Supplementary material

Appendix 1

Questionnaire

A. Endodontic Difficulties:

Please rate the frequency with which you have experienced difficulties in the following aspects of endodontic procedures. Use the following scale to rate each item: Never (0), Rare (1), Sometimes (2), and Frequent (3).

1. Accurate endodontic diagnosis
2. Delivering local anesthesia prior to treatment
3. Pain management
4. Rubber dam application
5. Accessing the pulp chamber
6. Deroofing the pulp chamber
7. Canal location after access opening
8. Avoiding excessive cutting, gouging, or perforation
9. Interpreting preoperative radiographs for working length estimation
10. Reaching the apex after canal location
11. Developing tactile sensation
12. Using an apex locator
13. Maintaining correct working length during the procedure
14. Preventing ledges in root canals during shaping
15. Preventing canal blockage due to debris accumulation during shaping
16. Avoiding over-instrumentation during canal shaping
17. Preventing canal transportation during shaping
18. Avoiding strip perforations during canal shaping
19. Preventing instrument separation in canals during preparation
20. Creating sufficient taper in canals during shaping
21. Avoiding sodium hypochlorite spillage or accidents
22. Using chelating agents during canal preparation
23. Achieving tug-back prior to master cone radiograph
24. Applying sealer during obturation
25. Adjusting the spreader to 1-2 mm of working length during cold lateral condensation
26. Accessory cone placement during lateral condensation
27. Avoiding voids in post-operative radiographs following obturation

B. Endodontic Mistakes:

Please describe any mistakes or challenges you have encountered during endodontic treatment
Appendix 2

Python code for generating heatmap 1:

```python
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt

# create the dataframe
data = {
    'Accurate endodontic diagnosis': [2.09, 2, 0.468],
    'Local anesthesia delivery': [1.89, 2, 0.714],
    'Pain management in endodontic treatment': [2.13, 2, 0.661],
    'Rubber dam placement': [1.78, 2, 0.765],
    'Patient management difficulties': [1.82, 2, 0.62],
    'Reaching the pulp chamber during access opening': [1.93, 2, 0.78],
    'Deroofing the pulp chamber during access opening': [1.98, 2, 0.783],
    'Locating canals following access opening': [2.09, 2, 0.676],
    'Perforating the tooth during access opening': [1.07, 1, 0.837],
    'Interpreting preoperative IOPA to estimate working length': [1.84, 2, 0.878],
    'Reaching the apex following canal location': [2.16, 2, 0.562],
    'Feeling the apical constriction/developing tactile sensation': [2.40, 3, 0.72],
    'Using the apex locator': [2.02, 2, 0.952],
    'Lost working length': [2.21, 2, 0.6],
    'Creating ledges': [1.70, 2, 0.638],
    'Blocked canals due to debris accumulation': [1.67, 2, 0.715],
    'Apical perforations': [1.52, 2, 0.773],
    'Transportation': [1.57, 2, 0.668],
    'Strip perforations': [1.50, 1, 0.716],
    'Separation of instruments': [0.944, 1, 0.893],
    'Insufficient taper': [1.79, 2, 0.709],
    'Sodium hypochlorite spills/accidents': [1.13, 1, 0.906],
    'Difficulty with chelating agents': [1.60, 2, 0.632],
    'Difficulty with sealer application': [2.17, 2, 0.73],
    'Difficulty with spreader placement': [2.00, 2, 0.73],
    'Difficulty with accessory cone placement': [2.50, 3, 0.707],
    'Void in post-operative IOPA': [2.03, 2, 0.57]
}

# Create the DataFrame
df = pd.DataFrame(data)
# Transpose the DataFrame
df = df.transpose()
# Rename the columns
df.columns = ['Mean', 'Median', 'SD']
# Sort the values by mean in ascending order
df.sort_values('Mean', inplace=True)
# Create a heatmap with Seaborn
plt.figure(figsize=(8, 6))
sns.heatmap(df, annot=True, cmap='coolwarm', cbar=True, fmt='.2f', linewidths=0.5)
# Customize the heatmap
plt.title('Difficulties Faced by Dental Students in Root Canal Treatment')
plt.xlabel('Statistics')
plt.ylabel('Questions')
# Show the heatmap
plt.show()```
Python code for generating heatmap 2:

```python
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt

data = {
    'Pain management': [2.21, 2, 0.615],
    'Rubber dam application': [1.87, 2, 0.665],
    'Reaching the pulp chamber': [1.97, 2, 0.584],
    'Adequate deroofing of the pulp chamber': [2.00, 2, 0.569],
    'Locating canal orifices': [2.26, 2, 0.498],
    'Perforations': [2.15, 2, 0.587],
    'Reaching the apex': [2.37, 2, 0.675],
    'Tactile sensation development at the apical constriction': [2.13, 2, 0.615],
    'Using apex locators': [2.32, 2, 0.574],
    'Loss of working length during shaping': [2.05, 2, 0.456],
    'Chemo-mechanical preparation related difficulties': [2.18, 2, 0.601]
}

# Create the DataFrame
df = pd.DataFrame(data)
# Transpose the DataFrame
df = df.transpose()
# Rename the columns
df.columns = ['Mean', 'Median', 'SD']
# Sort the values by mean in ascending order
df.sort_values('Mean', inplace=True)
# Create a heatmap with Seaborn
plt.figure(figsize=(8, 6))
sns.heatmap(df, annot=True, cmap='coolwarm', cbar=True, fmt='.2f', linewidths=0.5)
# Customize the heatmap
plt.title('Difficulties Faced by Dental Students in Root Canal Treatment')
plt.xlabel('Statistics')
plt.ylabel('Questions')
# Show the heatmap
plt.show()
```