1815 - Feasibility of Surgical Autonomy Program for Timely Evaluation of Resident Performance of ACDF Surgery

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Introduction

Existing tools for evaluating resident operative competence are sometimes disruptive to operative workflow, are resource-intensive, and are often completed long after the procedure being addressed. Duke Neurosurgery developed and implemented an innovative, smartphone-based tool, the Surgical Autonomy Program (SAP), in our spine surgery workflow. We hypothesized that it would improve efficiency and efficacy of the resident and faculty feedback process. Here we present our experience, with a focus on anterior cervical discectomy and fusion (ACDF).
Methods

The SAP applies Vygotsky’s Social Learning Theory to the process of acquisition of surgical skills and competence. Each case is broken into 4 zones that a resident sequentially works through. At the end of each case, the resident self evaluates and the attending evaluates the resident’s performance on a scale assessing their independence in the operating room. Between August 2017 and October 2019, we implemented the IRB-approved SAP, which was made available to all neurosurgical faculty and residents at Duke University Hospital. We present data from 226 ACDF cases performed and recorded within the SAP software.
Results

The SAP provides a scalable and efficient approach that divides each surgical procedure into four Zones of Proximal Development (ZPD) for focused learning on the key steps of the procedure in a sequential manner, based on the resident’s experience to date. For the Anterior Cervical Discectomy and Fusion procedure, the case was broken into the following 4 zones:

<table>
<thead>
<tr>
<th>Zone 1</th>
<th>Zone 2</th>
<th>Zone 3</th>
<th>Zone 4</th>
</tr>
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<tbody>
<tr>
<td>Positioning/Exposure/Level Confirmation</td>
<td>Retractor Distractor placement/discectomy/end plate prep/size graft</td>
<td>Removal of osteophyte PLL/foraminal decompression</td>
<td>Graft Hardware placement/Closure</td>
</tr>
</tbody>
</table>
Results

Furthermore, the TAGS scale provides insights into resident expectations and faculty perceptions. The resident self evaluates how they felt they did on each zone. The faculty rates them as well and provides written feedback on specific areas to improve upon.

**T: Teach & Demonstrate:**
Faculty teaches and demonstrates through the agreed upon ZPD by Faculty and Resident:
Primary Surgeon: Faculty  First Assist: Resident  Guiding Case: Faculty

**A: Advise & Scaffold:**
Faculty does most of talking, while resident doing more and more in ZPD:
Primary Surgeon: Resident  First Assist: Faculty  Guiding Case: Faculty

**G: Guide & Monitor:**
Resident doing most of case and most of talking, faculty helping with finer points in ZPD:
Primary Surgeon: Resident  First Assist: Faculty  Guiding Case: Resident

**S: Solo & Observe:**
Resident can perform independently the chosen ZPD or train a junior resident in that ZPD:
Primary Surgeon: Resident  First Assist: Faculty  Guiding Case: Resident
## Results

### Image of the Resident Self Evaluation

#### Self Evaluation

How would you rate the difficulty of this case as compared to an average Anterior Cervical Discectomy and Fusion +/- Corpectomy?

- Easy
- Average
- Hard

Which ZPD were you focused on in today’s Anterior Cervical Discectomy and Fusion +/- Corpectomy?

- ZPD 1=Positioning/Exposure/ Level Confirmation
- ZPD 2=Retractor Distractor placement/discectomy/end plate prep/size graft
- ZPD 3=Removal of osteocyte PLL foraminal decompression
- ZPD 4=Graft Hardware placement/Closure

Please select your TAGS value for each ZPD: [View TAGS Scale]

<table>
<thead>
<tr>
<th>ZPD</th>
<th>T</th>
<th>A</th>
<th>G</th>
<th>S</th>
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<tbody>
<tr>
<td>ZPD1= Positioning/Exposure/ Level Confirmation</td>
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<tr>
<td>ZPD2= Retractor Distractor placement/discectomy/end plate prep/size graft</td>
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<td></td>
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<tr>
<td>ZPD3= Removal of osteocyte PLL foraminal decompression</td>
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<tr>
<td>ZPD4= Graft Hardware placement/Closure</td>
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[View TAGS Scale]

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Results

Use of the SAP appeared to be efficient and feasible for both resident self-evaluation (median 16 sec, mean 53 sec) and faculty evaluation of residents (median 24 sec, mean 72 sec). The vast majority of faculty feedback was provided within 24-48 hours.

Example chart showing a resident’s progression through multiple ACDF cases
Discussion

• This pilot has demonstrated the ability of the SAP to easily and clearly measure resident learning and progress in performing ACDFs and enhance the efficiency, frequency and timeliness of intraoperative assessment.

• This information can be used to advise individual residents, modify program curricula, and inform training guidelines for spine surgery.
Summary Points

1. The Surgical Autonomy Program (SAP) makes real-time intraoperative performance assessment feasible for every index spine case and can be feasibly integrated into a residency training program.

2. The SAP provides a scalable and efficient approach that divides each surgical procedure into four Zones of Proximal Development (ZPD).

3. This pilot has demonstrated the ability to easily and clearly visualize resident progress for ACDF, as an example index spine case.