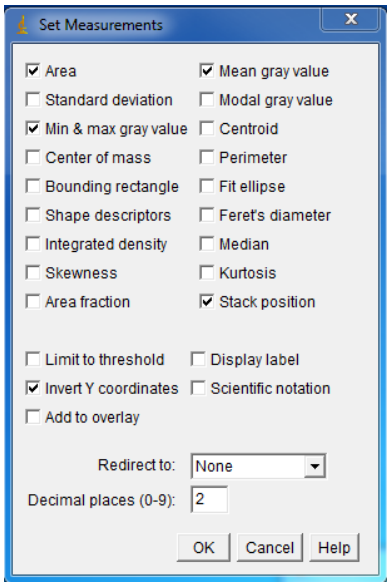
Hyoid Displacement Calculation Instructions

Introduction: In this file you will find instructions for measuring hyoid displacement (single peak and two peaks). While recent data from research in our lab suggests that measurement of a single point (peak position) is adequate for capturing variations in hyoid movement during swallowing across different conditions, you may still wish to measure displacement between a rest and peak position. In this case, we recommend that you choose a rest position at the end of the swallow, after the hyoid has returned to baseline; we call this frame the "Swallow Rest" frame.

How to Measure Hyoid Rest to a Single Hyoid Peak

1. **Open *ImageJ***
   (Download from the following website: http://rsbweb.nih.gov/ij/)

2. **Set Measurements**
   - Click *Analyze* → *Set Measurements*
     - Only necessary the first time you set up ImageJ on your computer
   - Set measurements as per the diagram to the right:
   - Click *OK*

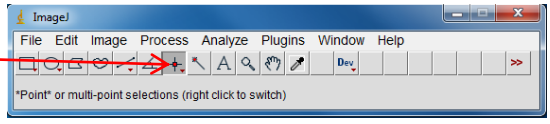


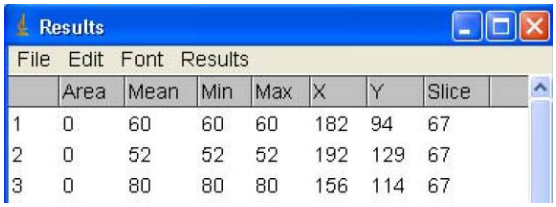
3. **Find the hyoid rest frame**
   - Locate the hyoid rest frame

4. **Take measurements on hyoid rest frame**
   - Select the *Point* tool
   - Locate the C2 vertebrae:
     - Click on the anterior inferior edge of C2 vertebrae
     - Press *Ctrl* + *M*

   a. Locate the C4 vertebrae:
     - Click on the anterior inferior edge of C4 vertebrae
     - Press *Ctrl* + *M*

   b. Locate the Hyoid:
     - Click on the anterior inferior edge of the hyoid
     - Press *Ctrl* + *M*





Note: The measurements must be taken in the exact order described above.

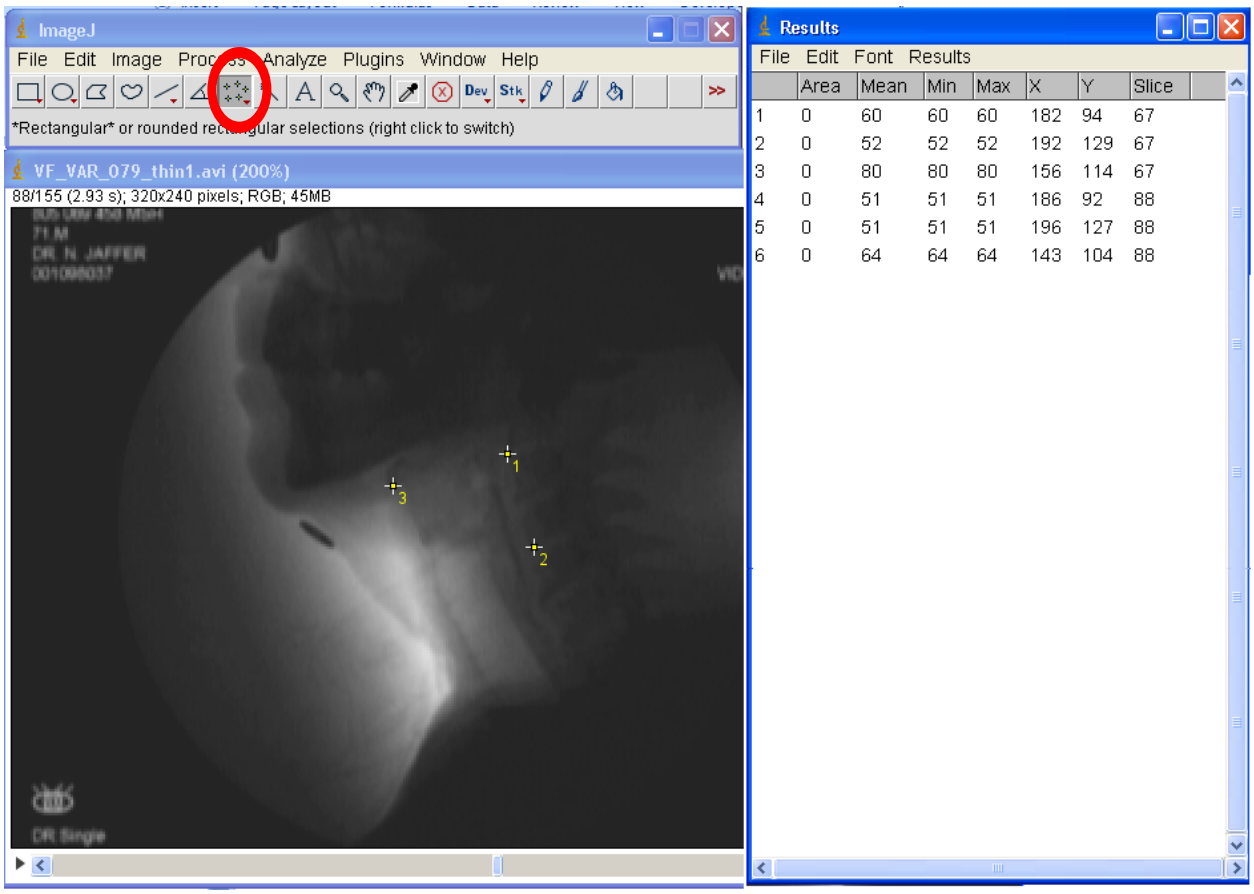
5. **Find the hyoid peak frame**
    - Locate the hyoid peak frame

6. **Take measurements on hyoid peak frame**
    - Select the *Point* tool
    - Locate the C2 vertebrae:
        - Click on the anterior inferior edge of C2 vertebrae
        - Press *Ctrl + M*

    c. Locate the C4 vertebrae:
        - Click on the anterior inferior edge of C4 vertebrae
        - Press *Ctrl + M*

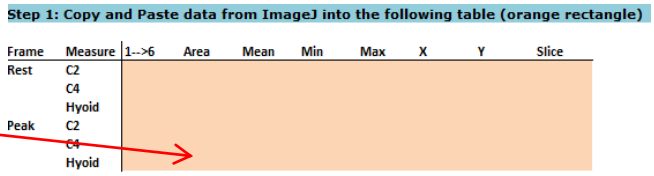
    d. Locate the Hyoid:
        - Click on the anterior inferior edge of the hyoid
        - Press *Ctrl + M*

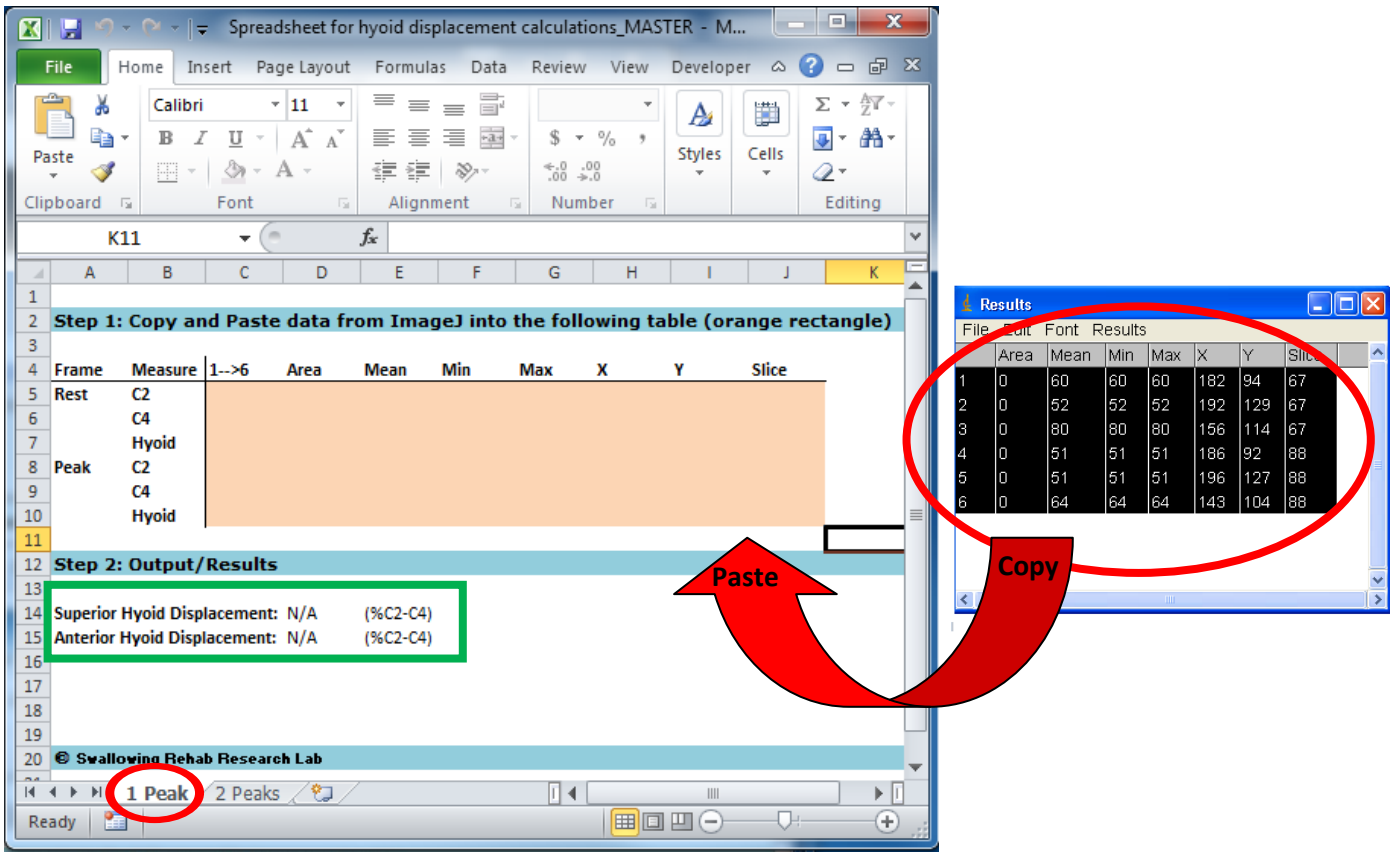
Note: The measurements must be taken in the exact order described above.



7. **Collate data**

- Open the *Hyoid Displacement Calculation Sheet*
- Select the *'1 Peak'* tab
- In the Results box, select all 6 rows
- Press *Ctrl + C* to copy the data Press *Ctrl + V* to paste the data into the orange rectangle in the Excel worksheet





8. Review the results

- The hyoid displacement will be displayed in the Excel worksheet (green box in image above)

How to Measure Hyoid Rest to Two Hyoid Peak

1. **Open *ImageJ***
   (Download from the following website: http://rsbweb.nih.gov/ij/)

2. **Set Measurements**
   - Click *Analyze* → *Set Measurements*
     - Only necessary the first time you set up ImageJ on your computer
   - Set measurements as per the diagram to the right:
   - Click *OK*

3. **Find the hyoid rest frame**
   - Locate the hyoid rest frame
   - Select the *Point* tool
     a. Locate the C2 vertebrae:
        - Click on the anterior inferior edge of C2 vertebrae
        - Press *Ctrl* + *M*
     b. Locate the C4 vertebrae:
        - Click on the anterior inferior edge of C4 vertebrae
        - Press *Ctrl* + *M*
     c. Locate the Hyoid:
        - Click on the anterior inferior edge of the hyoid
        - Press *Ctrl* + *M*

     Note: The measurements must be taken in the exact order described above.

4. **Find the hyoid peak SUPERIOR frame**
   - Locate the hyoid peak SUPERIOR frame
   - Select the *Point* tool
     d. Locate the C2 vertebrae:
        - Click on the anterior inferior edge of C2 vertebrae
        - Press *Ctrl* + *M*
     e. Locate the C4 vertebrae:
        - Click on the anterior inferior edge of C4 vertebrae
        - Press *Ctrl* + *M*
     f. Locate the Hyoid:
        - Click on the anterior inferior edge of the hyoid
        - Press *Ctrl* + *M*

     Note: The measurements must be taken in the exact order described above.

5. **Find the hyoid peak ANTERIOR frame**
    - Locate the hyoid peak ANTERIOR frame
    - Select the *Point* tool
        g. Locate the C2 vertebrae:
            - Click on the anterior inferior edge of C2 vertebrae
            - Press *Ctrl + M*
        h. Locate the C4 vertebrae:
            - Click on the anterior inferior edge of C4 vertebrae
            - Press *Ctrl + M*
        i. Locate the Hyoid:
            - Click on the anterior inferior edge of the hyoid
            - Press *Ctrl + M*

        Note: The measurements must be taken in the exact order described above.

6. **Collate data**
    - Open the *Hyoid Displacement Calculation Sheet*
    - Select the *'2 Peaks'* tab
    - In the Results box, select all 6 rows
    - Press *Ctrl + C* to copy the data Press *Ctrl + V* to paste the data into the orange rectangle in the Excel worksheet

7. **Review the results**
    - The hyoid displacement will be displayed in the Excel worksheet