USE OF TECHNOLOGY IN THE TREATMENT OF APHASIA:

A SYSTEMATIC REVIEW

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A Dissertation Submitted in Part Fulfillment for the Degree of Master of Science (Speech-Language Pathology)

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SEPTEMBER 2021

CERTIFICATE

This is to certify that this dissertation entitled **"Use of Technology in the Treatment of Aphasia: A Systematic Review"** is a bonafide work submitted in part fulfillment for the degree of Master of Science (Speech-Language Pathology) of the student (Reg. No.: 19SLP008). This has been carried under the guidance of a faculty of this institute and has not been submitted earlier to any other University for the award of any other Diploma or Degree.

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DECLARATION

This is to declare that this dissertation entitled **"Use of Technology in the Treatment of Aphasia: A Systematic Review"** is the result of my own study, under the guidance of Mr Manohar, Reader and Head of Department of Electronics, and co-guidance of Dr Anjana B Ram, Assistant Professor in Speech Pathology, All India Institute of Speech and Hearing, Mysuru. I further declare that this work has not been submitted earlier to any other University for the award of any other Diploma or Degree.

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Chapter 1

INTRODUCTION

Aphasia is an acquired neurological disorder that affects all areas of communication, including verbal and written expression, as well as written and auditory language comprehension. Aphasia is differentiated from other related disorders. Aphasia is a language disorder rather than a speech disorder, but may co-exist with speech disorders like dysarthria (Kirshner & Wilson, 2021).

The word 'digital' has become a part of our everyday vocabulary because of the dramatic way digital technology has been widely used in almost all areas of our life. As a matter of fact, the rapid advances in technology in the latter part of the 20th century ushered utilization of the e-mode in speech and language therapy.

The first report of using digital technology to help persons with communication impairments overcome their challenges was dubbed "teaching machines." (Holland & Matthews, 1970). Since the early days of using digital technology into clinical practice, a lot has changed. The availability of personal computers in the 1980s and 1990s gave software developers and therapists focusing on aphasia intervention a new opportunity to create and investigate therapies for enhancing language functioning (Salis& Hwang, 2015). Smartphones, tablets, and internet connectivity, for example, have lately helped to the integration of technology into many parts of everyday life, opening up new communication and working habits. Understanding and removing barriers to using digital technology, as well as making the most of technology to improve the lives of individuals with aphasia, needs an interdisciplinary approach.

While the use of digital technology in aphasia rehabilitation is not a new study area, there have been an increasing number of studies in recent years attempting to show the

usefulness or efficacy of computerized aphasia therapy procedures. A study covers the components of a Boston University intense, comprehensive aphasia program, as well as how the iPad (Apple Inc, Cupertino, CA) was used. Individual, dyadic, and group treatment formats are all possible with the iPad (Hoover & Carney, 2014). Improving aphasia patients' access to mobile computing technologies has the ability to improve both socioeconomic involvement and aphasia treatment (Brandenburg et al., 2013).

An aphasic speaker used sentence Shaper to practice constructing narrative (based on wordless picture books or silent movies), and the aphasic speaker made significant structural improvements (McCall et al., 2009). According to a study, practice instructions and treatment integrity do not predict success during solo practice with a physician (Ball et al., 2018).

Using a smart tablet, self-administered treatment was used in a trial with four persons with post-stroke aphasia to enhance the naming of functional terms for all members. The self-administered at-home treatment (four times per week for four weeks) resulted in a significant improvement (Lavoie et al., 2019).

Need for the Study

The efficacy of the technology in speech and language therapy needs to be highlighted in the current era to substantiate the utilization of electronic devices and e-platforms. Existing literature focuses on technology-related health services like tele-rehabilitation, assessment and management through mobile applications, software and other e-platforms. Although various studies on technology and its impact on speech and language therapy have been made from the late 20th century, this study will provide opportunities to transfer knowledge and improve awareness of technology-based practices for aphasia.

The need to produce a systematic review of the technology-based practice for further clinical application is immense and hence, the present study is highly needed.

Aim of the study

1. To systematically review the studies on technologies used in the treatment of aphasia.
2. To provide awareness to the speech-language therapist about effective utilization of technology in aphasia therapy.

Objectives of the study

1. To describe various computer-based techniques used in the treatment of aphasia.
2. To compile the findings of pre-and post-therapy treatments.

Chapter 2

METHOD

The primary aims of this study were to systematically review the studies on technologies used in the treatment of aphasia and to provide awareness to the therapists about the effective utilization of technology in aphasia therapy.

The objectives of the study were as follows:

1. To describe various computer-based techniques used in aphasia treatment.
2. To compile the findings of pre-and post-therapy treatments

The Preferred Reporting Items for Systematic Reviews and Meta-analyses statement (PRISMA) was used to conduct the systematic review (Ravi et al., 2016). PRISMA is concerned with how researchers can ensure that systematic reviews and meta-analyses are properly reported (Liberati et al., 2009). As a result, the PRISMA flowchart is utilised to select the studies that are relevant to the suggested research question.

Search Strategies

The systematic review research study was conducted between May and July 2021 to identify the treatment strategies for aphasia using technology. The research study included articles that addressed different strategies for the improvement of language impairment in adults and geriatrics. The following electronic databases were systematically searched; Science Direct, PubMed, Google Scholar and J-Gate. 11 key search phrases (see Table 2.1) were included, which returned 1119 citations. The reference lists in the articles were looked into to see if there were any other research studies that were relevant.

Table 2.1

Search Phrases used in Electronic Databases

Keywords used: Technology, Aphasia, Teletherapy, Language disorder, Aphasia treatment, Adult language disorder, Applications for speech therapy, Treatment strategies for aphasia, Teletherapy for Aphasia, Telerehabilitation, Aphasia management

Study Selection

The various stages of reporting followed were according to PRISMA (Page et al., 2010). The stages are as follows:

a) Stage 1: Identification of the articles

b) Stage 2: Screening of the articles

c) Stage 3: Finalization of studies

The systematic review includes articles that qualified under the inclusion and exclusion criteria decided in accordance with the objectives of the study. The reviewer independently screened titles, abstracts to fulfill the inclusion and exclusion criteria (given in Table 2.2).

The full-length studies that met the participation criteria were considered for the purpose of this review. The complete text of articles was examined by the reviewer irrespective of the selected criterion. Both the abstract and full-text screening results were discussed. The articles for the study were extracted using the Mendeley extractor by the reviewer. After removing duplicates from the papers, the reviewer discovered 990 suitable citations for inclusion. The publications were then evaluated based on their titles, and 959 were excluded from the study. Thirty-four articles were obtained, then 21 articles were discarded after analyzing the full-length papers, and seven articles were finally included for the study.

Table 2.2

Criteria for Inclusion and Exclusion

	Inclusion	Exclusion
Population	i. Aphasia, including acquired dysgraphia and dyslexia, as well as post-stroke or traumatic brain damage. ii. Participants over the age of 18 years. iii. People who have cognitive or communicative problems (e.g., dysarthria, apraxia, cognitive-communication deficits).	i. Participants under the age of 18 years. ii. Language difficulties related to other complications (e.g., intellectual impairment, autism, primary progressive aphasia).
Intervention	i. Therapy focusing on language, including verbal outcomes, comprehension, reading, and writing, at deficits, activity, or daily living. ii. Another part of communication is the focus of therapy (e.g., speech, cognitive-communication, pragmatics) in addition to language (e.g., computer, iPad, tablet, handheld devices).	i. Providing any form of service (e.g., home program, allied health assistant or therapist initiated, group or individual therapy) Treatment that does not use technology. ii. Treatment that does not focus on language or simply addresses one area of communication (e.g., speech, cognitive-communication, pragmatics) iii. Therapy focused at compensating for a person's language deficiencies (e.g., AAC, voice recognition software).

Table 2.2 (*continued.*)

Comparison	i.	Tele-rehabilitation is used to deliver therapy.	i.	Medication-assisted therapy, such as drug trials.
	ii.	Technology-assisted therapy.	ii.	Therapy focusing solely on other areas of communication (e.g., speech, cognitive-communication, pragmatics).
	iii.	A comparison with a control group.	iii.	There is no control or comparison group.
Result	i.	Any of the aforementioned outcomes, such as disability, activity, functional, psychological, or quality of life outcomes.	i.	No outcome mentioned
Research	i.	Peer-reviewed publications.	i.	Conference speeches, for example, are examples of non-peer reviewed publishing. unpublished theses.
	ii.	Articles in English.	ii.	Non-English articles.
	iii.	Published in 2019-2020.		

Data Extractor

The data extraction table was customised and constructed, then pilot tested and fine-tuned as needed. For individualised research, the following data was gathered: the study's goal, design, inclusion and exclusion criteria, recruiting technique, intervention details,

outcome measures, summary, and conclusion. All relevant information pertaining to the objectives of the study were extracted by the reviewer and confirmed by the guide.

Assessment of Quality

The Physiotherapy Evidence Database (PEDro) scale was used to determine methodological quality. PEDro was created through a series of controlled studies in mind. The PEDro scale consists of 11 quality ratings, including ten items pertaining to internal validity being evaluated for a total score of ten. The PEDro scale is a reliable indicator of clinical trial methodological effectiveness.

Its items were arranged in a hierarchical structure from least to most adhered to, with no redundancy. PEDro data can be treated as interval level measurement because the original PEDro ordinal scores and transformed PEDro interval scores have a high correlation (Morton, 2009). The methodological quality of each study was then evaluated using guidelines established for the Evidence-Based Review of Stroke Rehabilitation. A score of 9–10 indicated "excellent" methodological quality, 6–8 indicated "good" quality, 4–5 indicated "fair" quality, and 4 indicated "poor" quality. Each article was analyzed by the rater, who then discussed respective results.

Data Synthesis

Data was first synthesised using tables to compare the studies. The studies eligible for review were heterogeneous in terms of their design and type, the population under study, treatment being used, and their outcomes thus meta-analytical information could not be obtained.

CHAPTER 3

RESULTS

The primary aims of this research were to conduct a comprehensive evaluation of studies on technologies used in the treatment of aphasia and to educate therapists on how to use technology effectively in aphasia therapy. The focus of the research was to describe various computer-based strategies used in aphasia treatment and to compile the results of pre- and post-therapy treatments for tele-practitioners.

3.1 Results of the Systematic Search Process

The search and selection process using PRISMA is represented in Figure 3.1. All the studies included in this review are strictly adhering to the aforementioned inclusion and exclusion criteria.

3.2. Results of Qualitative Analysis

The final short-listed articles underwent qualitative analysis using the PEDro scale. It is vital to separate research of relative higher and lower quality to organize the contribution of studies based on their quality. Typically, researchers quantify evaluation outcomes to generate an overall study quality score. A determining criterion is applied to establish comparable study quality. Review teams decide the 'tipping point' criteria based on what they believe is relevant for the aim of their review (Long et al., 2020). The inclusion criteria decided for the current study was a score of 7 or more on the PEDro scale. The result of the same is given in Table 3.1.

Figure 3.1

Schematic representation of the systematic search process using PRISMA

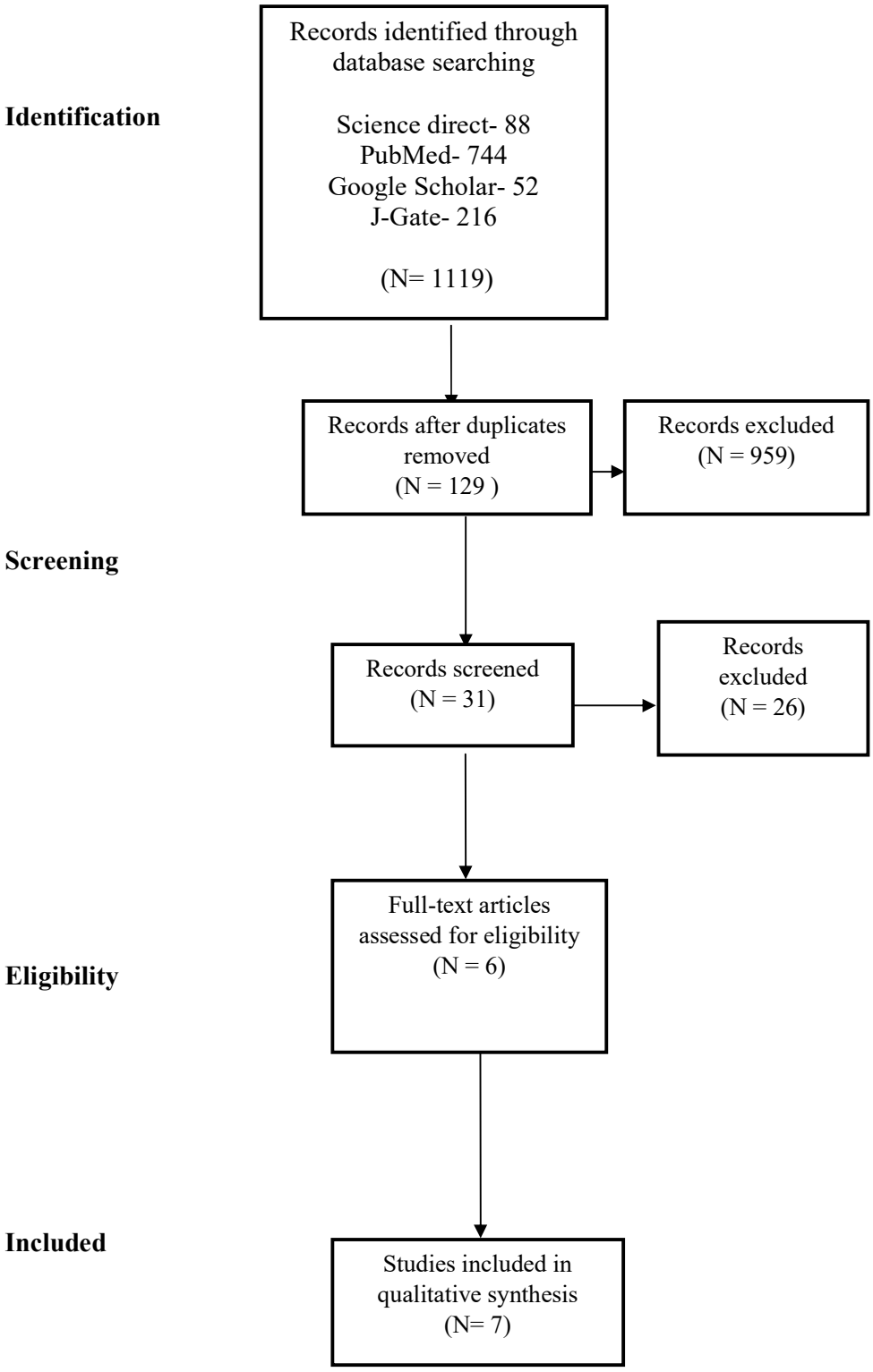

Table 3.1

Results of qualitative assessment of the included studies

Study	Eligibility criteria Mentioned	Randomly allocated	Allocation that is hidden	At the start, the groups were similar	Blinding of subjects	Blinding of assessors	Blinding of therapists	The measure of a least one key outcome from more than 85%	Intentions of treatment	Statistical comparison between groups	Measurement of variability	Total
Caute et al., 2019),	1	1	1	1	0	0	0	1	1	1	1	8/10
Ballard et al., 2019	1	1	1	0	0	0	0	1	1	1	1	7/10
Palmer et al., 2019	1	1	1	0	0	0	0	1	1	1	1	7/10
Pugliese et al., 2019	1	1	1	0	0	0	0	1	1	1	1	7/10

Table 3.1 *(continued.)*

Study	Eligibility criteria Mentioned	Randomly allocated	Allocation that is hidden	At the start, the groups were similar	Blinding of subjects	Blinding of assessors	Blinding of therapists	The measure of a least one key outcome from more than 85%	Intentions of treatment	Statistical comparison between groups	Measurement of variability	Total
Garcia, 2019	1	1	1	0	0	0	0	1	1	1	1	7/10
Barbieri et al., 2019	1	1	1	0	0	0	0	1	1	1	1	7/10

3.3. Characteristics of the Studies included in the Review

The study characteristics and participant characteristics of each of the studies are given in Table 3.2. The table represents the summary of all those articles which met the inclusion criteria mentioned in the method section. The table summarises the demographic and research details of the studies under review i.e., type of management, number of subjects and types of study based on Population Evaluation Control Group Outcome format.

Table 3.2

The study characteristics and participant characteristics in PECO format

Sl no	Author	Year	Country	Management done	No of subjects	Types of study	Quality analysis
1	Caute et al.	2019	United kingdom	Communicate project, writing, spoken discourse and conversation over skype	21	Quasi-randomised control study	Good
2	Ballard et al.	2019	United states of America	Word trainer application	5	Multiple baseline design	Good
3	Palmer et al.	2019	United kingdom	Computerised speech language therapy	278	Single-pilot blind randomized clinical trial	Good
4	Pugliese et al.	2019	Canada	Recover Now web portal	30	Randomised control trail	Good
5	Garcia, M	2019	Philippines	Theraphasia Mobile game based therapy	13	Single-group, prospective cohort design	Good
6	Barbieri, et al.	2019	United States of America	Eye tracking, fMRI naming task	19	Randomised	Good

The results of the findings of the present review are described based on the following research questions:

3.4 Are the new era technologies helpful in aphasia therapy?

3.5 Is technology based practice as effective as a clinical based practice?

3.4 Are the New Era Technologies helpful in Aphasia Therapy?

The methods of intervention in the 7 shortlisted studies suitable for review were the use of assistive reading technology, custom-made word trainer app, self-managed computer speech and language therapy (CSLT), game-based speech therapy, and bioengineering based feedback systems.

The effectiveness of each method used has been documented in Table 3.3.

In various ways, all of these therapy modalities aided in the treatment of aphasia. Maintaining progress, increased word production accuracy, the early beginning of therapy, rapid training sessions, high feasibility rating, and enhanced production and comprehension of both trained and untrained syntactically related structures were just a few of the benefits. Some of the intervention methods, on the other hand, had no effect on conversation, self-perceived improvements in everyday communication, social participation, or quality of life.

Table 3.3

Effectiveness of technology based intervention methods

Sl.no	Author	Age range (years)	Intervention method	Assessment method	Results
1	Caute et al.	55.8 (±11.9)	Technology Enhanced Reading Therapy	Gray Oral Reading Test-4	• GORT-4 scores increased by ≥10 points • Well maintained progress • Higher confidence regarding reading activities
2	Ballard et al.	68.6 (±5.1)	Word Trainer Application with built in Automatic Speech Recognition	Online documentation of Word Production Score for each session	• Improved word production accuracy • Well maintained gains • Accepted by clients with Mild-Moderate Apraxia of Speech
3	Palmer et al.	65.4(±12.9)	Self-managedComputerised Speech-language therapy (CLST) vs. Big CACTUS	• Activity Scale of Therapy Outcome Measures • Communication Outcome After Stroke Questionnaire • EuroQoL instrument • CarerQoL questionnaires	• Higher word finding ability scores of personal relevance for CLS • No effect on conversation, self-perceived improvements in everyday communication, social participation, or QoL.

Table 3.3 *(continued.)*

Sl.no	Author	Age range (years)	Intervention method	Assessment method	Results
4	Pugliese et al.	40-95	RecoverNow: A mobile tablet-based therapy platform	Follow up interview to demonstrate feasibility	• Easy and speedy recruitment of patients • Early initiation of therapy and quick training sessions • Higher hours of engagement in therapy for patients with mild aphasia (over 2 hours) as compared to chronic stroke patients • High feasibility rating
5	Garcia, M	Males: 61.5 (±9.2) Females: 55.2 (±12.2)	Mobile game-based therapy- Theraphasia	Quick Aphasia Battery Scores	Significant improvement across all subtests
6	Barbieri, et al.	49.7 (11.2)	Treatment of underlying forms	• Online eyetracking comprehension task • Picture-verification fMRI task	• Improved on production and comprehension of both trained structures and untrained syntactically related structures • Shift toward more normal-like eye movements and a significant increase in neural activation from baseline to post-testing • Better offline comprehension accuracy • Positive changes in processing strategies during sentence comprehension

3.5 Is Technology Based Practice as effective as a Clinical Based Practice?

Of the six articles shortlisted, only 2 of the articles discuss technology based practice in comparison to clinical based practise. First article is by Caute et al. (2019), who compared technology assisted reading with technology unassisted reading. In pre-therapy, the scores on technology assisted reading for Gray's Oral Reading Test was 17.67 while scores for technology unassisted was 19.72. But, in contrast, post-therapy scores for technology assisted was 28.83 while scores for technology unassisted was 15.94. This shows a very clear improvement when it was a technology assisted approach and the improvement roughly equated to 2 more paragraphs than otherwise. Moreover, it is important to note that the improvement was maintained even during a follow up visit. It is also interesting to note that performance during technology unassisted reading remained unchanged with therapy as seen in pre- to post-therapy scores.

The second study is by Palmer et al. (2019). Their aim was to assess the efficacy of self-managed computerised speech and language therapy (CSLT) as a way of providing more than therapy as compared to the usual care.Word finding improvement was 16.2% higher in CSLT group than usual group. The improvement was maintained at 9 months and 12 months post therapy. Around 61% of the participants preferred to continue using the computer program unsupported even after therapy period. While significant improvements were noted for word-finding, functional communication differences between groups remained negligible.

In general, taking into consideration these two studies, the use of technology seems to have benefitted more than usual or traditional approaches, but for those specific tasks. It must also be noted that the use of technology in both of the studies did not hinder improvement in any way, as reported in their respective results.

Chapter 4

DISCUSSION

The systematic review revealed that fulfilling the answers of our two questions

Research question 1: Are the new era technologies helpful in aphasia therapy?

Research question 2: Is technology-based practice as effective as a clinical-based practice?

The above mentioned research questions are addressed using the following subsections:

4.1 Description of technology based methods in aphasia intervention

4.2 Efficacy of technology based methods in aphasia intervention

4.1 Description of technology based methods in aphasia intervention

4.1.1 Technology Enhanced Reading Therapy (Caute et al. 2019)

Caute et al. (2016) investigated whether using a Kindle enhanced reading comprehension, involvement in reading, and enjoyment in four people who had suffered a stroke. Three of the four participants said they preferred reading on Kindle to reading printed books, that their reading confidence had grown greatly, and that they read more regularly following therapy. However, as measured by the Gray Oral Reading Test-Fourth Edition, their reading comprehension scores were unaffected by treatment (GORT-4). Caute et al. (2019) made a similar attempt, which may be regarded an extension of the 2016 work. The 2019 study had a higher sample size, a stronger randomised controlled design, two technologies instead of one, and more training hours (approximately 14 vs. 4 in the prior trial). Caute et al. (2019) expected that their unique strategy using digital technology for people with aphasic reading deficits will increase

reading comprehension, confidence, enjoyment, functional communication, mood, and quality of life. In contrast to the 2016 study, GORT mean scores for technology-assisted reading improved by at least 10 points from pre-therapy to post-therapy, and the improvements were maintained at the 6-week follow-up session. The secondary hypothesis, that functional communication would improve, was not supported. However, after the intervention, participants reported more confidence and fewer negative sentiments about their reading activities, which is a positive thing.

4.1.2 Word Trainer Application with built-in Automatic Speech Recognition (Ballard et al. 2019)

The study's main purpose was to explore if a newly developed speech therapy app that employed ASR-based performance feedback could help adults with apraxia of speech improve word production accuracy after a stroke. The findings of five participants suggest that this method is worthwhile to pursue. The preliminary test of treatment response demonstrated that all five participants felt the effects of practise right away, with four of them demonstrating no overlap in probe performance between baseline and treatment periods. For one month, skills were maintained. With repeated practise of word production, there is a consistent improvement in word retrieval and word production accuracy. Second, the ASR system delivered satisfactory results in their tablet-based word teaching programme. Despite the fact that ASR accuracy improved over the course of the 4-week therapy and showed substantial persistence of therapeutic benefits, it varied between 65 and 83 percent across the five patients. ASR has been used rarely in speech pathology therapy due to the difficulty in achieving sufficient accuracy for abnormal speech. Four of the five participants found the app engaging and valued the app-based exercises at the conclusion of the trial, saying that they would continue to use it and would prefer to complete the therapy at home rather than in the clinic.

4.1.3 Self-managed Computerised Speech-Language Therapy (CLST) (Palmer et al. 2019)

Big CACTUS shows that combining CSLT with traditional treatment allows for more therapy practise and improves the ability to recall personally relevant phrases chosen for practise. It's worth mentioning that 57 (61%) of the 94 participants chose to use the computer software unsupervised after the formal intervention period finished (if they still had access to it), demonstrating that many people appreciated the option to practise language skills independently. Subgroup analysis found that the length of time after a stroke (which in this study ranged from 4 months to 36 years) had no effect on the ability to improve word discovery, implying that people can continue to learn new words even after a stroke Palmer et al.,(2019).

Only a few unfavourable effects were reported by participants, and there were no significant differences in the occurrences of adverse events or severe adverse events across the groups. CSLT is a low-cost option for patients with chronic aphasia after a stroke who require further word finding therapy. The time spent setting up the programme and providing technical assistance, which in our study was done by therapists, is the primary cost driver of delivering CSLT. The CSLT intervention is also applicable internationally, as it is manualized and publicly available, allowing for replication. The WHO International Classification of Functioning, Disability, and Health included disability, activity, and participation as outcome variables (ICF). One restriction is that only one computer software was employed out of the many commercial programmes and apps available, and for only one aphasia-affected language domain (word finding).

4.1.4 RecoverNow: A mobile tablet-based therapy platform (Pugliese et al. 2019)

Thirty acute stroke patients were recruited by Pugliese et al. (2019) to use Recover Now for up to three months. These individuals experienced mild to moderate post-stroke communication and/or mood symptoms, or a National Institute of Stroke Score of less than or equal to 1. (NIHSS). First, the participants were given the Recover Now tablet and instructed to utilize it for three months. A baseline examination was conducted, and data on tablet usage was collected during a three-month period.

4.1.5 Mobile game-based therapy: Theraphasia (Garcia, 2019)

When compared to prior treatment, the related speech, word comprehension, sentence comprehension, picture-naming, repetition, repetition, and reading aloud scores (all P = 0.0001), as well as overall scores (all P = 0.0001), improved significantly. The study's findings suggest that incorporating a "play" component, such as a video game, into aphasia rehabilitation can help people produce more speech. As indicated by previous studies, incorporating the speech therapy game into treatment sessions affected the frontal speech network, resulting in improved speech production. In addition, individuals who received computer-based treatment in addition to traditional therapy sessions improved more than those who did not. Games, on the other hand, should be used in conjunction with traditional therapy sessions rather than as a replacement. The usage of playing Theraphasia has no effect on the role and value of clinician-based aphasia treatment. This is why the game was developed with the assistance of therapists.

It's also worth mentioning that both therapists and participants gave the video game-based treatment high marks. After bonding and playing with her, one patient related a story about how her grandkids bonded with her and showed her how to operate the gadget.

4.1.6 Treatment of underlying forms (Barbeiri et al. 2019)

This study looked at the effects of linguistically oriented treatment on sentence generation and understanding. As indicated by acquisition curves obtained from weekly testing of trained structures and associated high effect sizes, all but one participant (P12) showed better offline output of training items. TUF (Treatment of underlying form) has weaker acquisition and generalisation effects in patients with WAB AQs below 60 than in patients with WAB AQs above 60, implying that more severe language deficits may prohibit meaningful benefit from TUF. Group-level analysis of the production data revealed that the treatment, but not the natural history group, had considerable generalisation to untrained structures, including entire passives, simple passives, active sentences with unaccusative verbs, and active sentences with transitive verbs. In terms of comprehension, an examination of training item acquisition revealed that 7 of the 14 treated participants increased their comprehension of trained full passives, with effect sizes ranging from medium to large.

In reality, analysis of the online eye movement data revealed that the treated individuals did not learn a Theme-first approach, but rather exhibited the emergence of an Agent-first strategy from pre- to post-treatment, indicating normal theme prediction. With the exception of P12, who demonstrated no treatment-induced improvement in sentence comprehension or production, participants who received treatment showed alterations in brain activation from pre- to post-treatment.

Both healthy controls and patients used the superior parietal lobule for passive phrase processing, with healthy controls showing bilateral activity in this region and patients showing unilateral (right) hemisphere up regulation. The latter hypothesis was supported by our ROI analyses, which revealed considerably more upregulation in the treatment group than in the natural history group in both the sentence processing and dorsal

attention networks. These findings show that treatment has an effect on the processing techniques employed to answer sentences, resulting in the use of more normal-like online thematic processes and the recruitment of associated brain tissue to support these processes.

From baseline to follow-up, participants in the natural history group demonstrated improved thematic prediction. Untreated partici diners, on the other hand, showed only minor activation alterations, especially in the right hemisphere.

4.2 Efficacy of technology based methods in aphasia intervention

4.2.1 Use information from Caute et al. (2019)

The first analysis revealed a clear effect of therapy on this measure, with the “as yet untreated” delayed group improving while the “immediately treated” group did not. When treatment was started, the delayed group also improved, and the pooled results showed that treatment effects were maintained at 6 weeks of follow-up. Therapy had no effect on unassisted reading. The RCBA-2 results strongly demonstrated this, with all participants' scores remaining steady over time. Scores on the GORT-4 unassisted format were less consistent. Despite their reading disabilities, participants were able to access textual content using their training technologies and reading strategies. The therapy had no effect on these deficits, which became apparent when independent reading was attempted. The findings are similar to those of technologically assisted writing therapies, which have yielded compensating outcomes in the same way. The third study hypothesis indicated that technology-assisted reading therapy would improve functional communication, mood, and quality of life throughout a 6-week follow-up period, with maintenance. This theory was found to be false. Almost all of the CADL-2, VAMS-R (Sad), and ALA data analyses were negligible. When all of the data from all of the

subjects was evaluated, there was a primary effect of time on the ALA, with a considerable improvement from pre- to post therapy. However, claiming a therapeutic benefit from this one finding is problematic.

4.2.2 Use information from Palmer et al. (2019)

In the first co-primary outcome, participants in the CSLT group had 162 percent better word finding than those in the usual care group (95 percent CI 127–196; p00001) and 144% better than those in the attention control group. The mean difference in change between the usual care and CSLT groups was –003 (95 percent CI –021 to 014; p=0709), and the mean difference in change between the CSLT group and the attention control group was –001 (–020 to 018). As a result, the CSLT technique did not appear to increase conversational functional communication. The CSLT group spent an average of 28 hours on individual work. As a result, CSLT is a low-cost option for giving additional word finding therapy to individuals with persistent aphasia post-stroke when compared to face-to-face speech and language therapy. Given that CSLT did not appear to affect dialogue, the QALY gain associated with CSLT compared to normal care was small, and the intervention is unlikely to be regarded cost-effective for the entire aphasia patient population due to the small incremental cost-effectiveness ratio.

Chapter 5

SUMMARY AND CONCLUSION

This systematic study shows that modern technology-based therapy can improve language and reading comprehension, naming. Several studies looked at a unique technologies for intervention that used commonly available and affordable gadgets which were integrated with the technology. It is evident from the below listed summaries that technology for aphasia intervention yields fruitful results in most cases.

The study done in app-based therapy approach that provided ASR-based feedback on accuracy, five participants with apraxia of speech and aphasia due to stroke made sufficient gains in word production accuracy. The findings suggest that an ASR(automatic speech recognition) -based method be tested as a supplement to clinician-led sessions to help clients with similar profiles achieve higher levels of practise and intensity while also empowering them to direct their own therapy programme Ballard et al., (2019).

Computerised Speech Language Therapy (Palmer et al., 2019) in combination with standard treatment resulted in a clinically meaningful improvement in personally relevant word discovery but not in conversation. Future research should look into how patients with chronic aphasia after a stroke can apply new vocabulary to conversation .Recent studies have indicated that computerized speech-language therapy is a low-cost strategy that allows individuals with chronic aphasia access to extra word-finding therapy, resulting in considerable improvements in the capacity to locate words of personal meaning. Aphasiologists, speech therapists, and aphasia patients have enthusiastically embraced the inclusion of a supplementary therapy treatment modality to

mainstream speech rehabilitation programmes by incorporating therapeutic tasks in video games. In the acute environment, tablet-based depression screening appears to be viable, albeit some stroke survivors may need support depending on their limitations. To reduce barriers to care and maximise therapy compliance, the tablet-based therapy platform and therapeutic material must be properly matched to stroke survivors' deficiencies. By removing barriers to care, regular contact with patients through a simple and practical way is critical to promoting consistent therapeutic engagement Pugliese et al.,(2019).

Following the intervention, technology-assisted reading comprehension increased, with the treatment compensating for rather than correcting the reading deficit. The participants' reading confidence and emotions improved as well. Improvements have been achieved after 14 therapy sessions, utilising readily available and very inexpensive assistive devices, indicating that this strategy might be used in clinical practise Caute et al., (2019).

In a study by Barbieri et al. (2019), the aphasic individuals and a healthy age-matched control group also completed an online eyetracking comprehension task and a picture-verification fMRI task, which the aphasic groups repeated at post-testing. Individuals in the treatment group, but not those in the natural history group, increased their production and comprehension of both trained and untrained syntactically linked structures, according to the findings. From baseline to post-testing, treatment resulted in a shift toward more normal-like eye movements as well as a significant increase in brain activation.

The preliminary research in this pilot investigation by Garcie et al. (2019) warrants confirmation that speech and language therapy applied to aphasic patients using a mobile game-based rehabilitation as an intervention was an effective therapeutic tool

for treating aphasia in a natural and community-based clinical practice. The QAB (Quick Aphasia Battery) assessment tool revealed a statistically significant improvement in aphasia patients' level of consciousness, sentence comprehension, picture naming, connected speech, repetition, word comprehension, reading aloud, and motor speech.

Huge technology bumps roughly occur every 4-5 years. With those advances, technologies involved in treatment for aphasia must also be updated. It is clear that use of technologies most definitely has an added effect or the primary positive effect in rehabilitation of linguistic skills and/or cognitive skills lost to stroke. Technology in aphasia rehabilitation and speech language pathology in general is an exciting opportunity for interdisciplinary research work and for building evidence based practises. In the coming years, it must be explored thoroughly to produce reliable treatment methods.

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