Evaluation of Panoramic Acquisition Errors by Pre-doctoral Dental Students

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Introduction

- Panoramic imaging is a commonly used dental radiograph for diagnosing and treating dental lesions.

- Accurate patient positioning is crucial for creating a diagnostic image.

- As novel clinicians, dental students are prone to positioning mistakes affecting the quality of the image.

- Positioning errors can cause superimposition, minification, magnification, and other artifacts in the panoramic image.

- Patient characteristics such as height, stature, and mobility can have an impact on patient positioning during imaging acquisition.

Figure 1: Chin upward positioning error. Distortion leading to a flattened mandible.

Figure 2: Chin downward positioning error. Distortion leading to extreme curvature of the mandible.

Figure 3: Rotation (left) positioning error. Magnification of the left ramus of mandible.
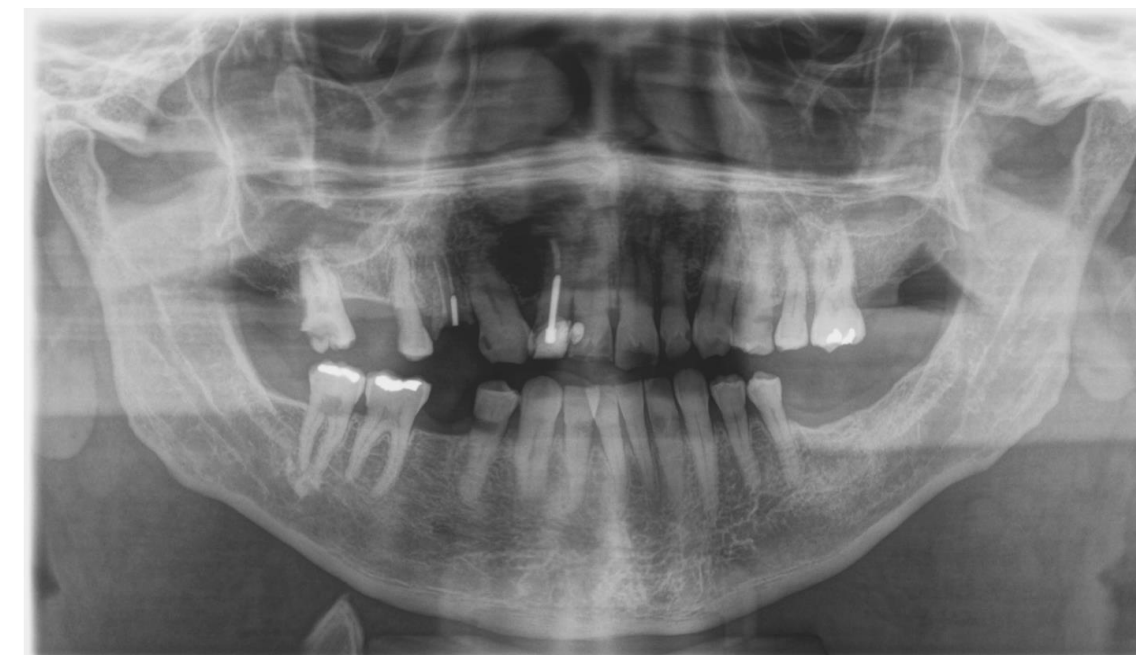
Figure 4: Tilt positioning error. Left mandibular condyle is positioned higher than right.

Figure 5: Tongue placement error. Palatoglossal airspace presents over apices of maxillary dentition.

Figure 6: Foreign Object error. Present of ghosting image over maxilla.

- Exercises were categorized into two forms of assessments, formative and summative.

- Formative exercises (Exercises 1-4) allowed for students to receive help from instructors and assistants.

- During summative skills assessment (SA), students completed the exercise independently without instructor assistance.

Methods

- Four panoramic exercises (formative assessments) and one final skills assessment (summative assessment) submitted by third-year dental students (D3) were analyzed by radiology instructors.

- Technical errors, including anterior-posterior, Frankfort plane, and midsagittal plane misalignment, tongue and spinal placement, foreign objects, and exposure errors, were recorded.

- The recorded technical errors were totaled by category in each assessment.

- The percentage of students making various errors was calculated.

- Error trends were compared among formative and summative assessments via inferential analysis.

Results

- A total of 263 panoramic images were taken during the 5 exercises.

- Overall, 39 images were error free (14.83%) and 224 contained at least 1 error (85.17%).

Table 1: Percent of students committing various errors sorted by exercise.

Error Type	Exercise 1 (%)	Exercise 2 (%)	Exercise 3 (%)	Exercise 4 (%)	Skills Assessment (%)
Chin Upward	39.22%	45.45%	37.74%	42.31%	40.38%
Chin Downward	7.84%	12.73%	16.98%	19.23%	25.00%
Rotation	33.33%	18.18%	18.87	21.15%	32.69%
Tilt	11.76%	9.09%	7.55%	11.54%	9.62%
Tongue Placement	23.53%	12.73%	15.09%	17.31%	17.31%
Spinal Slouching	17.65%	5.45%	1.89%	5.77%	9.62%
Forward	0.00%	12.72%	11.32%	11.54%	5.77%
Backward	3.92%	5.45%	7.55%	3.85%	5.77%
Foreign Object	3.92%	5.45%	11.32%	13.46%	11.54%
Apron	0.00%	0.00%	1.89%	1.92%	1.92%
Patient Motion	5.88%	5.45%	3.77%	0.00%	1.92%
Over Exposure	0.00%	0.00%	0.00%	0.00%	0.00%
Under Exposure	5.88%	0.00%	0.00%	0.00%	0.00%

Figure 7: Percent of Students Committing Various Errors vs Panoramic Exercise with Time
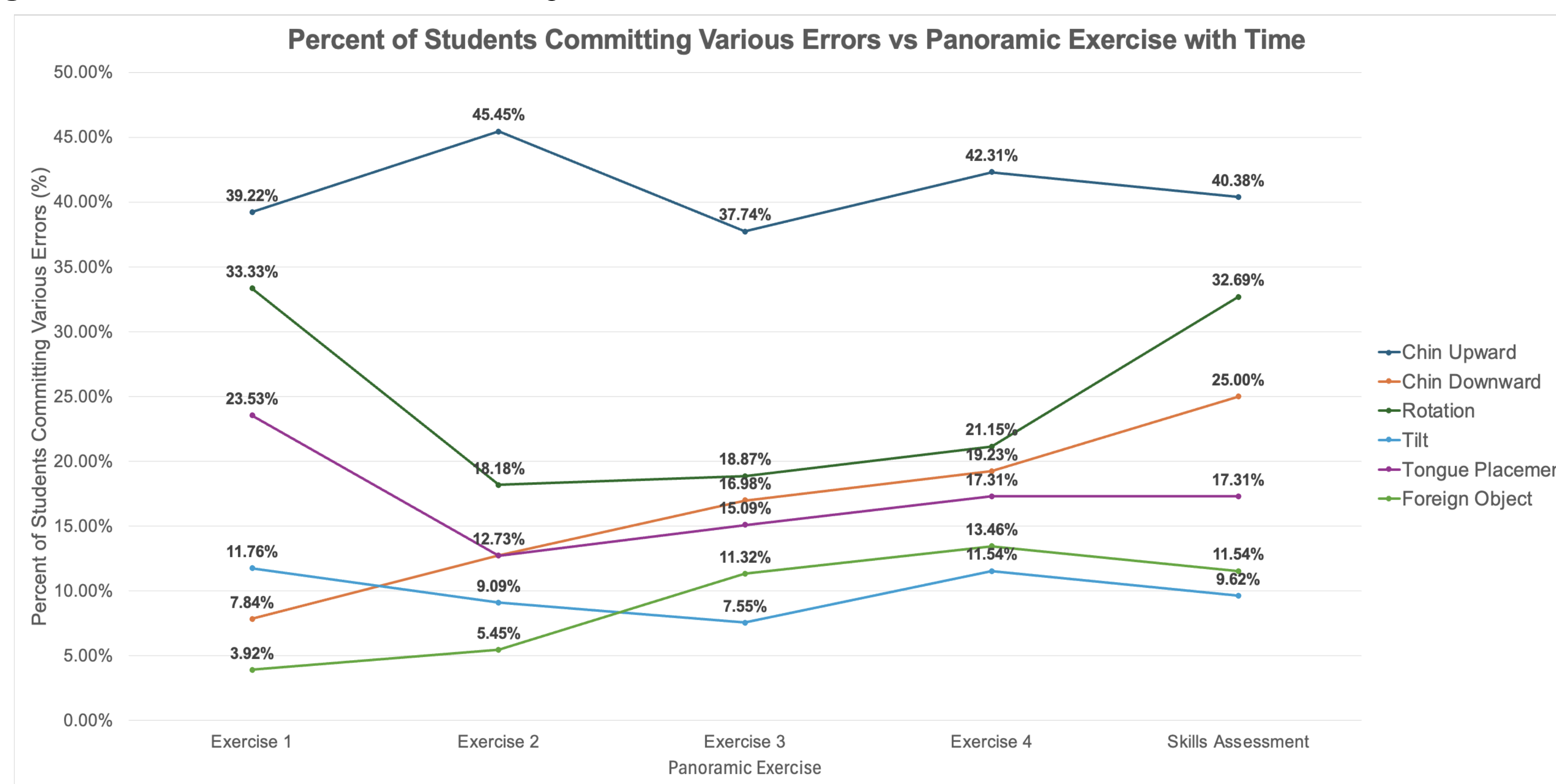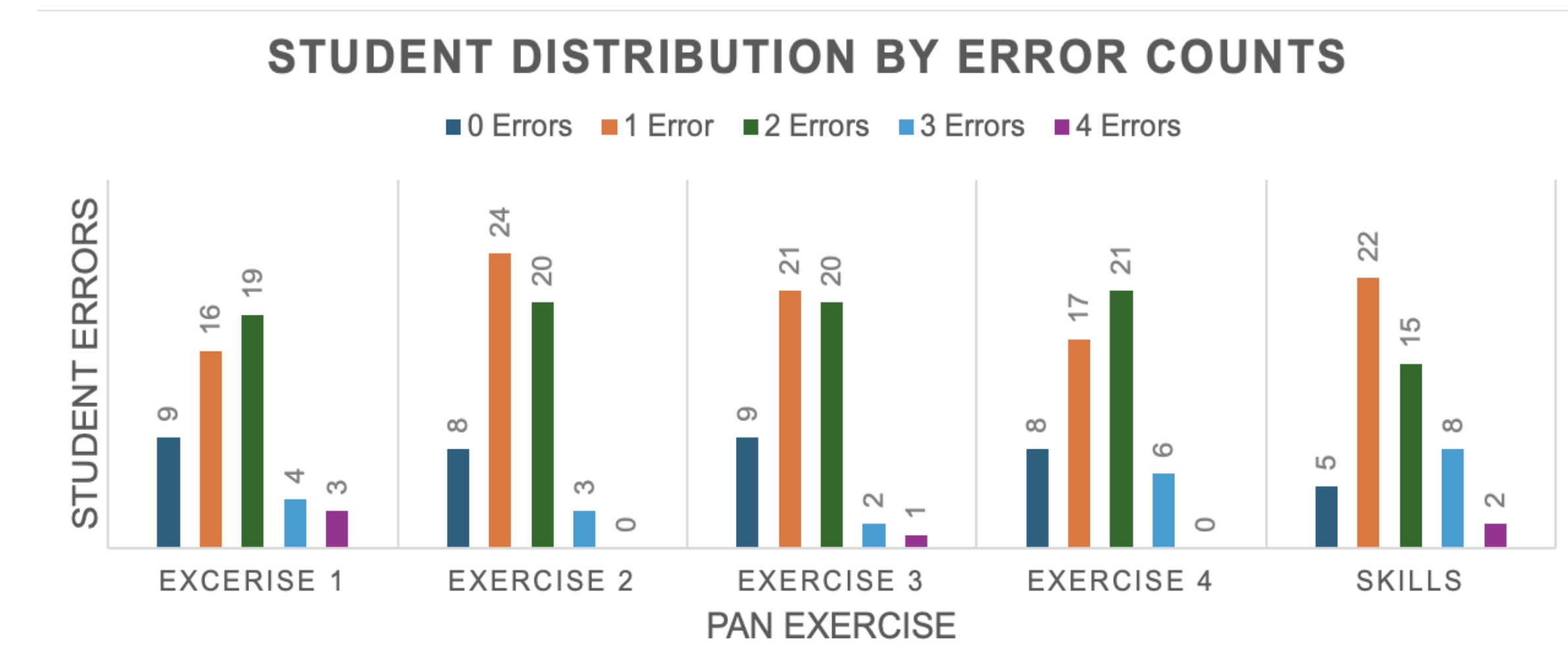

Figure 8: The student distribution by error counts during each panoramic exercise.

- Errors such as chin upward, chin downward, rotation, tilt, tongue placement, and foreign object were the most frequent errors committed by SoDM D3 students.

- Most students made 1 to 2 errors with 4 being the highest number of errors committed during an exercise **(Figure 8)**.

- The error types and distributions did not demonstrate statistically significant differences between formative and summative exercises, as revealed by the calculated exact 95% confidence interval.

Discussion

- Patient positioning errors such as chin upward/downward and rotation/tilt are persistent (**Figure 7**) showing a need to provide increased attention and instruction to improve student performance in these areas.

- There is no statistical significance between the errors committed during formative and summative exercises.

- It is speculated that unlike formative assessments, anxiety occurring during summative assessment could partially contribute to the errors committed by the students.

Conclusions

- All SoDM D3 students passed the panoramic summative assessments by producing diagnostic quality radiographs, reflecting the quality of clinical instruction.

- Frankfort and midsagittal plane errors, caused by errors in chin placement and head rotation, persisted throughout all 5 exercises, indicating that more instruction needs to be directed towards these areas to optimize imaging performance.