower	33	12.3	14	5.7	

P* < 0.05; *P* < 0.01; *** *P* < 0.001

procedure: Hospital group (97 molars) or private practice group (419 molars) [Figure 1]. Of the 516 molars, 43 (8.3%) were extracted and 473 (91.7%) survived after the index date, during the investigation period, indicating that the overall survival rate for root-resected molars was 91.7%.

The demographic characteristics of patients/molars who had received root-resection therapy are listed in Table 1. Interestingly, with respect to tooth type and location, the root-resected first molars were significantly more frequent than second molars (*P* = 0.007), especially the lower first molars (*P* = 0.025) [Table 1].

Those molars receiving root-resection therapy were further categorized into two groups: The root resection group with

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concomitant flap surgery (FS group) and the group without flap surgery (NFS group). In subjects who underwent root-resection therapy, the medical institutions providing resection therapy significantly differed between the FS and NFS groups ($P < 0.0001$). Similar to medical institutions, the arch and tooth location significantly differed between these two groups (all $P < 0.0001$). A significantly greater number of root-resected molars underwent flap surgery (FS group, $n = 45$ molars) in the hospital-affiliated dental departments (91.1%) than at private practice clinics (8.9%) ($P < 0.0001$). In contrast, molars that underwent root-resection therapy without flap surgery (NFS group, $n = 471$) were more likely to be seen in private practice clinics (88.1%) than in hospital-affiliated dental departments (11.9%). Interestingly, the root-resection procedure with concomitant flap surgery was more commonly performed on the upper molars (77.8%) than lower molars (22.2%), especially on the maxillary first molars (64.5%). On the other hand, in the NFS group, the root-resection procedure with concomitant flap surgery was more commonly performed on the mandibular molars (60.5%), and it was significantly greater than on the maxillary molars (39.5%), particularly the mandibular first molar (50.7%) [Table 2].

Of the total of 516 eligible root resection molars, 43 root-resected molars had undergone an extraction procedure during the follow-up period. The tooth-associated prognostic factors between the two groups (extraction vs. survival) were quite similar [Table 3]. The reasons for performing root-resection therapy on multirooted molars and the extraction of the root-resected teeth were further analyzed [Table 4]. Most of the molars receiving root-resection therapy in the hospital was due to the periodontal-compromised conditions (66.0%), whereas, those molars in private practice clinics were caused by caries/endodontic diagnosis (45.5%) [Table 4a]. The distribution characteristics of the reasons for performing the extraction procedure on a root-resected molar were similar to the reasons for receiving root-resection therapy [Table 4b].

Similar to our previous results²⁰, the Kaplan-Meier survival curve was used to assess the overall survival proportion of root-resected molars and there was no significant difference between the hospital and private practice groups ($P = 0.072$) [Figure 2a]. After adjusting for age, gender, and arch, a statistically significant difference between the two groups was noted ($P = 0.039$) [Figure 2b]. Details of the adjusted hazard ratios for extraction occurrence, by prognostic factors, based on the Cox proportional hazard regression, are provided in Table 5. After adjusting for other factors, the results showed that molars receiving root-resection therapy in hospitals (hazard ratio = 2.03; 95% CI = 1.04 to 3.98; $P = 0.039$) had a 2.03 times higher incidence of extraction occurrence than that in private practice clinics [Table 5].

Table 2. Subject and tooth-associated prognostic factors of eligible molars receiving root-resection therapy with concomitant flap surgery and without flap surgery (controls) in Taiwan, during the follow-up period (2006-2008)

Parameters/groups	Flap surgery (FS group)		Non-flap surgery (NFS group)		<i>P</i>
	<i>n</i>	%	<i>n</i>	%	
Subject					
Gender					0.138
Male	27	62.8	223	49.7	
Female	16	37.2	226	50.3	
Age, years					0.746
Mean±SD	52±12.2		51±13.2		
<45	12	27.9	130	29.0	
45–64	25	58.1	249	55.4	
>65	6	14.0	70	15.6	
Tooth					
Medical institution					<0.0001***
Hospital	41	91.1	56	11.9	
Private practice	4	8.9	415	88.1	
Arch					<0.0001***
Upper molars	35	77.8	186	39.5	
Lower molars	10	22.2	285	60.5	
Side					0.523
Right molar	21	46.7	249	52.9	
Left molar	24	53.3	222	47.1	
Type					0.778
First molar	38	84.4	384	81.5	
Second molar	7	15.6	87	18.5	
Location					<0.0001***
First molar, upper	29	64.5	145	30.8	
Second molar, upper	6	13.3	41	8.7	
First molar, lower	9	20.0	239	50.7	
Second molar, lower	1	2.2	46	9.8	

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$

DISCUSSION

To the best of our knowledge, this study is the first attempt to examine the survival factors of root-resected molars among patients, with an epidemiological approach, using a population-based database. The overall survival rate for root-resected molars was 91.7%. Of the analyzed prognostic factors, medical institutions, arch, and location, had significant impacts on the therapeutic decision of root-resection therapy. After adjusting for patient demographic characteristics, our study demonstrates,

Table 3. Comparison of subject and tooth-associated prognostic factors of root-resected molars undergoing the extraction procedure (extraction group) and non-extraction (survival group) during the follow-up period (2006-2008)

Parameters/groups	Extraction group		Survival group		<i>P</i>
	<i>n</i>	%	<i>n</i>	%	
Subject					
Gender					0.552
Female	23	54.8	219	48.7	
Male	19	45.2	231	51.3	
Age, yr					0.132
Mean±SD	48±6.87		47±9.51		
<45	10	23.8	132	29.3	
45–64	23	54.8	251	55.8	
>65	9	21.4	67	14.9	
Tooth					
Medical institution					0.072
Hospital	13	30.2	84	17.8	
Private practice	30	69.8	389	82.2	
Surgery					0.672
Flap surgery	5	11.6	40	8.5	
Non-flap surgery	38	88.4	433	91.5	
Arch					0.537
Upper molars	16	37.2	205	43.3	
Lower molars	27	62.8	268	56.7	
Side					0.542
Right molar	20	46.5	250	52.9	
Left molar	23	53.5	223	47.1	
Type					0.336
First molar	38	88.4	384	81.2	
Second molar	5	11.6	89	18.8	
Location					0.227
First molar, upper	12	27.9	162	34.3	
Second molar, upper	4	9.3	43	9.1	
First molar, lower	26	60.5	222	46.9	
Second molar, lower	1	2.3	46	9.7	
Reasons for root resection					0.355
Caries/endodontic	15	34.9	199	42.1	
Periodontics	16	37.2	161	34.0	
Trauma	4	9.3	15	3.2	
Others	8	18.6	98	20.7	
Reasons for extraction					
Caries/endodontic	12	27.9	N/A	N/A	
Periodontics	17	39.5	N/A	N/A	
Trauma	3	7.0	N/A	N/A	
Others	11	25.6	N/A	N/A	

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$; N/A = not available

Table 4. The reasons for performing root-resection therapy (A) and extraction of resected-molar (B) in hospital and private practice during the investigation period

(A) Reasons for performing root-resection therapy				
Parameter/groups	Hospital		Private practice	
	n	%	n	%
Caries/endodontic	24	24.8	200	45.4
Periodontics	64	66.0	113	27.0
Trauma	5	5.1	14	3.3
Others	4	4.1	102	24.3
(B) Reasons for extraction of resected-molar				
Parameter/groups	Hospital		Private practice	
	n	%	n	%
Caries/endodontic	0	0	12	40.0
Periodontics	11	84.6	6	20.0
Trauma	2	15.4	1	3.3
Others	0	0	11	36.7

Table 5. Adjusted hazard ratio for root resection prognostic factors during the investigation period; hazard ratios were all derived from the same Cox regression model and adjusted for all other variables. Adjustments were made for patients' age, gender, arch, and medical institution during the follow-up period

Parameters	Extraction occurrence		
	Hazard ratio	95% CI	P
Age (years)			
<45(reference group)	1.00		0.426
45-64	1.31	0.63-2.74	0.475
>64	1.83	0.74-4.50	0.192
Gender			
Male (reference group)	1.00		0.327
Female	1.35	0.74-2.46	
Arch			
Upper molars (reference group)	1.00		0.245
Lower molars	1.46	0.77-2.78	
Medical institution			
Private practice (reference group)	1.00		0.039*
Hospital	2.03	1.04-3.98	

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$

for the first time, that the root-resection surgeries performed in hospitals were 2.03 times (95% CI = 1.04 to 3.98; $P = 0.039$) more likely to have had extraction of root-resected molars compared to those in private practice clinics.

The prognosis of root resection has been well-documented in the previous studies.^{4-15,21} Considerable variation in the success

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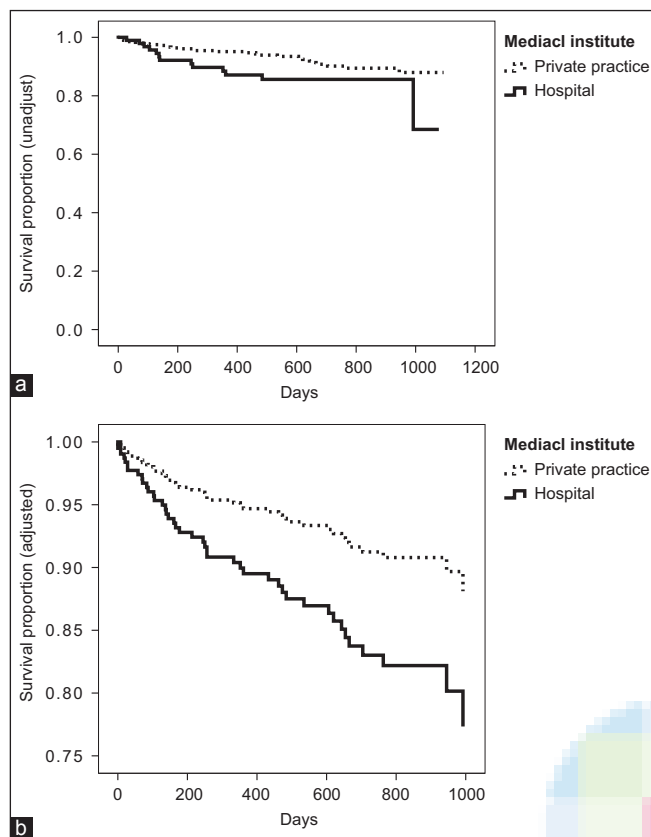


Figure 2. Unadjusted (a) and adjusted (b) prognostic factors of tooth survival analysis by age, gender, and arch. Survival proportion was stratified by tooth factor 'medical institute' in root-resected molars, in Taiwan, from 2006 to 2008

rates was noticeable when comparing the different studies. An accurate comparison and summary of the survival rates in the discussed studies is difficult to achieve, because the observed variability mainly comes from the different inclusion criteria, outcome definition, and follow-up periods in the various studies. Until now, the efficacy and the efficiency of root-resection therapy has remained controversial. In the present study, the overall survival rate of root-resection therapy is satisfactory. A substantially larger sample size has been used, and the claims data from large collections of patients experiencing actual care in hospitals or private practice clinics have been analyzed, so this set of data provides valuable information to allow better patient care and optimal clinical judgment.

Factors affecting the survival rate of resected molars have been proposed by previous studies.^{5,6,8,9,14,21-23} An evaluation of the survival factors of root-resection therapy was advocated at the resection-, patient-, tooth-, and site-related levels, which represented a logical sequence for the clinical evaluation to be performed, before rendering root-resection therapy.¹⁴ In this study, the factors were broadly categorized into patient- and tooth-related factors, due to the limited information retrieved

from the database.

In this study, there were significant differences in the number of molars receiving root-resection therapy, with or without concomitant flap surgery, in hospitals, compared to private dental clinics; flap surgeries were mostly carried out in hospitals ($P < 0.0001$) [Table 2]. Several reasons may account for this finding:

1. The policy of the NHI in Taiwan provides more medical service payment for individuals requiring flap surgery in hospital settings, which might explain why the frequency of flap surgery in hospitals is higher than in private practice clinics;
2. The reason for each molar receiving root-resection therapy differed, so various treatment options may exist between hospital and private practice [Table 4]
3. Hospitals may have more well-trained specialists, and may be better equipped to perform flap surgery compared to private practice clinics. Therefore, for medical institutions, the reasons for performing the root-resection procedure and the experience level of the clinician, may play important roles in deciding whether or not the root-resection procedure is to be executed.

Of the tooth-related factors, medical institutions (hospital vs. private practice clinic), arch (upper molar vs. lower molars), and molar location, significantly influenced the treatment decision in whether root-resected molars received concomitant flap surgery or not [Table 2]. Flap surgery was performed significantly more frequently on maxillary molars, whereas, non-flap surgery was more frequently performed on mandibular molars ($P < 0.0001$). There were also significant differences related to molar location ($P < 0.0001$) [Table 3]. In particular situations, the root-resection procedure could be conducted without flap reflection (non-flap surgery), however, this treatment option was not recommended. Previous studies indicated that flap surgery was accomplished with osseous recontouring, by utilizing rotary and hand instruments to re-create a positive architecture and obtain an environment conducive to good oral hygiene and easy dental care, which was highly recommended.¹ Note, compared to mandibular resections (23%), residual root fragments, furcation lips, and ledges were more frequent causes of failure of maxillary resections (33%).¹ These deficiencies were radiographically detectable in only 38% of the maxillary cases; thus dentists should be careful in evaluating and eliminating these tooth-oriented factors.²⁴ Maintenance of such morphology could easily lead to plaque accumulation and disease reoccurrence.¹ For these reasons, explanations for the discrepancies between the locations of root-resected molars, in terms of flap surgery, could include differences in anatomical features, severity of

furcation involvement, levels of self-accessibility to maintain oral hygiene, and optimal restorative rehabilitation. In the present study, there was no significant difference in the survival of root-resected molars in the flap surgery group and non-flap surgery group (Table 3, $P = 0.672$). However, it has been suggested, in light of the high incidence of residual root fragments, that all root resections should be executed using the flap approach.^{1,24}

Of all the reasons for performing root-resection therapy, most molars receiving root resection in hospital were a result of periodontal problem(s) [Table 4a], whereas, the most common reason for molar extraction in private practices was caries/endodontic reason(s) [Table 4b]. Various explanations have been proposed to discuss the outcomes with respect to tooth survival. The major difference in the reasons for performing root-resection therapy and extraction of resected-molar between hospital and private practice are as follows:

1. As previously described, the NHI policy tends to result in more periodontal-compromised molars receiving advanced periodontal therapy in a hospital, rather than in a private practice.
2. The details of tooth site-related factors, such as the periodontal status of the molars, is limited in this study. The bone support of the remaining root at the time of surgery significantly affects the survival rates.^{12,14,25,26} However, the amount of bone support for the resected molars could not be identified from the claims data. It was suggested that molars with bone support >50% of the remaining roots showed a significantly higher survival rate¹⁴;
3. Molars receiving a root resection procedure in a hospital may retained less periodontal support; on the contrary, the molars receiving root-resection therapy in private practice could mainly be attributed to caries/endodontic problem(s) [Table 4], which implied that they had better bony support. Therefore, tooth-related factors could have a critical impact on the treatment plan and decision, but a limited influence on the survival of root-resected molars;
4. Other inevitable factors could be attributed to endodontic, fracture, caries or strategic reasons.^{14,27-30}

In this study, the overall survival rate for root-resected molars was 91.7%. The analyzed factors listed could affect the therapeutic decisions [Table 2]. However, these factors had no significant influence on tooth survival. In addition, other factors associated with tooth survival should be carefully evaluated by practitioners before performing a root-resection procedure, because these factors could eventually influence the prognosis of the root-resection procedure.

This study is the first to demonstrate that root-resected molars occurring in hospitals have 2.03 times higher rates of extraction occurrence than a reference group and these factors may play a role in the survival of molars after the root-resection procedure [Table 5]. Although it is difficult to compare the data obtained and the outcomes previously reported in the literature, a particular strength of this study is the use of a population-based dataset, which has enabled us to trace the medical outcomes of the investigated subjects and molars. Furthermore, this large sample size affords considerable statistical power for detecting the real differences between the compared variables. Nevertheless, this study still suffers from a few limitations that must be addressed. First, root-resected subjects/molars in this study have been identified from the NHIRD under the principal payment code for dental service; however, the actual decision criteria leading to molar root-resection therapy depends on the clinical situations. Moreover, the database does not contain information regarding factors such as, the extent of caries or furcation involvement, status of periodontal breakdown, remaining alveolar bone loss, root canal status, restorative and occlusal conditions, and even tobacco use, which will not be identified in the administrative database if the subject has not been undergoing active management, all of which might relate to a higher risk of root-resected molar failure.

CONCLUSION

Root-resection therapy is still a valid treatment option for indicated molars. Of the analyzed prognostic factors, medical institutions significantly affect the treatment decision and survival of root-resected molars. Therefore, a comprehensive evaluation, risk assessment, and treatment plan must be executed before the root-resection procedure is performed.

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