Analysis Report

This report is structured as follows.

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Methods

To test if different factors have any influence on the presence of teeth after Year 1, Year 2, Year 3 and Year 4, chi-square tests of independence were applied on all the four years. Patients who dropped out from the study and did not show up on particular years were not considered on the analysis.

The Chi-square test is a statistical test used to determine if there is a significant association between two categorical variables. It is based on the comparison between observed frequencies (the data collected or observed from experiments or surveys) and expected frequencies (the frequencies we would expect to obtain if there were no association between the variables). The results of these tests provide two types of statistics:

Chi-Square Statistic (χ^2): This value measures the discrepancy between the observed and expected frequencies. The larger the Chi-square statistic, the greater the difference between what was observed and what would be expected if there were no association between the variables.

P-value: The p-value tells you the probability of observing a test statistic as extreme as, or more extreme than, the value observed, under the assumption that the null hypothesis (no association between the variables) is true. A small p-value (typically ≤ 0.1 or 0.05) indicates strong evidence against the null hypothesis, so you reject the null hypothesis. A large p-value (> 0.1 or 0.05) suggests weak evidence against the null hypothesis, so you fail to reject the null hypothesis.

The sections below show the results for each yearly follow-up. If a particular level of a variable had fewer than 5 cases, these were dropped out from the analyses, in order to avoid distorting the results with low statistical power.

Results – Year 1

The table below shows the results for the first-year follow-up.

Variable	Level	Sample Size	N (%)	Y (%)	Chi Square	P Value
Tooth type	Anterior	20	0.0	11.8	4.734	0.094
	Molar	103	90.0	55.3		
	Premolar	57	10.0	32.9		
Number of appointments	Multiple	146	70.0	81.8	0.853	0.356
	Single	34	30.0	18.2		
Diagnosis	Acute periapical periodontitis	26	12.5	15.2	5.875	0.118
	Chronic apical periodontitis	63	75.0	34.8		
	Chronic periapical periodontitis	39	0.0	23.8		
	Irreversible pulpitis	44	12.5	26.2		
Obturation within 2mm of radiographic apex	no	104	80.0	56.5	2.143	0.143
	yes	76	20.0	43.5		
Presence of pre operative lesion	no	35	10.0	20.0	0.603	0.437
	yes	145	90.0	80.0		
Presence of voids	no	129	40.0	73.5	5.229	0.022

Variable	Level	Sample Size	N (%)	Y (%)	Chi Square	P Value
	yes	51	60.0	26.5		
Location of voids	All	8	30.0	3.0	17.054	0.000
	coronal	40	30.0	22.2		
	no	129	40.0	74.9		
Coronal restoration prior to root canal treatment	Direct	161	90.0	89.4	0.003	0.953
	Indirect	19	10.0	10.6		
Coronal restoration post root canal treatment	Direct	165	90.0	91.8	0.039	0.844
	Indirect	15	10.0	8.2		
Irrigant used	Other	28	20.0	15.3	0.159	0.690
	Sodium hypochlorite	152	80.0	84.7		
Dental dam used	N	8	10.0	4.1	0.769	0.380
	Y	172	90.0	95.9		
Crown placed Y N	N	111	90.0	60.0	3.596	0.058
	Y	69	10.0	40.0		

For tooth type, a significant association was found between the type of tooth (anterior, molar, premolar) and the presence of teeth one year post-treatment, $\chi^2(2, N = 180) = 4.734$, $p = .094$. When considering the number of appointments, whether multiple or single, there was also no significant association observed, $\chi^2(1, N = 180) = 0.853$, $p = .356$.

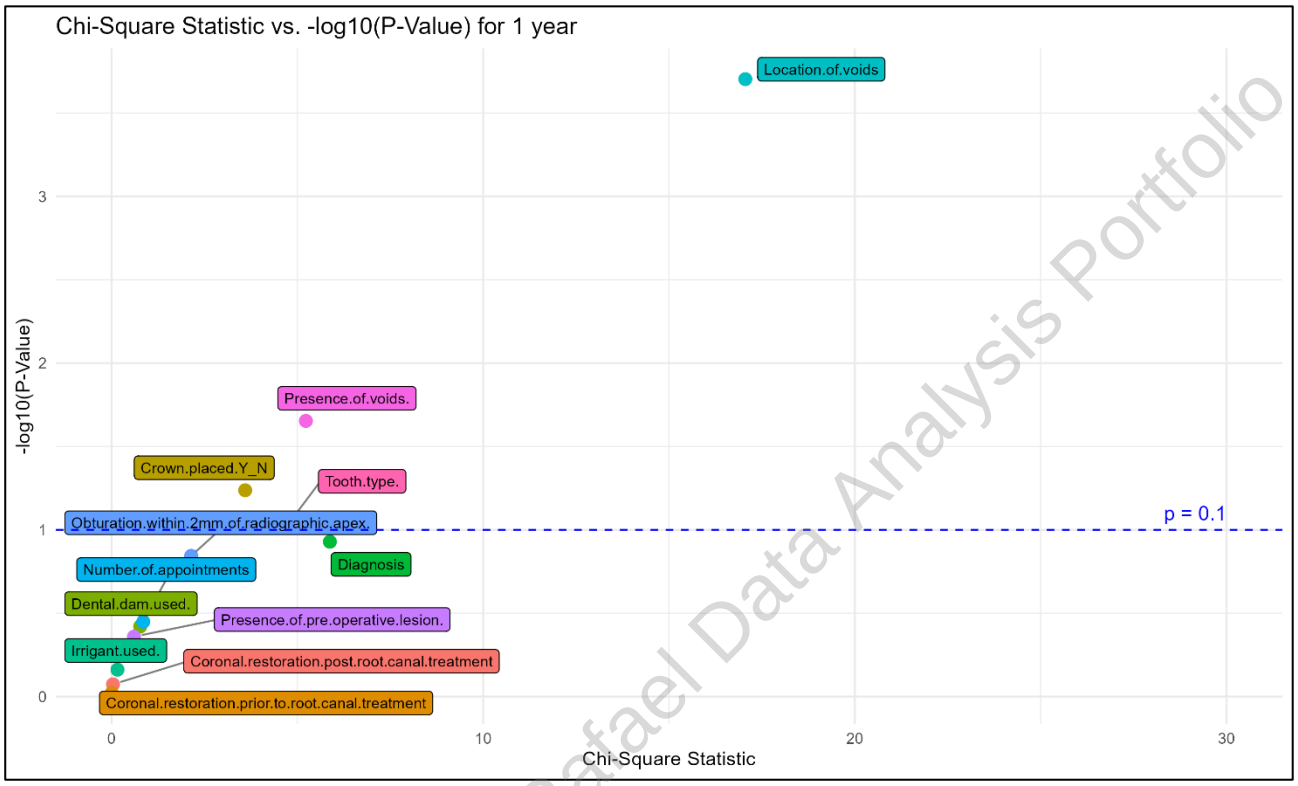
Regarding the diagnosis, including acute periapical periodontitis, chronic apical periodontitis, chronic periapical periodontitis, and irreversible pulpitis, no significant differences were detected in the presence of teeth at the 1-year follow-up, $\chi^2(3, N = 172) = 5.875$, $p = .118$. Similarly, whether the obturation was within 2mm of the radiographic apex did not significantly influence the outcome, $\chi^2(1, N = 180) = 2.143$, $p = .143$.

The presence of a pre-operative lesion, $\chi^2(1, N = 180) = 0.603$, $p = .437$, and the type of coronal restoration performed either prior to or post-root canal treatment did not significantly affect the presence of teeth at the follow-up, with p-values of .953 and .844, respectively. The type of irrigant used also showed no significant association, $\chi^2(1, N = 180) = 0.159$, $p = .690$.

However, the presence of voids was significantly associated with the presence of teeth, $\chi^2(1, N = 180) = 5.229$, $p = .022$, indicating that patients with voids had different outcomes compared to those without. Specifically, the location of voids showed a highly significant association with tooth presence, with the category 'All' showing a notable difference, $\chi^2(2, N = 177) = 17.054$, $p < .001$. This suggests that the location of voids within the treated teeth significantly impacts their presence after one year.

The figure below shows the chi-square statistics and respective p-values for all factors examined. The X-axis shows the Chi-square statistic, indicating the strength of association, with higher values suggesting stronger associations. The Y-axis, transformed using -log10(p-value), highlights the significance of these associations. Points above the reference line (e.g., y = 1.0 for p = 0.1) are

considered statistically significant, suggesting that the null hypothesis of no association can be rejected for those cases. This visualization makes it straightforward to identify which pairs of variables have the most statistically significant relationships, based on both the strength and significance of the observed associations.



Results – Year 2

The table below shows the results for the second-year follow-up.

Variable	Level	Sample Size	N (%)	Y (%)	Chi Square	P Value
Tooth type	Anterior	17	5.3	11.0	3.896	0.143
	Molar	95	78.9	55.2		
	Premolar	52	15.8	33.8		
Number of appointments	Multiple	130	73.7	80.0	0.408	0.523
	Single	34	26.3	20.0		
Diagnosis	Acute periapical periodontitis	22	17.6	13.6	6.213	0.102
	Chronic apical periodontitis	56	58.8	32.9		
	Chronic periapical periodontitis	38	5.9	26.4		
	Irreversible pulpitis	41	17.6	27.1		
Obturation within 2mm of radiographic apex	no	95	68.4	56.6	0.971	0.324
	yes	69	31.6	43.4		
Presence of pre operative lesion	no	31	21.1	18.6	0.065	0.799
	yes	133	78.9	81.4		
Presence of voids	no	119	57.9	74.5	2.322	0.128
	yes	45	42.1	25.5		
Location of voids	All	8	15.8	3.5	6.099	0.047
	coronal	34	26.3	20.4		
	no	119	57.9	76.1		
Coronal restoration prior to root canal treatment	Direct	148	94.7	89.7	0.493	0.483
	Indirect	16	5.3	10.3		
Coronal restoration post root canal treatment	Direct	151	94.7	91.7	0.209	0.648
	Indirect	13	5.3	8.3		
Irrigant used	Other	23	21.1	13.1	0.880	0.348
	Sodium hypochlorite	141	78.9	86.9		
Dental dam used	N	6	10.5	2.8	2.876	0.090
	Y	158	89.5	97.2		
Crown placed Y N	N	99	78.9	57.9	3.101	0.078
	Y	65	21.1	42.1		

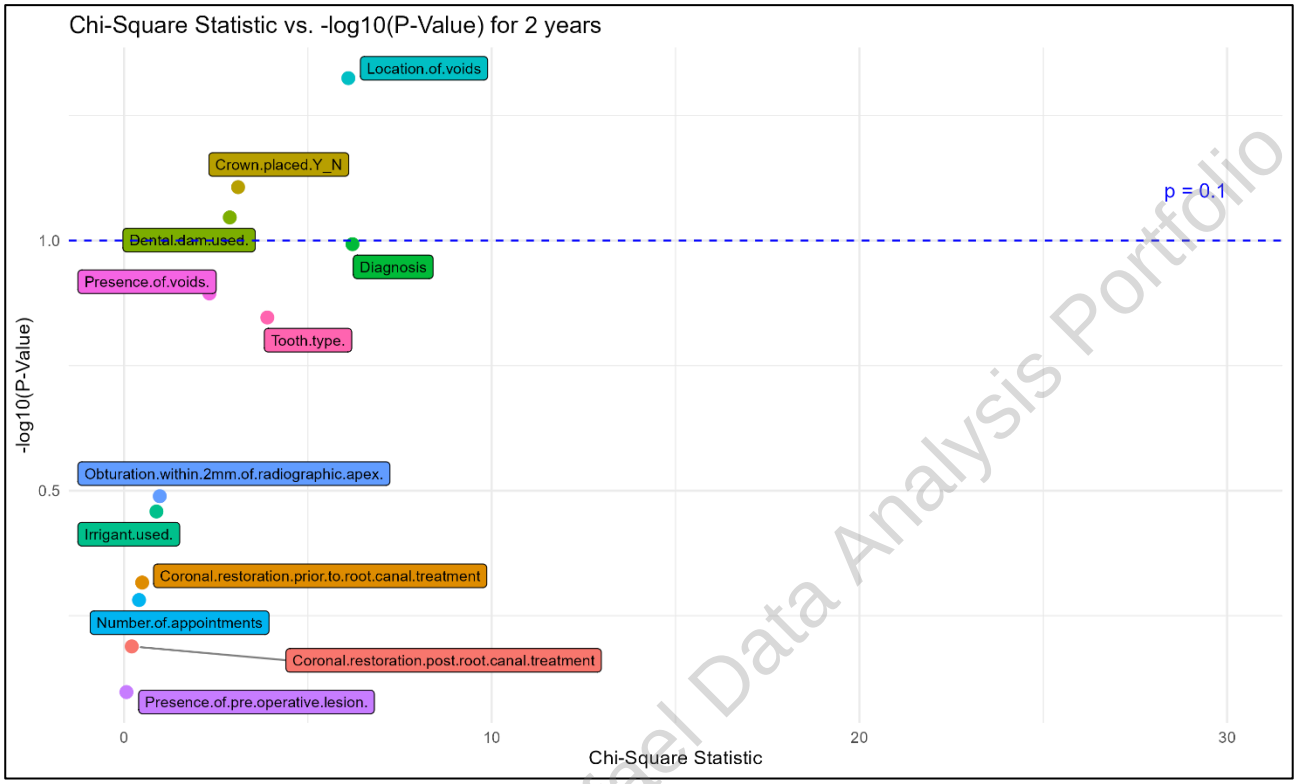
At the 2-year follow-up of dental patients, an examination of various factors revealed significant associations with the presence of teeth post-treatment, utilizing a p-value threshold of 0.1 for identifying noteworthy findings.

The presence of voids and the location of these voids within treated teeth emerged as influential factors. Specifically, the location of voids demonstrated a statistically significant association with tooth presence, $\chi^2(2, N = 161) = 6.099$, $p = .047$, indicating that the spatial distribution of voids has a critical impact on the long-term retention of teeth.

Additionally, the use of a dental dam was significant, $\chi^2(1, N = 164) = 2.876$, $p = .090$, suggesting an influence on treatment outcomes. Similarly, whether a crown was placed showed significance, $\chi^2(1, N = 164) = 3.101$, $p = .078$, hinting at its role in the preservation of teeth over time.

Other variables, including tooth type, number of appointments, diagnosis, obturation within 2mm of the radiographic apex, the presence of a pre-operative lesion, coronal restoration before and after root canal treatment, and the type of irrigant used, did not demonstrate significant associations.

The figure below shows the visual pattern of p-values for each variable.



Results – Year 3

The table below shows the results for the third-year follow-up.

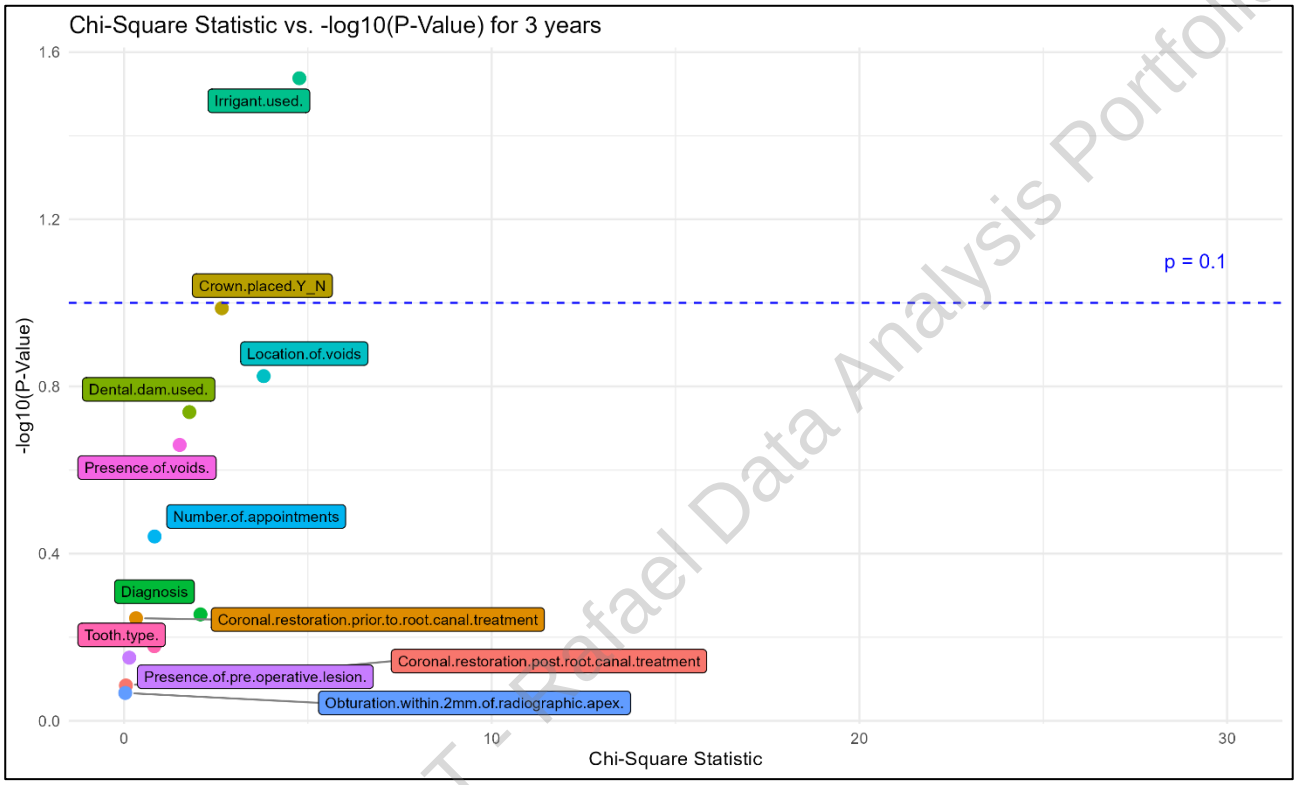
Variable	Level	Sample Size	N (%)	Y (%)	Chi Square	P Value
Tooth type	Anterior	16	11.1	10.3	0.823	0.663
	Molar	92	66.7	58.7		
	Premolar	45	22.2	31.0		
Number of appointments	Multiple	123	74.1	81.7	0.830	0.362
	Single	30	25.9	18.3		
Diagnosis	Acute periapical periodontitis	21	16.0	14.0	2.078	0.556
	Chronic apical periodontitis	49	44.0	31.4		
	Chronic periapical periodontitis	36	16.0	26.4		
	Irreversible pulpitis	40	24.0	28.1		
Obturation within 2mm of radiographic apex	no	94	63.0	61.1	0.032	0.858
	yes	59	37.0	38.9		
Presence of pre operative lesion	no	30	22.2	19.0	0.142	0.706
	yes	123	77.8	81.0		
Presence of voids	no	111	63.0	74.6	1.513	0.219
	yes	42	37.0	25.4		
Location of voids	All	7	11.1	3.3	3.798	0.150
	coronal	32	25.9	20.3		
	no	111	63.0	76.4		
Coronal restoration prior to root canal treatment	Direct	137	92.6	88.9	0.326	0.568
	Indirect	16	7.4	11.1		
Coronal restoration post root canal treatment	Direct	140	92.6	91.3	0.050	0.823
	Indirect	13	7.4	8.7		
Irrigant used	Other	20	25.9	10.3	4.767	0.029
	Sodium hypochlorite	133	74.1	89.7		
Dental dam used	N	5	7.4	2.4	1.777	0.183
	Y	148	92.6	97.6		
Crown placed Y N	N	92	74.1	57.1	2.659	0.103
	Y	61	25.9	42.9		

At the 3-year follow-up, the investigation into the determinants of tooth presence post-treatment revealed limited significant associations, employing a Chi-square test to elucidate these relationships. Notably, the type of irrigant used was the only variable to demonstrate a statistically significant association with tooth presence, $\chi^2(1, N = 153) = 4.767$, $p = .029$. Specifically, the use of sodium hypochlorite compared to other irrigants was associated with a higher percentage of tooth presence (89.7% vs. 10.3%), suggesting its effectiveness in enhancing the likelihood of tooth retention over time.

While the presence of voids, location of voids, and whether a crown was placed did not reach conventional levels of statistical significance, the analysis of crown placement approached significance, $\chi^2(1, N = 153) = 2.659$, $p = .103$. This trend suggests a potential influence of crown placement on tooth preservation, warranting further exploration in future studies to confirm its impact.

Other variables, including tooth type, number of appointments, diagnosis, obturation within 2mm of the radiographic apex, the presence of a pre-operative lesion, coronal restoration before and after root canal treatment, and the use of a dental dam, did not exhibit statistically significant associations with tooth presence at the 3-year mark. Their p-values ranged from .103 to .858, indicating no clear evidence of their influence on the outcomes of interest within this dataset.

The figure below shows the visual pattern of p-values for each variable.



Results – Year 4

The table below shows the results for the fourth-year follow-up.

Variable	Level	Sample Size	N (%)	Y (%)	Chi Square	P Value
Tooth type	Anterior	14	9.7	9.7	0.872	0.647
	Molar	88	67.7	59.3		
	Premolar	42	22.6	31.0		
Number of appointments	Multiple	115	74.2	81.4	0.789	0.374
	Single	29	25.8	18.6		
Diagnosis	Acute periapical periodontitis	21	13.8	15.6	0.629	0.890
	Chronic apical periodontitis	46	37.9	32.1		
	Chronic periapical periodontitis	35	20.7	26.6		
	Irreversible pulpitis	36	27.6	25.7		
Obturation within 2mm of radiographic apex	no	90	67.7	61.1	0.463	0.496
	yes	54	32.3	38.9		
Presence of pre operative lesion	no	28	19.4	19.5	0.000	0.989
	yes	116	80.6	80.5		
Presence of voids	no	102	61.3	73.5	1.741	0.187
	yes	42	38.7	26.5		
Location of voids	All	7	9.7	3.6	3.152	0.207
	coronal	32	29.0	20.9		
	no	102	61.3	75.5		
Coronal restoration prior to root canal treatment	Direct	128	93.5	87.6	0.868	0.351
	Indirect	16	6.5	12.4		
Coronal restoration post root canal treatment	Direct	131	93.5	90.3	0.319	0.572
	Indirect	13	6.5	9.7		
Irrigant used	Other	19	22.6	10.6	3.039	0.081
	Sodium hypochlorite	125	77.4	89.4		
Dental dam used	N	5	6.5	2.7	1.046	0.306
	Y	139	93.5	97.3		
Crown placed Y N	N	84	74.2	54.0	4.088	0.043
	Y	60	25.8	46.0		

At the 4-year follow-up, the analysis of factors affecting tooth presence post-treatment revealed a statistically significant association with crown placement, $\chi^2(1, N = 144) = 4.088$, $p = .043$. Specifically, the presence of a crown was associated with a higher percentage of tooth retention (46.0% for those with crowns vs. 54.0% for those without), indicating the effectiveness of crown placement in enhancing long-term tooth preservation.

Furthermore, the analysis revealed a significance in the type of irrigant used during treatment, $\chi^2(1, N = 144) = 3.039$, $p = .081$. Specifically, 89.4% of the teeth that were present used Sodium hypochlorite compared to other irrigants (10.6%). This suggests a potential advantage of sodium hypochlorite in promoting tooth preservation, meriting further investigation to confirm its efficacy.

Other variables examined, including tooth type, number of appointments, diagnosis, obturation within 2mm of the radiographic apex, the presence of a pre-operative lesion, the presence of voids, the location of voids, coronal restoration before and after root canal treatment, and the use of a dental

dam, did not demonstrate statistically significant associations with tooth presence at the 4-year mark. Their p-values ranged from .187 to .989, indicating no discernible impact on the outcomes of interest within this dataset.

The figure below shows the visual pattern of p-values for each variable.