

# EVALUATION OF THREE-DIMENSIONAL HYOID BONE MOVEMENTS USING 320-ADCT IN PATIENTS AFTER HEMIGLOSSECTOMY AND NECK DISSECTION.

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## Introduction

Surgical treatment of head and neck cancer can cause swallowing complications. For glossectomy patients, the resection of the hyoid muscles and the asymmetrical reconstructed tongue can affect hyoid bone mobility. VFSS aimed at the anterior point of the hyoid bone in the lateral image has been used in many studies for analyzing the hyoid bone movements. However, the results of such analyses may not represent post-surgical hyoid bone movements because the hyoid muscles are asymmetrical in these patients.

This study was aimed at examining three-dimensional (3D) hyoid bone movements during swallowing using 320-row area detector CT (320-ADCT) scans in patients who underwent hemiglossectomy and unilateral neck dissection.

## Materials & Methods

This study included 7 patients above level 4 in the FOIS who underwent hemiglossectomy and unilateral neck dissection (Table 1). We evaluated swallowing function using 320-ADCT (Aquilion ONE, Toshiba Medical, Japan [Fig.1]) 1 week before and 1 month after the surgery. A 4-mL bolus of barium sulfate solution was administered to each patient. This system can scan in the range of 250 mm with one rotation of the X-ray tube over 0.275 s. Multiphase scanning was performed to record swallowing. Multiplanar reconstruction and 3D-CT images were reconstructed and analyzed using software (SYNAPSE VINCENT, Fujifilm Medical, Japan).

Table 1. Characteristics of the Patients

| Case No. | Sex | Age | T stage | Neck Dissection | Resected Suprahyoid Muscles |
|----------|-----|-----|---------|-----------------|-----------------------------|
| 1        | M   | 81  | T3      | mRND            | aDM, pDM, MM, OHM           |
| 2        | F   | 68  | T3      | mRND            | aDM, pDM, MM, OHM           |
| 3        | F   | 20  | T3      | SOHND           | aDM, pDM, MM                |
| 4        | M   | 66  | T2      | SOHND           | aDM, MM                     |
| 5        | M   | 66  | T2      | SOHND           | MM                          |
| 6        | M   | 66  | T2      | SOHND           | MM                          |
| 7        | M   | 75  | T2      | SOHND           | MM                          |

mRND: modified Radical Neck Dissection, SOHND: Supraomohyoid Neck Dissection, aDM: anterior digastric muscle, pDM: posterior digastric muscle, MM: mylohyoid muscle, OHM: omohyoid muscle

We evaluated the two positions, at rest and at the highest position during swallowing, at 3 points on the hyoid bone (most anterior point of the middle body [MH], and the right and left greater horn [Fig.2]). A coordinate system (Fig. 3) was applied to the images, and superior, anterior, and 3D movement distances were statistically compared between preoperative and postoperative images of the resected side of the greater horn (RS), and the non-resected side of the greater horn (NRS).



Fig.1 320-ADCT

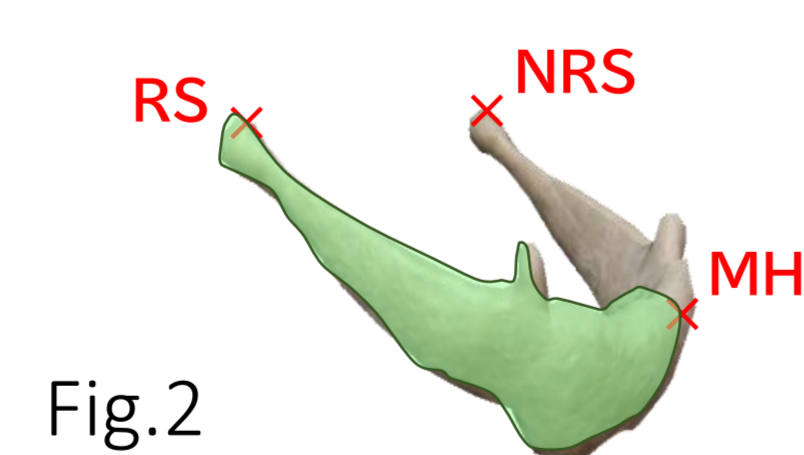


Fig.2 Analyzed Points on Hyoid Bone  
Resected side is colored in green

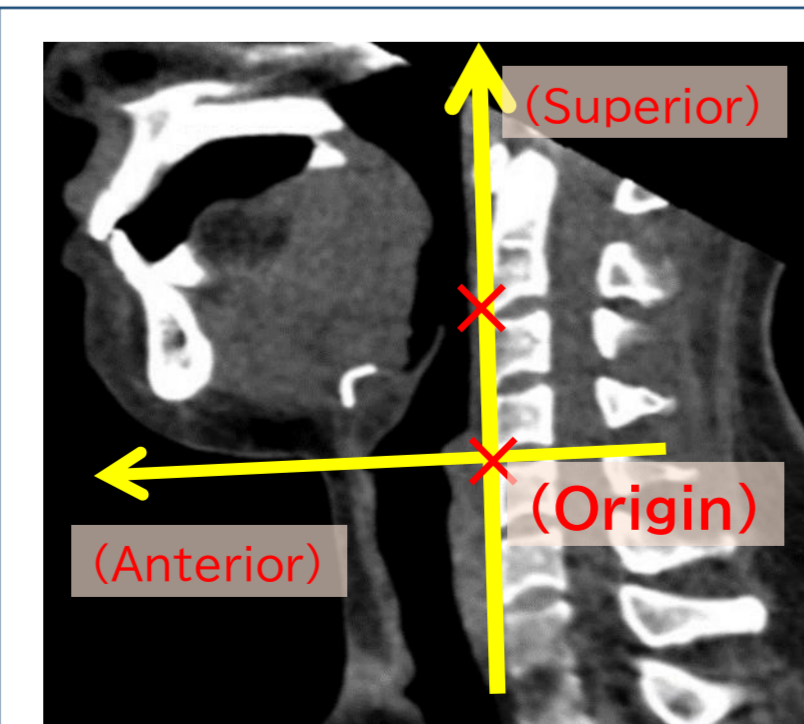


Fig.3 Reference Coordinate System

## Results

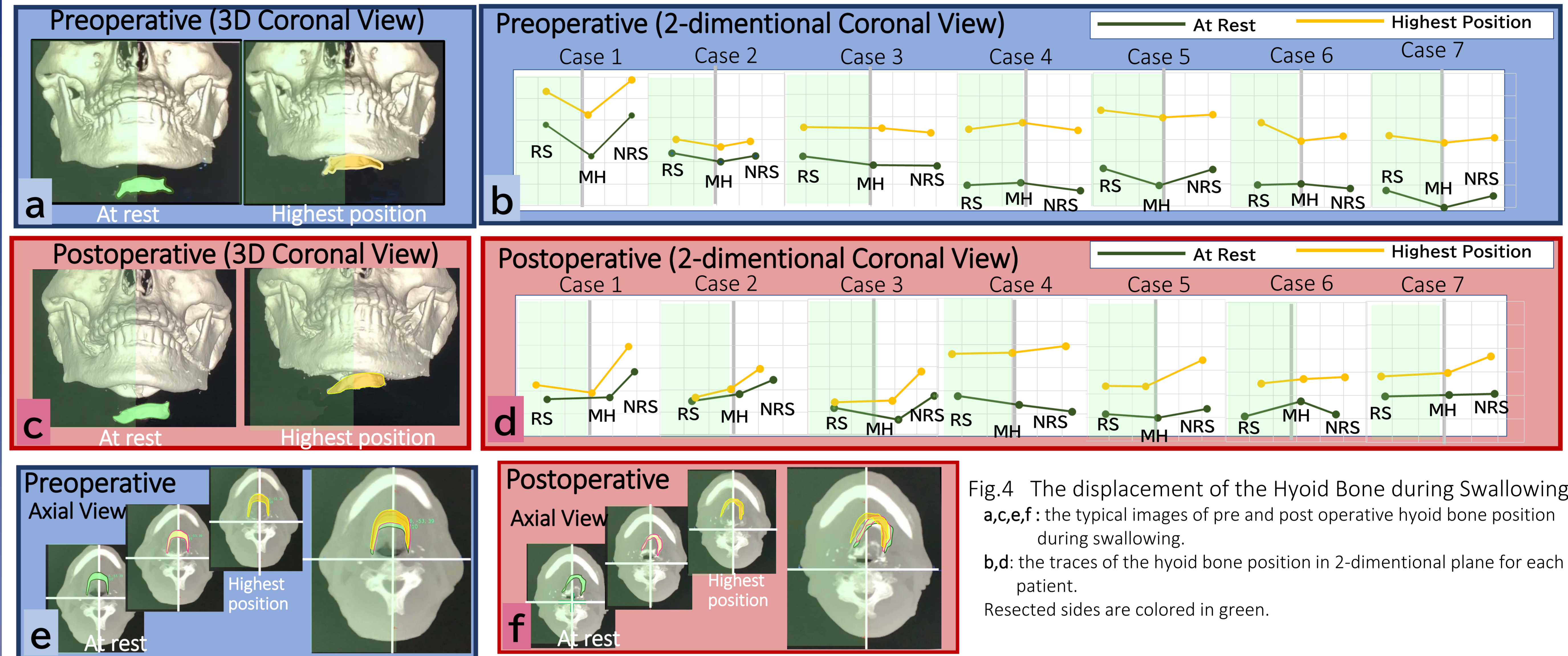


Fig.4 The displacement of the Hyoid Bone during Swallowing  
a,c,e,f: the typical images of pre and post operative hyoid bone position during swallowing.  
b,d: the traces of the hyoid bone position in 2-dimensional plane for each patient.  
Resected sides are colored in green.

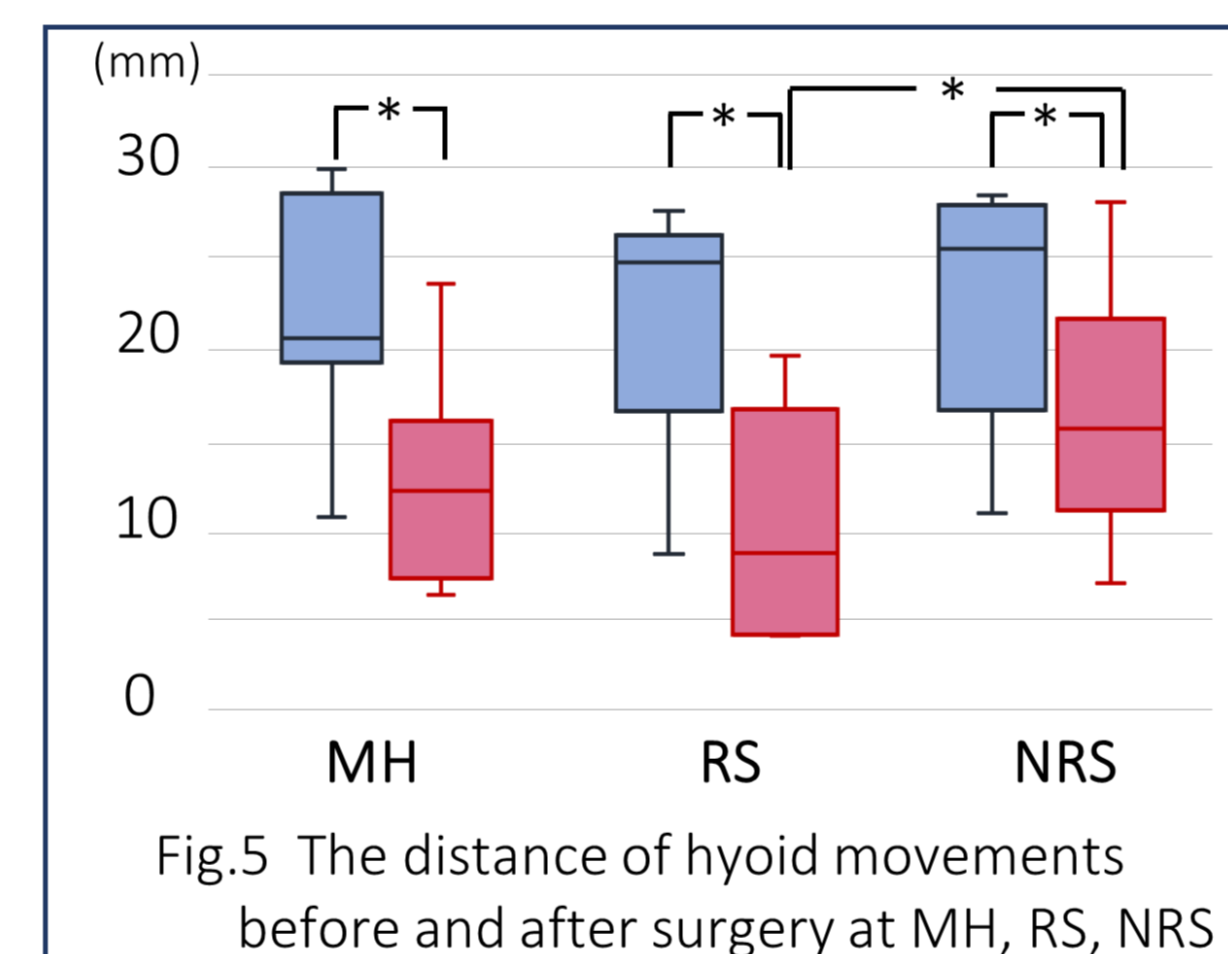


Fig.5 The distance of hyoid movements before and after surgery at MH, RS, NRS

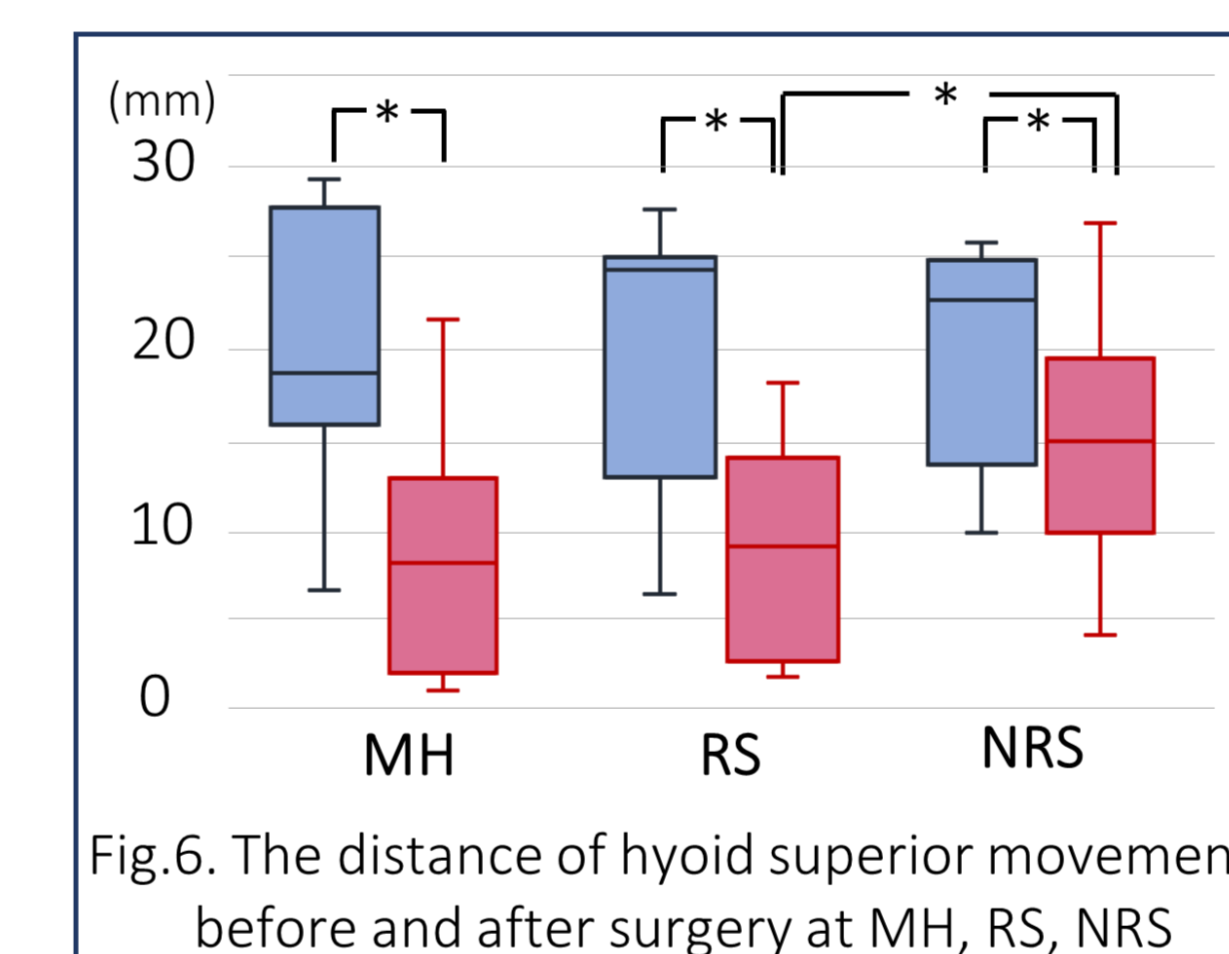


Fig.6 The distance of hyoid superior movements before and after surgery at MH, RS, NRS

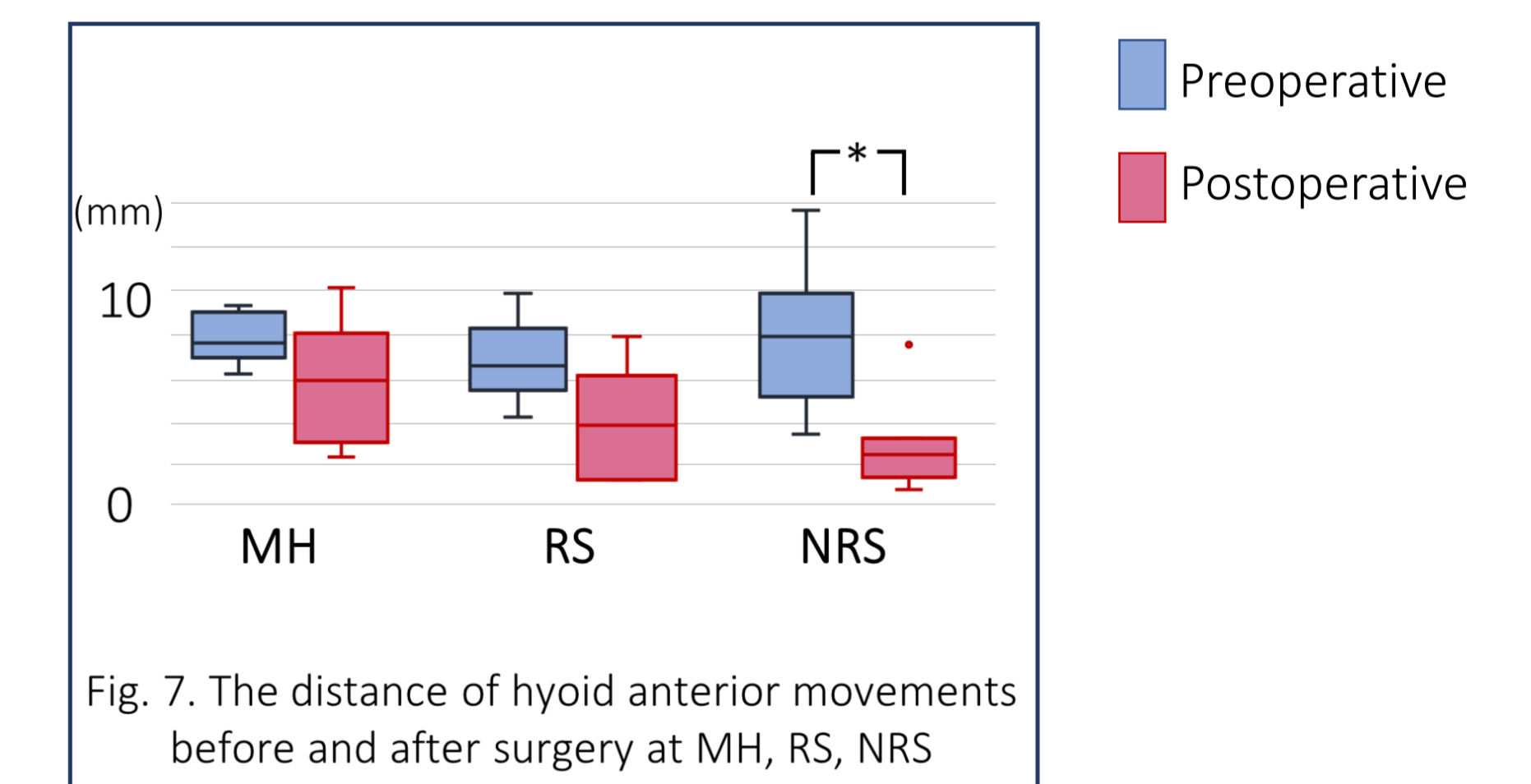


Fig.7 The distance of hyoid anterior movements before and after surgery at MH, RS, NRS

Before surgery, the hyoid bone showed approximately lateral symmetry during swallowing (Fig. 4a,b,e). After the surgery, the hyoid bone at rest was rotated toward the non-resected side (Fig. 4f), and the RS of the hyoid bone was located more inferiorly (Fig. 4c,d). Compared to before surgery, the hyoid bone moved significantly shorter distances; however, the displacement of the NRS was significantly longer and was better maintained than the RS (Fig. 5-7).

## Discussion & Conclusion

This study is the first to evaluate asymmetrical hyoid bone movement during swallowing after hemiglossectomy and neck dissection. The swallowing evaluation on the axial plane using 320-ADCT could detect the incline toward the non-resected side at rest, which was caused by lateral disequilibrium of the suprahyoid muscles due to the resection in affected side, restored toward the midline during swallowing by the presence of suprahyoid muscles on the affected side.

A previous study that analyzed the MH on lateral projection of videofluoroscopy reported that surgical invasion decreased hyoid bone movement. However, our study indicated that together with the existent suprahyoid muscle on RS, maintained elevation in the NRS of the hyoid bone was able to compensate for this decreased in movements. Our results suggest that resection of DM, MM, and OHM, which are frequent in neck dissection had, little effect on functional hyoid movement.