

Ultrasound Evaluation of Swallowing to detect subclinical changes in swallow kinematics and timings in early Parkinson's



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1: INTRODUCTION

Dysphagia in Parkinson's often goes undetected without objective assessment (Kalf et al., 2012). Subclinical changes may occur early before progressing to overt dysphagia (Wang et al., 2017).

Ultrasound Evaluation of Swallowing (USES) (Ma and Wrench, 2022) is an innovative procedure potentially useful for early detection of subclinical swallowing changes in Parkinson's.

Advantages of USES:

- Safe & Minimally invasive
- Headset-stabilised
- Automatic kinematic tracking of hyoid and tongue



Only one ultrasound study has investigated Parkinson's swallowing: Oh et al. (2016) found delays between tongue movement initiation (oral stage) and hyoid peak, but overt dysphagia only.



Is there evidence of subclinical changes in Parkinson's when assessed with Ultrasound Evaluation of Swallowing?

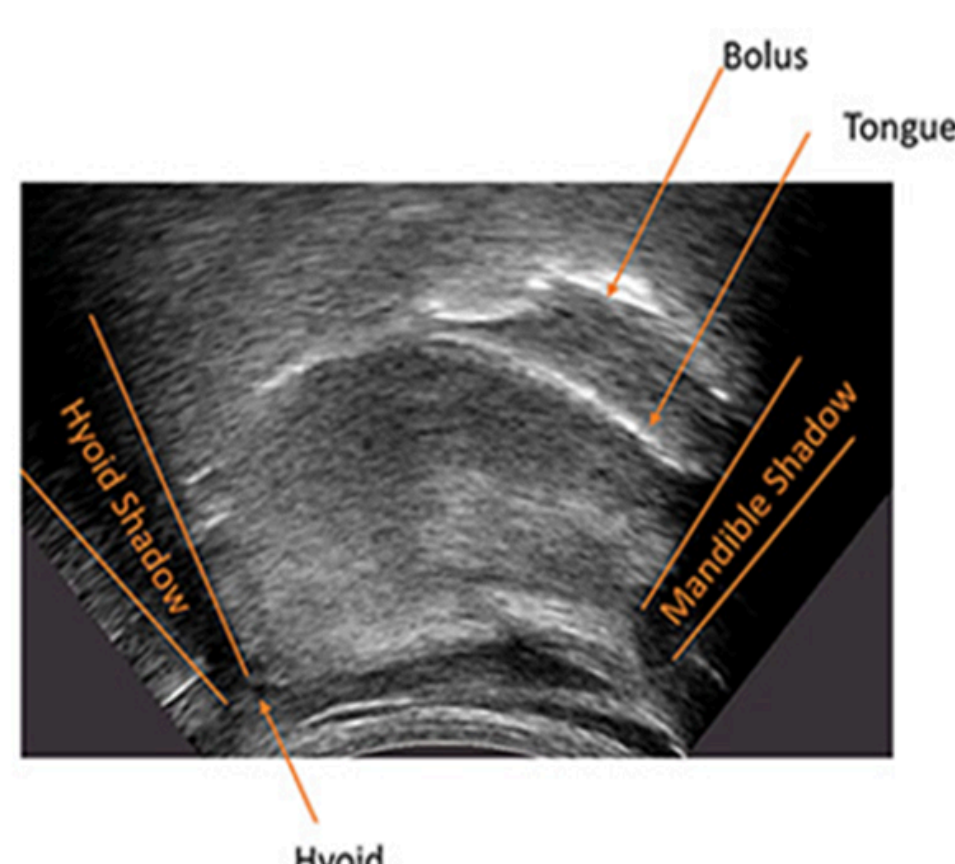
Does functional Parkinson's swallowing feature:

1. Higher Number of Swallows?
2. Longer Total Swallow Duration?
3. Lower max. amplitude of hyoid at peak (MHA)?
4. Longer Duration from lingual propulsion to MHA (DtomMHA)?

2: DATA COLLECTION

n= 10, all male:

- 5 Parkinson's with no diagnosed/self-reported dysphagia (Swallow Questionnaire); 71-85yrs
- 5 age-matched controls (<3 EAT-10 score); 71-79yrs
- 5 x 20ml water (cup)
- "finish in one swallow"
- 2-4 MHz 60 mm radius convex probe
- Ultrafit headset-stabilised
- Pocket-sized ultrasonic system (standard B-mode)
- Synchronised lip video



3: DATA ANALYSIS

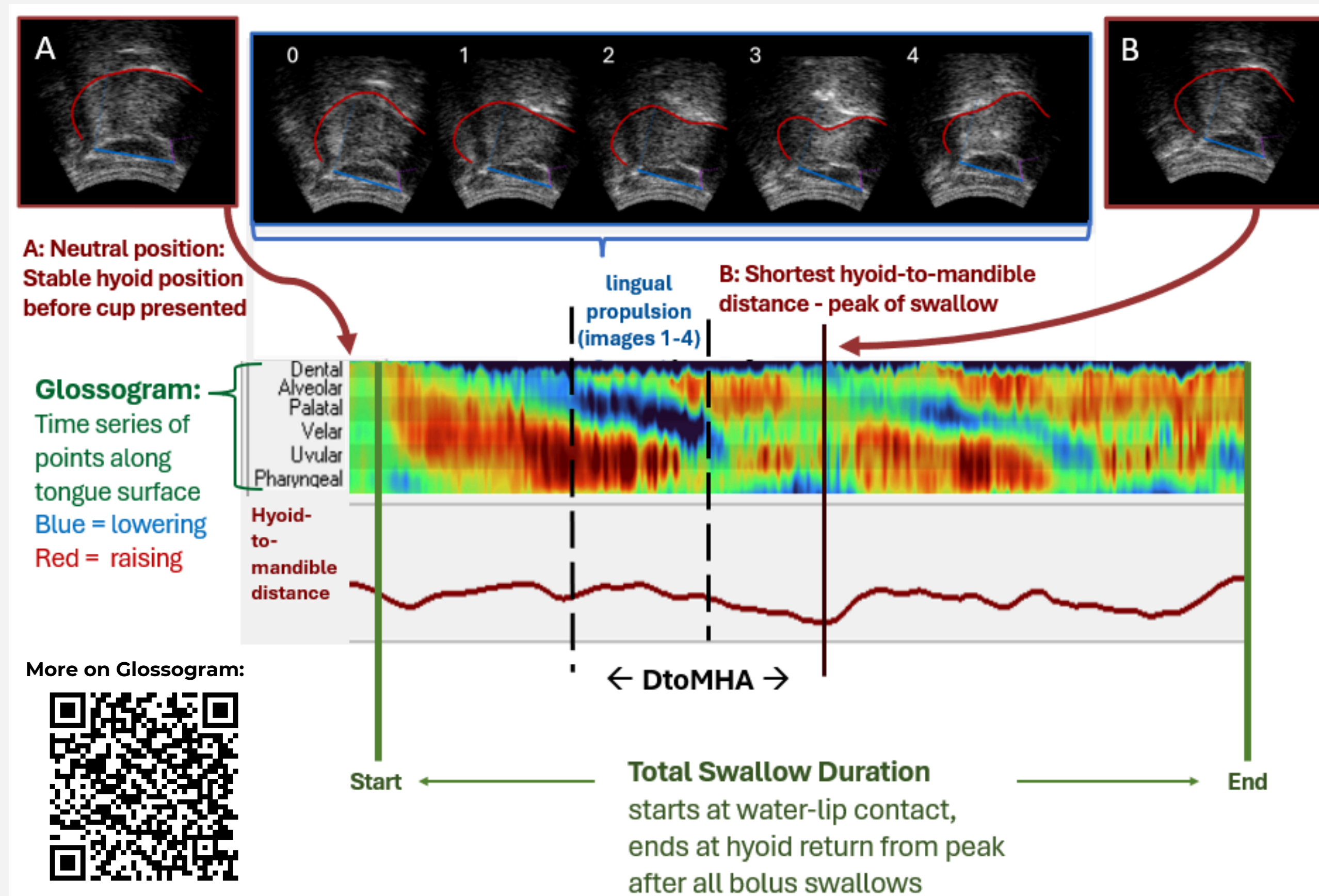
Hyoid, anterior mandible, tongue surface automatically extracted in *Articulate Assistant Advanced* with DeepLabCut - neural net ResNet50: Tongue model.

MHA: difference between hyoid-mandible distance: at peak (B) vs. hyoid in neutral position (A), normalised as % of neutral position distance

$$MHA = ((A - B) / A) \times 100$$

DtomMHA: duration from start lingual propulsion to peak of swallow

Time series: male with Parkinson's drinking 20ml in 2 swallows

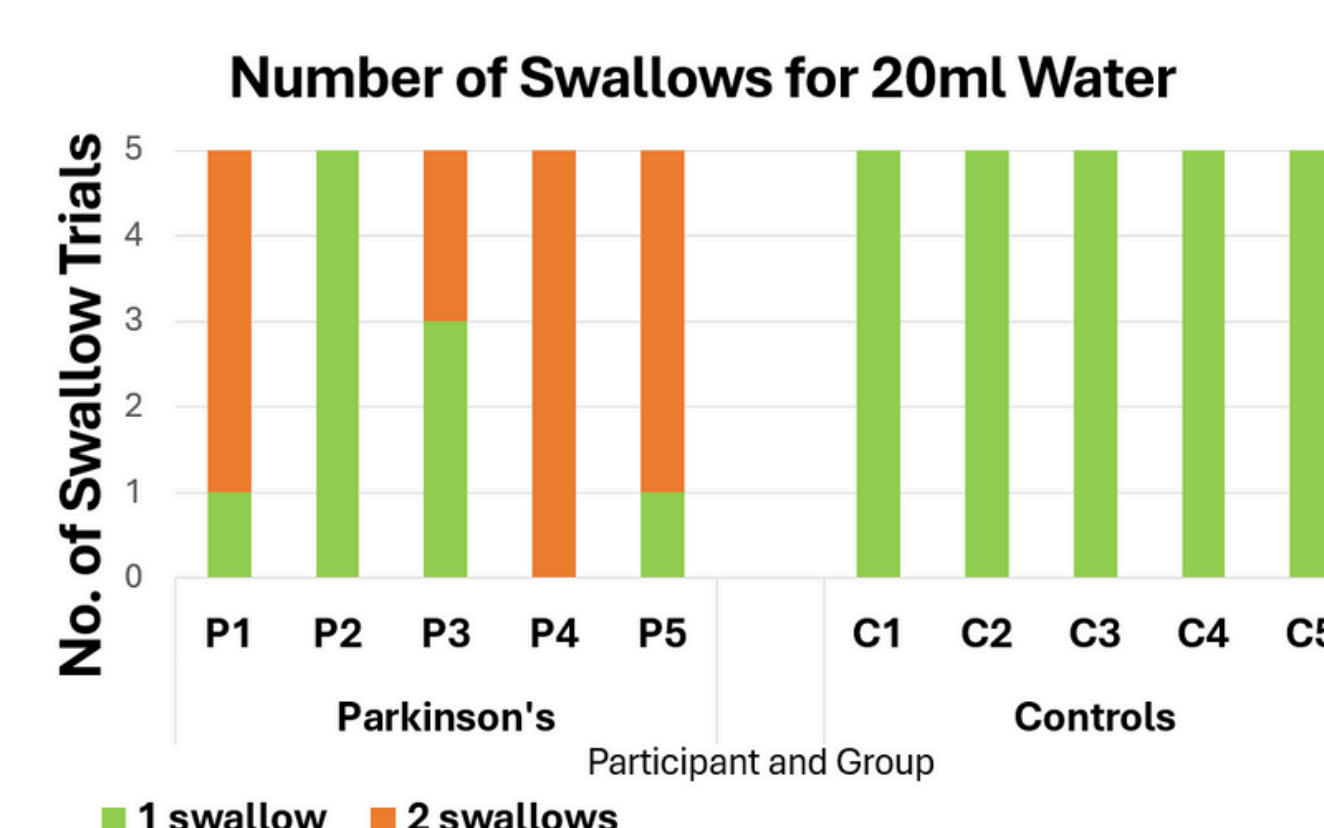


4: RESULTS

Measure (mean ± SD)	Parkinson's (n=5)	Control (n=5)
Number of Swallows	1.6 ± 0.5	1 ± 0
Total Swallow Duration (s)	5.09 ± 1.14	3.94 ± 0.54
MHA (%)	24.9 ± 8.3	20.9 ± 7.1
DtomMHA(s)	1.22 ± 0.39	1.14 ± 0.45

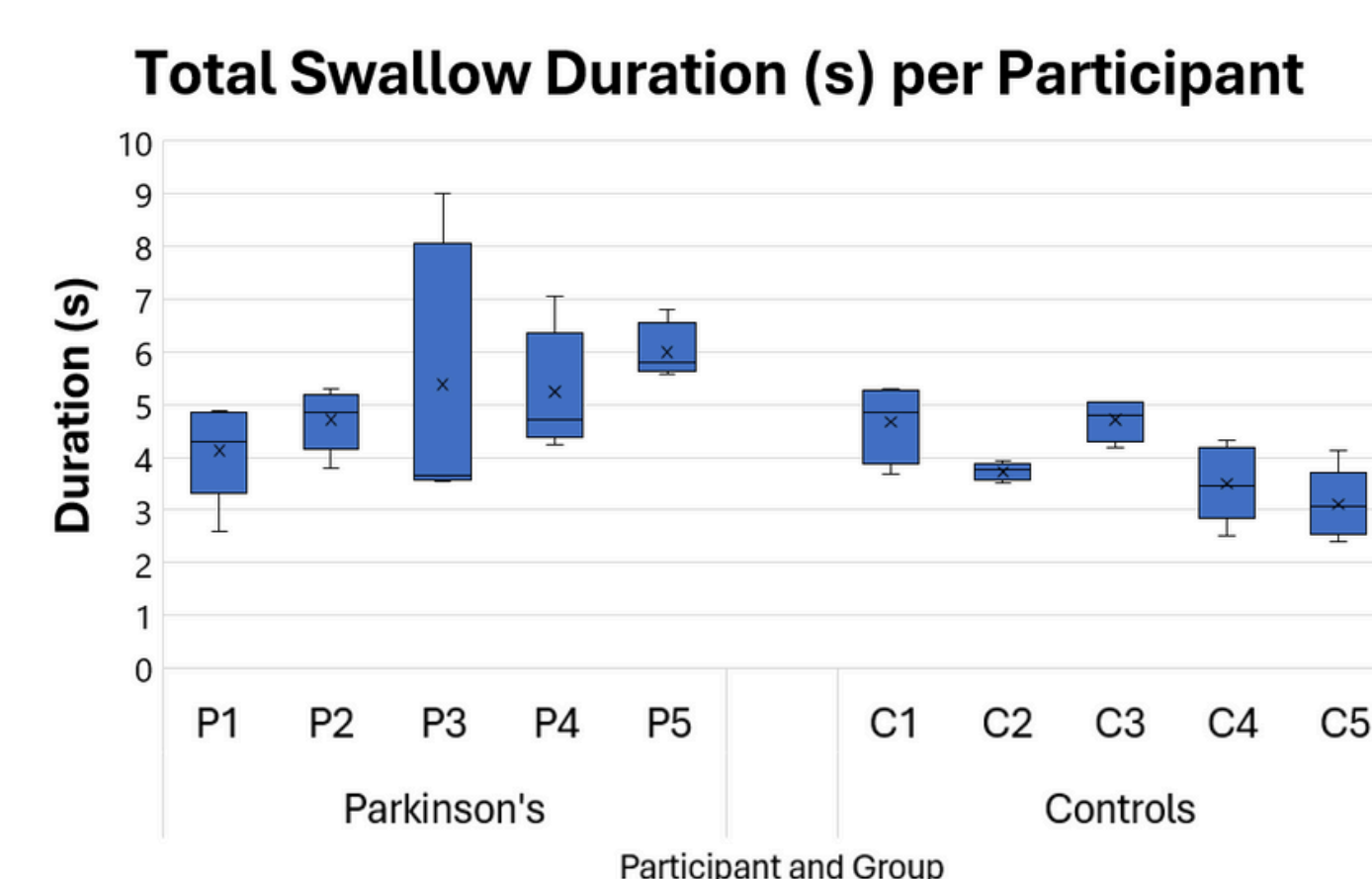
No clear difference in mean Max Hyoid Amplitude (MHA)

- slight difference in opposite of direction predicted



Higher Number of Swallows and longer mean Total Swallow Duration

- piecemeal deglutition in 60% of trials in Parkinson's group



Similar mean Duration to MHA (DtomMHA)

- average ~100ms longer lingual propulsion -> hyoid peak

5: CONCLUSIONS

Ultrasound allows simple instrumental examination to detect subclinical changes in Parkinson's swallowing

We present a novel method for analysis of oral/pharyngeal stage hyoid-tongue coordination

- Higher number of swallows required for 20ml water is prominent subclinical finding
- Hyoid and tongue measures did not imply clear predicted subclinical changes - motivates further investigation with larger sample, more volumes

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References:



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