



## Correction to: Volumetric Changes to the Pharynx in Healthy Aging: Consequence for Pharyngeal Swallow Mechanics and Function

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**Correction to: Dysphagia (2019) 34:129–137**  
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We are writing to inform the readers of the Dysphagia journal of an error in the following publication:

Molfenter SM, Lenell C & Lazarus CL. Volumetric changes to the pharynx in healthy aging: Consequence for pharyngeal swallow mechanics and function. *Dysphagia*. 2019, 34(1):129–137.

This paper describes the impact of age-related expanding of pharyngeal lumen volume on pharyngeal biomechanics and function in healthy older adults. This analysis used an open source downloadable spreadsheet from <https://www.steeleswallowinglab.ca>, which was designed to quantify hyoid position in the anterior and superior planes, relative to the 4th cervical vertebrae. We used this spreadsheet to quantify the anterior and superior position of the posterior laryngeal air column (rather than the hyoid) as a proxy measure for pharyngeal displacement during swallowing.

It has been brought to our attention that an error in the mathematical formula built into the spreadsheet resulted in a reversal of the results for the X and Y planes of measurement. This means that the reported findings for pharyngeal shortening (which is one of four dependent variables) actually represent changes to *anterior* (X) peak position of the pharynx during swallowing, not superior (Y) peak position. The overall findings of the manuscript are unchanged: larger

pharyngeal lumen volume is significantly associated with worse pharyngeal constriction and vallecular residue (and trending with pyriform sinus residue) and continues to not be associated with pharyngeal shortening (when correcting the X and Y plane reversal) [ $F=0.16$ ,  $p=0.89$ ].

However, there are also two secondary findings that we would like to correct given discovery of the calculation error. First, the original paper reports that pharyngeal shortening was significantly and positively correlated with posterior tongue strength. However, in the context of the calculation error, this relationship actually reflects *anterior* peak position of the pharynx (increasing posterior tongue strength is associated with increased anterior displacement of the pharynx). We speculate that this finding may be related to the extrinsic tongue muscles' role in displacing the hyolaryngeal unit in an anterior direction. When the plane of movement was corrected in the linear effects regression model, the main effect of tongue strength on pharyngeal shortening disappears [ $F=1.06$ ,  $p=0.31$ ]. Second, the original paper reported a significant main effect of bolus condition on pharyngeal shortening. However, when the plane of movement is corrected in the analysis, this finding is also no longer significant [ $F=1.94$ ,  $p=0.15$ ]. Corrections to relevant tables can be found in Tables 3 and 5. Shaded cells represent corrected data. Finally, we would like to confirm that the intra-rater and inter-rater reliability of the corrected pharyngeal shortening variable were found to be excellent [intra-rater ICC 0.95, 95% CI 0.92–0.97; inter-rater ICC 0.88, 95% CI 0.82–0.92].

The original article can be found online at <https://doi.org/10.1007/s00455-018-9924-5>.

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**Table 3 (Correction to Original Table 3)** Descriptive statistics by bolus condition

Parameter	5 ml thin		5 ml nectar		20 ml thin	
	Mean	SD	Mean	SD	Mean	SD
Pharyngeal constriction (MPCAn)	0.004	0.011	0.037	0.058	0.017	0.027
Pharyngeal shortening (%C2-4)	38.84	19.25	37.67	18.34	38.55	19.32
Vallecular residue (NRRSv)	0.002	0.006	0.027	0.074	0.024	0.054
Pyriiform sinus residue (NRRSp)	0.006	0.040	0.043	0.270	0.037	0.200

SD standard deviation, MPC An Maximum pharyngeal constriction area normalized, %C2-4 % of the distance of the second to fourth cervical vertebrae, NRRS normalized residue ratio scale]. Shaded cells display corrected values

**Table 5 (Correction to Original Table 5)** Summary of bolus condition post-hoc comparisons for each dependent variable

Parameter	Measure	Volume	Viscosity
		5 ml thin versus 20 ml thin	5 ml thin versus 5 ml nectar
Pharyngeal constriction (MPCAn)	mean difference	<b>- 0.011</b>	<b>- 0.310</b>
	<i>p</i> value	<b>0.005</b>	<b>&lt; 0.001</b>
Pharyngeal shortening (%C2-4)	mean difference	- 0.003	1.925
	<i>p</i> value	0.99	0.248
Vallecular residue (NRRSv)	mean difference	<b>- 0.021</b>	<b>- 0.025</b>
	<i>p</i> value	<b>0.001</b>	<b>&lt; 0.001</b>
Pyriiform sinus residue (NRRSp)	mean difference	- 0.028	<b>- 0.038</b>
	<i>p</i> value	0.237	<b>0.050</b>

Bolded values are significant

Shaded cells display corrected values.

MPCAn maximum pharyngeal constriction area normalized, %C2-4% of the distance of the second to fourth cervical vertebrae, NRRS normalized residue ratio scale

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