A Statistical Analysis of Tooth Decay in Individuals with Down Syndrome
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Executive Summary

The client presents a retrospective study about dental anomalies and associated systemic conditions in adults with Down syndrome. The client indicated during the consultation that the statistical consulting team could aid in the creation of frequency tables for tooth anomalies , tooth damage and periodontal conditions, while also finding a relationship between thyroid calcification and thyroid disease. Extensive data cleaning was conducted to achieve these goals. Furthermore, the Chi-Square test for independence indicates there is a significant relationship between thyroid calcification and thyroid disease.

Background

The client has undertaken a comprehensive study involving the collection of demographic and panoramic radiograph data from a total of 183 participants. This study, utilizing Redcap for data collection, involved 53 participants directly associated with the study and an additional 130 controls, with the latter's data being collected by supervised dental students. The consolidated dataset has undergone initial frequency analysis using Jamovi software. However, due to pressing deadlines for thesis completion and recent health issues, Antonia requires urgent statistical consulting assistance.

Based on our initial consultation with the client we formed two main goals: produce frequencies and contingency tables for both cases and controls, with a focus on making these findings accessible and meaningful for the client's thesis and then analyze the independence between thyroid calcification and thyroid disease, using chi-square tests to identify any statistically significant relationships.

Dataset

The data was collected from 183 participants, including 53 cases directly associated with the study and 130 controls. It was found that among the case group, there were a total of 26 females and 27 males and among the control group, 59 females and 71 males were participants. All variables related to dental conditions are categorical with responses categorized as checked or unchecked, yes or no. The frequency table for frequency of tooth damage shows prevalence of different types of tooth damage and their distribution among cases and controls. The frequency table of tooth anomalies provides the frequency and distribution of tooth anomalies among cases

and controls. The frequency table of periodontal conditions presents the number of cases where dental bone loss conditions were present or absent in both case and control groups.

Analysis and Findings

The frequency table for frequency of tooth damage shows prevalence of different types of tooth damage and their distribution among cases and controls.. The table lists various types of tooth damage including grinding, restoration, trauma, caries, and root canal treatment. The data is categorized into 4 groups: case with damage, case with no damage, control with damage, and control with no damage. This denotes whether the individuals were cases, those within the client's study, or controls, healthy individuals, and whether they identified as having tooth damage.

Frequency of tooth damage

tooth_damage_type	case_control	tooth_damage_present	n	percentage	cumulative_percentage
grinding	Case	No	39	21%	21%
grinding	Case	Yes	14	8%	29%
grinding	Control	No	106	58%	87%
grinding	Control	Yes	24	13%	100%
restoration	Case	No	44	24%	24%
restoration	Case	Yes	9	5%	29%
restoration	Control	No	32	17%	46%
restoration	Control	Yes	98	54%	100%
trauma	Case	No	48	26%	26%
trauma	Case	Yes	5	3%	29%
trauma	Control	No	130	71%	100%
caries	Case	No	30	16%	16%
caries	Case	Yes	23	13%	29%
caries	Control	No	59	32%	61%
caries	Control	Yes	71	39%	100%
root canal tx	Case	No	47	26%	26%
root canal tx	Case	Yes	6	3%	29%
root canal tx	Control	No	85	46%	75%
root canal tx	Control	Yes	45	25%	100%

The frequency table of periodontal conditions presents the number of cases where dental bone loss conditions were present or absent in both case and control groups.

Frequency of periodontal conditions

bone_loss_condition	case_control	bone_condition_present	n	percentage	cumulative_percentage
any perio	Case	No	12	7%	7%
any perio	Case	Yes	41	22%	29%
any perio	Control	No	34	19%	48%
any perio	Control	Yes	96	52%	100%

The frequency table of tooth anomalies provides the frequency and distribution of tooth anomalies among cases and controls.

Frequency of tooth anomalies

tooth_anomalies_type	case_control	tooth_condition_present	n	percentage	cumulative_percentage
anomalies	Case	No	1	1%	1%
anomalies	Case	Yes	52	28%	29%
anomalies	Control	No	82	45%	74%
anomalies	Control	Yes	48	26%	100%
dilacerated root	Case	No	21	11%	11%
dilacerated root	Case	Yes	32	17%	29%
dilacerated root	Control	No	107	58%	87%
dilacerated root	Control	Yes	23	13%	100%
impacted	Case	No	36	20%	20%
impacted	Case	Yes	17	9%	29%
impacted	Control	No	107	58%	87%
impacted	Control	Yes	23	13%	100%
microdont	Case	No	33	18%	18%
microdont	Case	Yes	20	11%	29%
microdont	Control	No	127	69%	98%
microdont	Control	Yes	3	2%	100%
missing anodontia	Case	No	13	7%	7%
missing anodontia	Case	Yes	40	22%	29%
missing anodontia	Control	No	129	70%	99%
missing anodontia	Control	Yes	1	1%	100%
resorbed root	Case	No	51	28%	28%
resorbed root	Case	Yes	2	1%	29%
resorbed root	Control	No	124	68%	97%
resorbed root	Control	Yes	6	3%	100%
retained	Case	No	35	19%	19%
retained	Case	Yes	18	10%	29%
retained	Control	No	129	70%	99%
retained	Control	Yes	1	1%	100%
supernumary	Case	No	35	19%	19%
supernumary	Case	Yes	18	10%	29%
supernumary	Control	No	130	71%	100%
taurodont	Case	No	23	13%	13%
taurodont	Case	Yes	30	16%	29%
taurodont	Control	No	129	70%	99%
taurodont	Control	Yes	1	1%	100%
transposed	Case	No	48	26%	26%
transposed	Case	Yes	5	3%	29%
transposed	Control	No	130	71%	100%

We have investigated if thyroid calcification can be an indicator of thyroid disease as requested. We performed a chi-square test for independence and the result yielded a p-value of less than 0.05, indicating that there is an association between the presence of thyroid calcification and thyroid condition.

Null hypothesis (H_0) : There is no association between the presence of thyroid calcification and thyroid condition.

Alternative hypothesis (H_1) : There is an association between the presence of thyroid calcification and thyroid condition.

The result of the test yielded a Chi-Square value of 24,530 with 3 degrees of freedom and a p-value of less than < 2.2e-16, which is less than 0.05. This suggests that there is enough evidence to reject the null hypothesis, meaning that thyroid calcification can be an indicator of thyroid disease.

Conclusion

The creation of frequencies and contingency tables has provided a deeper understanding of conditions in both cases and controls. Furthermore, the Chi-Square test for independence between thyroid calcification and thyroid disease has highlighted important correlations. These results are presented in a clear and accessible format, enhancing the substance and utility of the client's thesis.