

Development of therapeutic exercises manual for Oro-Pharyngeal Dysphagia Phase I: Content validation therapeutic exercises manual for Oro-pharyngeal Dysphagia

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Author's Contribution

¹⁻³Conception and design, Collection and assembly of data, ¹⁻²Analysis and interpretation of the data, ¹Critical revision of the article for important intellectual content, ¹⁻²Statistical expertise, Final approval and guarantor of the article.

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A B S T R A C T

Objective: To reduce and eliminate aspiration and penetration ultimately, it was aimed to develop the indirect therapeutic exercises manual for patients with Oro-pharyngeal Dysphagia.

Methodology: The study based on analytical approach: a method for tool development, was conducted on the sample of five experts and one hundred speech and language pathologists through purposive sampling in clinical setting (from Nov 2021 to Sep 2022). The factors via already existed literature data base; speech BITE; MEDLINE; PakMediNet; PubMed; Web of Science; CINAHL; IndMed and Google Scholar were generated. The factors were divided into two domains/ latent variables (compensatory strategies and rehabilitative techniques) with fourteen items/ observable variables (relevant instructions). These domains and items were further modified into 'content validity performa. Content validity was assessed through 'face to face written and verbal reviews' by panel of five experts on the content validity performa. The refined and simplified factors (domains and fourteen items) were altered into an online survey based on five points Likert scale of preferences. One hundred speech and language pathologists from different regions of the Punjab were approached to participate in an online survey so the correlation between the domains and items can be found out.

Results: Content Validity Index (CVI), Content Validity Ratio (CVR) and kappa statistics were employed to calculate the content validity. The findings suggested that the therapeutic exercises manual met the satisfactory level of content validity (CVI= CVR= kappa= 0.85). To confirm the factor validity via Likert scale, AMOS version 23 was employed, suggesting fit in model ($\chi^2 (76) = 80.255, p < .001$) and good covariance ($p > .04$). The internal consistency (Cronbach Alpha) of therapeutic exercises manual was 0.833 and the inter-item correlation coefficient ranged from .082 to .488.

Conclusion: Content validity was found to be high, representing the core theme of the construct. The domains (compensatory strategies and rehabilitative techniques) showed good correlation with each other and their item (instructions). The therapeutic exercises manual may be use-able for the patients to eliminate the aspiration and penetration.

Keywords: Oro-Pharyngeal Dysphagia, therapeutic exercises manual, content validation, kappa, CVA and CVR.

Introduction

Normal swallowing, a process comprised of the integration of a systematic mechanism consisting in sensory, motor and psychological actions, accomplished with at least 30 nerves and muscles (Rajati et al., 2022).¹ This mechanism

starts from the oral cavity, oropharynx, larynx, hypopharynx, and ends at the esophagus to stomach (Thankappan, 2018).² Conversely, according to Kruger (2014),³ the problem in the bolus transfer from mouth to the stomach is called Dysphagia, and the patients, with the complaints about difficulty to start swallowing following coughing, choking, nasal regurgitation and

tracheal aspiration, are diagnosed with Oro-Pharyngeal dysphagia (OD).

Management of swallowing disorder consists in the screening, assessment, management of nutritional status, modification of food texture, and assuring the individual compliance to keep on oral intake. The current research aims to compile the therapeutic exercises (direct and indirect) only in a manual for the assistance of Speech and Language and Therapist, nurses and guardians/ care takers of the patients with OD. To treat these symptoms, the compensatory strategies and rehabilitative treatment are to fend of malnutrition, thirst drifting, and pneumonia while making better the swallowing disorder and upgrading the quality of life (QOL). So, the goals for Oro-Pharyngeal Dysphagia are to maintain the range of motion and strengthen the oral, pharyngeal, and laryngeal muscles. Mostly, the swallowing exercises include oral-motor exercises (lips, tongue, cheeks muscles, jaws and neck) with range of motion (ROM) and strengthening; four maneuvers (superaglottic, supersupraglottic, effoertfull, mandelsohn); diet modification (texture and viscosity); posture modification (chin tuck, head turn and side lying) (Akai 2015, Thankappan 2018).^{2,4} So, the current research particularly focuses on the exercises from compensatory techniques administered without food (1) Postural modification (side lying, chin tuck, and head rotation) and (2) Thermal Tactile Application (Cold laryngeal mirror or Icy Cotton Bud or hot spoon and Suck and Swallow) only. According to (Ekberg O 2002),⁵ some of the compensatory strategies act like therapy to increase 'sensory input', as the following table is a manifestation of the very phenomena.

Table I: Effectiveness of postural techniques to eliminate aspiration

Disorders	Posture Applied	Rationale
Not successful oral transit	Head back	Help to push down the food bolus (Rasley A 1993)
Delayed the pharyngeal swallow	chin down	Expands the space between tongue base and posterior pharyngeal wall to protect vetibules (Welch MW 1993)
Entry of Foreign particles in pyriform sinus	Chin down	Retract tongue base backward (Welch MW 1993)
Unilateral paralysed vocal fold or vocal Fold resection. Aspiration while swallowing	head rotated to damaged side	thyroid cartilage protection Airway protection and Epiglottis exurtion (Rasley A 1993)
Weak closure of vocal cords	chin down head rotated to damaged side	Closing laryngeal folds by extrinsic pressure (Welch MW 1993)

Weakness of Unilateral pharyngeal muscles Food residual in pyriform sinuses	head rotated to damaged side	Stop food to enter in week side (Ohmae 1997); (Ohmae Y 1998)
Weak contraction of pharyngeal muscles	lying down on one side	Slow down gravity towards weak side of pharynx (Rasley A 1993, O 1995)
Weakness on Same side (unilateral oral and pharyngeal muscles) Residual food particles in valleculae	head tilt to stronger side	Propel food bolus downward (Ekberg O 2002)
Deficits in Cricopharyngeal	head rotated	Set away cricoid cartilage from pyriform synuses by decreasing pressure in cricopharyngeal sphincter (Ekberg O 2002)

Table II: Maneuvers with their rationale

Swallow maneuver	Swallowing deficits	Rationale
Supraglottic swallow	Weak and delayed airway closure	Holding breath voluntarily helps in airway closure before and during swallow (Ohmae Y 1998); (Ohmae 1996)
Super-supraglottic swallow	Delayed or weak laryngeal elevation	holding breath effortfully pushes arytenoid forward (Ohmae 1996)
Effortful swallow	Parasis of tongue base movement and decreased pressure of pharyngeal muscles	Helps in retracting the tongue successfully (Ohmae 1996)
Mendelsohn maneuver	Decreased Range of motion in Larynx or disorganized swallow	Helps to elevate the Adam apples to avoid aspiration by opening UES (Cook 1992)

UES = Upper esophageal sphincter

In Tasikmalaya, Indonesia, (Yanti 2022)⁶ examined a study comparative effectiveness of swallowing exercises and Benson relaxation on the patients with stroke. It was concluded that the both therapies in the combination showed a significant impact on the swallowing status of the patients with stroke induced dysphagia symptoms. In UK, (Hashida 2001)⁷

quantified the significant results in efficacy of rehabilitative intervention on the patients with oropharyngeal cancer. In Dublin, Ireland, (Heslin 2022)⁸ elicited the effectiveness of effortful swallow on the adult patients with dysphagia. The focus of the study was to observe pharyngeal pressures during swallowing. Results showed that the pharyngeal contraction got improved during the intervention. Significant difference was also observed in other structural swallowing (pharyngeal and hypopharyngeal and upper esophageal sphincter).

The primary aim of the study was to design a therapeutic exercises manual through literature review and validate it through expert review panel of Speech and Language Pathologist, practicing in hospitals and rehabilitation centre affiliated with universities and hospitals. In addition, the study intended to confirm the factors of therapeutic exercises manual through Confirmatory Factor Analysis (CFA).

Methodology

The study, based on analytical approach, employing purposive sampling, recruiting a sample of panel of five experts and one hundred speech and language pathologists practicing with population of patients diagnosed with Oropharyngeal dysphagia in Govt. And private clinics with no age and gender limits. The study was started following the principals of Doctoral Departmental Permission Committee (DDPC), Centre for Clinical Psychology Punjab University Lahore dated January 10, 2022. (Ref No: **D/444/CCP**) This study has been divided into three phases aiming, (1) designing a therapeutic exercise manual (2) content validation of therapeutic exercises manual by experts, and (3) content validation of therapeutic manual through online survey.

As, these therapeutic exercises were developed facilitating the patients, so least health risk of aspiration was the utmost goal, that was why, all exercises were structured without food. The researcher generated fourteen item (therapeutic exercises with instructions) from literature and retrieved from speechBITE; MEDLINE; PakMediNet; PubMed; Web of Science; CINAHL; IndMed and Google Scholar. These search engines identified publications that assessed the effectiveness of these exercise in the Oropharyngeal Dysphagia population in different patients groups diagnosed with i.e. Head and Neck Cancer (HNC), traumatic brain injury (TBI) and Cerebral Vascular

Accident (CVA)/ stroke. The SLP dealing with swallowing therapy currently, in Govt. and private hospital and rehabilitation centres were included. The SLP, practicing in private clinic were excluded.

Five expert, speech and language pathologists (SLPs) from Govt. and private universities, affiliated with hospitals and rehabilitation centres were approached for content validation of therapeutic exercises manual. The process of content validation was consisted on six steps; (Step 1) preparing content validation form (Step II) selecting a review panel of experts, (Step III) conducting content validation, (Step IV) reviewing domain and items, (Step V) providing score on each item and (Step VI) calculating content validation. Moreover, to confirm the relationship of factors with their items presented in the manual, a self-structured online questionnaire with fourteen statements was processed. One hundred Speech and Language Pathologist, practicing in the different cities of Punjab were approached through the whatsapp groups of RIPHAH international university and University of Punjab.

Results

Content Validity Index (CVI), Content Validity Ratio (CVR) and kappa statistics were employed quantitatively to calculate content validity of 'content validity performa for manual'. Reliability analysis of questionnaire was also inferred. Moreover, Confirmatory Factor Analysis (CFA) was used to quantify the content validity of manual questionnaire'. So, the results of I-CVI, S-CVI, CVR and Kappa results were found same $0.85 > .078$ indicating the higher content validity.

I-CVI Results indicated that the Expert reviewed and agreed upon 12 items with "Relevant; 4 = very relevant" and 2 items with "Simplicity; 3 =simple but need minor revision.

Each item has the relevancy calculations on I-CVI presented in Table 1. Twelve items (85%) were marked as most relevant. Having calculated I-CVI, S-CVI/Ave and S-CVI/UA, it was seen that therapeutic exercises manual met the satisfactory level of content validity.

Content Validity Ratio (CVR)

The results showed that the two items out of 14 were

Table 1: Expert rating on Likert Scale

Options/Experts	Relevant	Clarity	Simplicity	Ambiguity
Expert 1	12	0	2	0
Expert 2	12	0	2	0
Expert 3	12	0	2	0
Expert 4	12	0	2	0
Expert 5	12	0	2	0

Table 2: Content Validation Index for Items and Scale								
Item	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert in Agreement	I-CVI	UA
1	1	1	1	1	1	5	1	1
2	1	1	1	1	1	5	1	1
3	1	1	1	1	1	5	1	1
4	1	1	1	1	1	5	1	1
5	1	1	1	1	1	5	1	1
6	1	1	1	1	1	5	1	1
7	1	1	1	1	1	5	1	1
8	1	1	1	1	1	5	1	1
9	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0
11	1	1	1	1	1	5	1	1
12	1	1	1	1	1	5	1	1
13	1	1	1	1	1	5	1	1
14	1	1	1	1	1	5	1	1
Av. Prop.	0.85	0.85	0.85	0.85	0.85	Av=0.85	CVI/Ave= 0.85	S-CVI/UA= 0.78

referred as 'not relevant'. Twelve items achieved 1.00 CVR and two items gained score 0.00, whereas, CVR for item 1 was;

$$CVR = (N_e - N/2) / (N/2)$$

$$CVR = (5 - 5/2) / (5/2)$$

$$CVR = 1$$

$$CVR \text{ total} = (1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 0 + 0 + 1 + 1 + 1 + 1) / 14$$

$$CVR \text{ total} = 12 / 14$$

$$CVR \text{ total} = 0.85$$

So, the CVR (0.85) < 1 showing 85% accuracy in the herapeutic tool and remaining 15 % was needed to be revised with suggested changing.

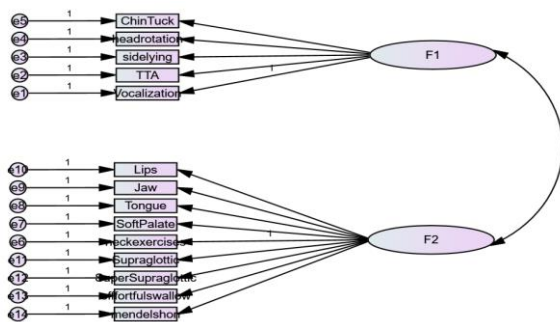


Figure: Path Diagram of CFA

Reliability Analysis: The scale on the development of therapeutic exercises for Oropharyngeal Dysphagia was processed on 100 samples of Speech and Language Pathologists (SLP). The internal consistency (Cronbach Alpha) of therapeutic exercises manual was 0.833, the inter-item correlation coefficient ranged from .082 to .488. The mean (+/- S.D) Scale on the development of therapeutic exercises manual ranged from 0.993 to 1.156. The mean score was 3.490 to 3.890 for SLPs for the manual.

The above table shows the descriptive and Cronbach alpha values of compensatory strategies with five items and rehabilitative exercises with nine items. So, the result showed that they have reliability value (.833) as a good effect size.

Confirmatory Factor Analysis: To investigate the cause and effect relationship theory of "Therapeutic Exercise manual", CFA was employed with two factor model (compensatory strategies and rehabilitative techniques). AMOS version 23 was used to verify the relationship between the domains (compensatory strategies and rehabilitative techniques) with the items (instructions). The correlation coefficient between compensatory strategies, rehabilitative techniques and with their 14 items was calculated.

Table 3: Descriptive Statistics and Reliability Coefficients for Study Variables						
Scale	α	K	M	SD	Range	
					Potential	Actual
Compensatory Strategies	.627	5	18.730	3.351	0-25	8-25
Rehabilitative Techniques	.771	9	32.920	5.850	0-45	15-42
Combine Scale	.833	14	51.650	8.491	0-70	14-70

Table 4: Goodness-of-Fit Indicator of each Model for Therapeutic Exercises Manual for OD (N= 100).

Model	* χ^2	df	χ^2/df	GFI	RMSEA	**p
Default	80.255	76	1.056	.901	.024	.347
Saturated	.000	0	--	1.000	--	--
Independence	334.6	91	3.676	.506	.164	.000

Table 5: Factor Loading or Regression Weight of each Factor (Standardized)		
Items	Compensatory Strategies	Rehabilitative Techniques
Vocalization	.509	
TTA	.496	
Side Lying	.507	
Head Turning	.562	
Chin-Tuck	.419	
Shaker Exercises		.427
Soft Palate		.437
Tongue Ex.		.471
Jaw Ex.		.639
Lips Ex.		.558
Supraglottic		.463
Supersupraglottic		.521
Effortful		.627
Mendelsohn		.525

CFA results were elicited through overall Chi square, root mean square error of approximation (RMSEA), comparative fit index (CFI) and the standardized root mean square residual (SRMSR). The inter-item correlation was comparatively greater in almost all items (instructions) in the therapeutic exercises manual ranged from 0.525 to 0.627. In short, covariance between latent factors and observed item values was also good ($p > .04$). To investigate cause and relationship theory, CFA pathways were drawn. Goodness-of-fit

statistics was elicited after estimating the model. The findings of the CFA pathways reveals Independence model fitted in with the therapeutic exercises manual $\chi^2 (76) = 80.255$, $p < .001$ for the therapeutic exercises' manual. RMSEA was ranged from .024 to .164. Besides this, GFI value was also above 0.90.

Discussion

Therapeutic Manual had two domains (Compensatory Strategies and Rehabilitative Techniques) with 14 items. After going through the process of content validation by expert review of five Speech and Language Therapist, it was highlighted that the manual guideline had some medical and biological terminologies related to the post-radiation problems e.g., Trismus (Jaws gets closed tightly), Tracheostomy (a hole in windpipe for breathing) and Glossectomy (removal of tongue through surgery). These terminologies were needed to be written in simple words, so they might be understandable for patients easily.

So, the results indicated that out of total, twelve items (85%) were "most relevant" ($CVI = CVR = \text{kappa ratio} = 0.85$) and remaining two items (15%) were suggested to be edited in

simpler form with minor revision. All calculations met satisfactory level, so, it can be stated as therapeutic exercises manual had 'satisfactory level of content validity' (Hadie 2017, Marzuki 2018).^{9,10} Besides this the results of Confirmatory Factor Analysis (CFA) revealed that the compensatory strategies and rehabilitative had good correlation with each other and high effectiveness on the patients with Oropharyngeal Dysphagia. CFA crux addressed that the combination of compensatory strategies and rehabilitative techniques can result in higher effectiveness than the present study therapeutic protocol.

Conclusion

It was concluded by making an inter-linkage between literature review and findings that I-CVI, S-CVI/Ave, S-CVI/UA, CVR and Kappa statistics reached to the "satisfactory level", and thus the therapeutic exercises manual had gained "satisfactory level of content validity". The development of the therapeutic exercise manual for swallowing disorders exhibited "high item-content validity" for the neuroplasticity and facilitating the aspiration free oral transit.

Limitations: Expert reviews were achieved from the Speech and Language Pathologists by approaching them in their job settings. A focus group was required for inter and intra-reliability.

Disclaimer: This study is a part of MS (Speech and Language Pathologist) Thesis.

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