A comparative effectiveness of PNF technique and Theraband exercises with PNF pattern on upper limb functions in patients with Diabetic Neuropathy

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A COMPARATIVE EFFECTIVENESS OF PNF TECHNIQUE AND THERABAND EXERCISES WITH PNF PATTERN ON UPPER LIMB FUNCTIONS IN PATIENTS WITH DIABETIC NEUROPATHY

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ABSTRACT

BACKGROUND: Diabetes mellitus is one of the commonest metabolic disorder in the world which is also responsible for manifesting other diseases. It has a deleterious effect on the nerves resulting in diabetic neuropathy. Patients with diabetic neuropathy have reported to be more disabled in self-care tasks and housework. But the general therapeutic measures pays less attention to the upper limb problems. Proprioceptive Neuromuscular Facilitation (PNF) is a rehabilitation approach to the disability associated with diabetic neuropathy that is widely used by physiotherapists in many countries. Theraband exercises with PNF pattern on the other hand can be an alternative to the conventional PNF technique in the management of subjects with diabetic neuropathy. So this study was done with an objective of comparing the effectiveness of the PNF technique and the Theraband exercises with PNF pattern along with conventional exercises common to both groups on the upper limb functions in patients with diabetic neuropathy.

METHODS: A simple randomized sampling was done and pre-test and post-test experimental method was used, treating one group with PNF technique and other group with Theraband exercises with PNF pattern for a period of 4 weeks (3 sessions per week on alternative days).

RESULTS: Both the groups showed statistically significant improvement from the baseline. But the group treated with Theraband exercises with PNF pattern on upper limb functions showed improvement as compared to PNF technique on upper limb functions in patients with diabetic neuropathy.

CONCLUSIONS: After 4 week of intervention it has been observed that Theraband exercises with PNF pattern on upper limb functions showed better improvement as compared to PNF technique on upper limb functions in patients with diabetic neuropathy.

KEYWORDS: Diabetic Mellitus, Diabetic Neuropathy, Proprioceptive Neuromuscular Facilitation, Theraband, Michigan Neuropathy Screening Instrument, Upper Extremity Functional Index

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INTRODUCTION

Diabetes mellitus (DM) represents a group of metabolic diseases characterized by chronic high glycemic levels resulting either from defects in insulin production, body tissue response to the insulin, or both. Such abnormalities in the metabolism of carbohydrates, lipids, and proteins result from the paucity of insulin as an anabolic hormone in the cells of the body (Kharroubi and Darwish 2015). There are around 537 million adults around the world with diabetes as per an estimation by the International Diabetes Federation out of which approximately 77 million individuals reside in India, having a higher prevalence (4.3%) as compared with the west (1%-2%) (International Diabetes Federation 2022) (Pradeepa and Mohan 2021) (Bansal et al. 2006).

Diabetic neuropathy (DN) is a common complication of DM with a prevalence in the Indian population ranging from 21% to 31% (Pradeepa et al. 2008). It can have a symmetrical presentation as in diabetic polyneuropathy, painful autonomic neuropathy, painful distal neuropathy, insulin neuritis, and polyneuropathy with glucose impairment; or asymmetrical presentation as in radiculoplexoneuropathies, mononeuropathies, and cranial neuropathy in patients with DM. Distal symmetrical polyneuropathy accounts for 75% of all DN making it the commonest type of DN (Bansal et al. 2006).

The exact pathogenesis of DN though remains unknown but hyperglycemia-induced direct damage to nerve cells and the hyperglycemia-induced decrease in the neurovascular flow resulting in neuronal ischaemia are the most accepted possible causes of DN in patients with DM. These rheological changes brought about by the hyperglycemia result in abnormality in the neuronal, axonal and Schwann cell metabolism, impairing axonal transportation (Edwards 2008).

In common acknowledgement, DN starts from the lower extremities but as the disease progresses, it also affects the upper limbs with advancement from the distal to the proximal, particularly in mononeuropathies. Patients with DN demonstrate a significant reduction in myelinated nerve fibres and endoneurial vascular densities in the upper limbs. These factors may also explain the higher prevalence of compressive neuropathy in patients with DM as its delayed complications (Thomsen et al. 2011). To date, a very small number of studies have investigated the prevalence of clinical and subclinical presentation of DN in the major nerves of the upper limbs including median and ulnar nerves, which may range between 58% to 93% (Bertora et al. 1998) (Yang et al. 2018).

Symptoms include sensory deficits such as loss of tactile sensation, impaired proprioceptive feedback, and painful limb. More importantly, they also include motor deficits such as a decrease in muscle strength, and impaired gross and fine motor skills involving hands. Motor symptoms tend to develop later in the course of the disease All these factors lead to patients reporting of being more disabled in self-care tasks and performing housework, requiring the primary attention of caregivers, physicians as well physiotherapists (Ziegler et al. 1992).

Symptomatic muscle weakness predominantly is responsible for the acquired disability in performing tasks in patients with DN, thus the management protocol must include majors addressing the prevention of any further complications and improvement of muscle strength. One of the physiotherapeutic techniques commonly utilized by therapists to improve muscle strength and restore functional range of motion (ROM) is proprioceptive neuromuscular facilitation (PNF). It is a rehabilitation approach and concept developed by Dr Herman Kabat and Margaret (Maggie) Knot, based on the works of Sir Charles

Sherrington in 1947. Since then it is being practised by physiotherapists and is also a part of the physiotherapy curriculum. Under this therapeutic procedure, the therapist uses the stretch reflex to initiate muscle contraction against the applied resistance, where the tactile stimulation and auditory stimulation from the therapist direct the movement of the patient (Adler et al. 2014).

Instruments such as resistance training machines and free weights are commonly used for resistance exercises to improve muscle strength. These are relatively more expensive and space-occupying than the resistance band that can be used as an alternative to them. Its deformation curve is associated with the increasing tension within it, i.e. the more the band is stretched, the greater the resistance one feel towards its further elongation (Iversen et al. 2016). As shown in a few of the studies, resistance bands or Theraband provide muscle activation to the exercises, similar to that of the other instruments (Aboodarda et al. 2016). Compared to the conventional PNF exercise program with manual resistance whose force may vary throughout the ROM, Theraband exercises in PNF patterns thus can be a better alternative.

Seeing the increasing number of patients with DN in a developing country like India, the demand for a well-accepted physiotherapeutic protocol addressing the upper limbs functional disability is the need of the moment. Many studies have been done testing the effectiveness of the PNF technique and Theraband exercises with PNF pattern individually as a treatment in improving upper limb functional disabilities (Candace et al. 2017) (Kaur 2010). But there is a lack of studies comparing both with respect to the upper limb functions in patients with DN. Therefore, this study was done to compare the effectiveness of PNF techniques versus Theraband exercises with PNF patterns on upper limb functions in patients with DN.

MATERIAL & METHODS

STUDY DESIGN

This structured comparative experimental study was carried out in the Department of Physiotherapy, Sun Valley Hospital, Guwahati, Assam within a period of 6 months. Approval of the Institute Ethical Committee (IEC), College of Physiotherapy and Medical Sciences as per the ethical guidelines for biomedical research on human subjects was taken before starting the study.

SUBJECTS

A total of 62 subjects diagnosed with chronic type 1 and type 2 DM were assessed for DN using detailed motor and sensory assessment and the Michigan neuropathy screening instrument (MNSI) Score. MNSI is a reliable and valid rapid tool consisting of two sections, 'section A' including 15 self-administered questions about neuropathic symptoms and 'section B' including neurological assessment and examination of the lower extremity (Moghtaderi et al. 2006). In the context of this study, only section A was considered. Individuals with impaired sensory and motor findings along with an MNSI score ≥ 10 were considered to be suffering from DN.

Of all, 32 subjects were identified to have DN. They were approached with the proposal of the study and were evaluated for the inclusion and exclusion criteria. 5 individuals were excluded and 3 were not willing to participate (Figure-01). Both male and female subjects, within the age group between 30-60 years, diagnosed with DN with a history of DM for the last 10-20 years and upper limb muscle strength between 3-4 as per manual muscle testing were included. The subjects with non-diabetic neuropathy (vitamin deficiencies, uraemia, thyroid disease, etc. induced), lumbar or cervical radiculopathy, history of cerebrovascular accident, history of upper limb injury, other neurological disorders, and mentally unstable subjects were excluded.

RANDOMIZATION

24 subjects who met the inclusion criteria and agreed to participate were explained in detail about the study and written informed consent was taken in their preferred language before their enrolment in the study. The enrolled subjects were randomized into two groups by simple random sampling. "Group-A" consisted of 12 subjects, who were treated with PNF exercises including dynamic reversal and rhythmic stabilization in both D1 and D2 patterns, whereas "Group-B" consisting of 12 subjects were treated with resistance exercises using the Theraband in PNF D1 and D2 pattern along with conventional exercises including generalised mild stretching

and active ROM exercises that were common to both the groups.

INTERVENTIONS

All the subjects in both groups were treated for a period of 3 sessions alternatively per week for 4 weeks. Each treatment session in both groups started with conventional exercises that were common to both groups, followed by the assigned treatment. The duration of each treatment session was of 45 minutes. The exercises were given on alternative days with each exercise being repeated 8-10 times and 1-2 minutes of rest in between.

In "Group-A" the subjects were treated with the subject in supine lying (Figure-02) and the subjects in "Group-B" were exercised with the Theraband in the sitting posture (Figure-03). The progression was made by increasing the resistance by subsequently using the next-in-line Theraband based on the resistance offered by it, once the subject achieves easiness with the current Theraband. In the beginning, the participants used the yellow band, and progressively the red band, followed by the green and blue were used. In this way, the exercise intensity gradually increased.

MATERIALS USED

The non-latex resistance bands of the company 'Theraband' were used, which were colour coded based on the maximum resistance offered by it. They were in the order of yellow, red, green, and blue where yellow being with least resistance and blue with the maximum.

OUTCOME MEASURE

The Upper Extremity Functional Index (UEFI) was used as the outcome measure. It is a patient-reported questionnaire used to assess upper limb functionality in individuals with upper limb dysfunction. It consists of 20 questions on a 5-point rating scale assessing the level of difficulty in performing activities of daily living using the upper limbs including household and work activities, hobbies, etc. Each item score ranges from 0-4, where 0 represents extreme difficulty and 4 represents no difficulty in performing the task with a cumulative total score maximum of 80 indicating the highest functional status and a minimum score of 0 indicating the lowest functional status. Subjects were asked to circle the number that best describes their level of difficulty in response to each item prior to any intervention and the end of 4 weeks of treatment. UEFI measures show both acceptable reliability and validity with the ICC value = 0.94 (Chesworth et al. 2014).

DATA ANALYSIS

Statistical analysis was performed using Statistical Package for Social Science (SPSS) version 28. The Kolmogorov-Smirnov test was used to test the normality of the data. The Chi-Square test was used to analyse the categorical data and the Independent Sample T-test was used to analyse the continuous data. For outcome measure, within-group analysis was done using the Paired Sample T-test and between-group analysis at baseline as well as following treatment was done using the Independent Sample T-test. The tests were applied at a confidence interval of 95%. For the level of significance p-value set to below 0.05 was considered a significant difference.

RESULTS

The pre- and post-intervention data for both limbs were normally distributed. The groups were homogenous preceding the interventions considering the demographic characteristics and baseline variables as there was a statistically non-significant difference ($p > 0.05$) between the two groups, in the way depicted in Table-01. Following 12 sessions of interventions, the intra-group comparison was suggestive of a statistically significant difference in both Group-A and Group-B concerning the UEFI score for both right and left side upper limbs. This represents that both treatments were effective in improving upper limb functions in subjects with DN. Whereas inter-group comparison was indicative of Group-B showing a statistically significant improvement over Group-A in UEFI score ($p < 0.05$) for the right as well as left upper limbs following treatment (Table-02). This shows that Theraband exercises with the PNF pattern were more effective than the PNF techniques on upper limb functions in patients with DN.

DISCUSSION

This study demonstrated that a 4-week therapeutic treatment program of PNF techniques and Theraband exercises with PNF patterns could improve the functionality of both

right and left upper limbs as measured using the UEFI score. The improvement however in the Theraband exercises with the PNF pattern group was more significant compared to the PNF techniques group.

The within-group development following exercises in both groups can be explained by the betterment in glucose control as induced by the exercises, which progressively slow down or stops the further progression of DN. Even though the therapeutic techniques do not prove to reverse pathogenesis and progression but they help with the control of the aetiology that is DM (Richter et al. 1981).

Previous literature reported that treatment with PNF techniques helps with increasing muscle strength (Hindle et al. 2012) (Nelson et al. 1986); and improving muscle endurance (Kofotolis and Kellis 2006), power output (Klein et al. 2002), and generalised functionality (Kaur 2010), which are mostly related to the increase in the cross-sectional areas and mass of the muscles following PNF training (Kofotolis et al. 2006). Moreover, when treated with PNF techniques also enhances proprioception firing, sensory-motor function, and muscle stabilization (Mathivathani 2018). On top of that, the manual contact and the tailor-made resistance offered by the therapist also played their role by inducing tactile feedback and making the treatment more subject-specific (Candace et al. 2017). All these factors may explain the observed within-group improvement in both upper limbs' functionality as assessed by UEFI seen in Group-A.

Conventionally PNF is a manual interaction technique, whereas the traditional Theraband exercises are practised in the non-PNF pattern. But as an alternative in this study, the resistance exercises were practised with the PNF patterns. However, there is a limited study exploring the therapeutic benefits of resistance exercises with PNF patterns. The use of a Theraband induces muscle activity that progressively increases from the beginning till the end of the range, mirroring the increasing resistance offered by the Theraband with its elongation. This gives an upper hand over the use of free weights as the muscle activation varies throughout the range (Bergquist et al. 2018). The goal of such an approach was to improve overall muscle strength, flexibility, and movement coordination of the upper limbs. When the resistance exercises were reinforced with repeated PNF patterns, it seems to increase coordination, promote joint stability, and improve neuromuscular control (Saliba et al. 1993). It also involves mass movement patterns that are diagonal and spiral in nature crossing the midline of the body, thus making it possible for the patients to learn the desired motor action and incorporate those responses into their daily functional activities. As most of our daily activities involve such types of movement patterns (Adler et al. 2014) (Saliba et al. 1993). The within-group improvement in both upper limbs' functionality seen in Group-B might be explicated by these considerations.

As aforementioned, this study aimed to find out which of the following therapeutic exercises, PNF technique and Theraband exercises with PNF pattern shows better results considering the function of the upper limb as determined by UEFI score among subjects with DN. The result of the study demonstrated that the UEFI score improved in both groups for the right and left upper limbs. But the between-group analysis implicated that the subjects in Group-B, who were treated with Theraband exercises with PNF pattern showed significantly better improvement in the upper limbs' functionality as compared to the PNF techniques group.

The muscle activation was proved to be greatest with the Theraband exercises with PNF pattern as compared to the conventional PNF techniques (Rhyu et al. 2015). The conventional PNF techniques lag behind in terms of the progressive nature of the treatment with the improvement in function, which was archived in Group-B by using different colour-coded Theraband. This might have acted on the psychological aspect of the intervention, offering subjects the feeling of accomplishment and motivating them to continue with the therapeutic program. All these differences between the groups possibly described the outcome variation following interventions.

The small sample size, targeting subjects with both type-I and type-II DM being subjected to a short duration of intervention without any follow-up may have contributed to the potential bias in the study. Hence future studies targeting subjects with either type-I or type-II DM, with large sample size and with longer treatment

duration along with long-term effects analysis is warranted to have greater clarity on the results.

CONCLUSION

Comparable improvement in upper limbs' function as assessed by the UEFI in subjects with DN was demonstrated in both groups. However, with better results gained subjectively in the Theraband exercises with PNF pattern group compared to the PNF technique group, the current findings suggest the use of Theraband exercises with PNF pattern as a better alternative to the PNF technique for the patients with DN.

ABBREVIATIONS

DM- Diabetes Mellitus

DN- Diabetic Neuropathy

MNSI- Michigan Neuropathy Screening Instrument

UEFI- The Upper Extremity Functional Index

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TABLES

Table-01: Demographics & Pre-Intervention Data

Variables	Group-A	Group-B	t-Value	P-Value
Age (Years)	51.41 ± 1.62	52.91 ± 2.84	-1.589	0.126
Male/Female*	05:07	04:08		0.673
Rt PreUEFI	42.92 ± 2.19	43.67 ± 2.19	-0.839	0.411
Lt PreUEFI	42.42 ± 1.88	43.25 ± 1.96	-1.063	0.299

- Rt PreUEFI= Right Upper Extremity Functional Index score at pre-intervention.
- Lt PreUEFI= Left Upper Extremity Functional Index score at pre-intervention.
- Quantitative variables are presented as mean ± SD and categorical variables (*) as the number

Table-02: Intra-Group & Inter-Group Comparison

	Group-A			Group-B			INTER-GROUP
	Pre-intervention	**Post-intervention**	**p-Value**	**Pre-intervention**	**Post-intervention**	**p-Value**	**p-Value**
Rt UEFI	42.92 ± 2.19	61.83 ± 1.08	0.000	43.67 ± 2.19	70.91 ± 2.27	0.000	0.000*
Lt UEFI	42.42 ± 1.88	61.08 ± 1.08	0.000	43.25 ± 1.96	71.67 ± 2.34	0.000	0.000*

- Rt UEFI= Right Upper Extremity Functional Index score.
- Lt UEFI= Left Upper Extremity Functional Index score.
- Quantitative variables are presented as mean ± SD.
- (*) = p-value < 0.05, Group-B statistically significant over Group-A

FIGURES

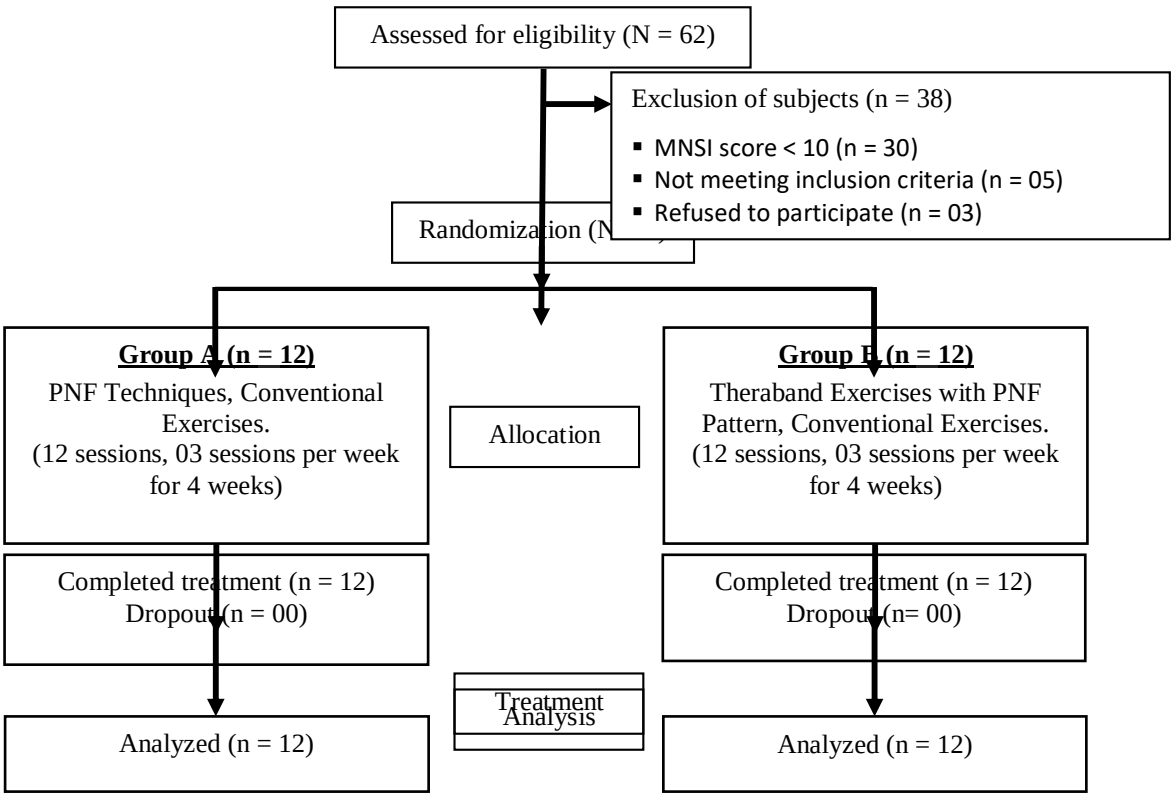

Figure-01: Consort Flow Diagram

Figure-02: PNF Techniques: (A) Dynamic Reversal; (B) Rhythmic Stabilization;

Figure-03: Theraband Exercises With PNF Patterns (Clockwise): (A) D_1 Flexion; (B) D_1 Extension; (C) D_2 Extension; (D) D_2 Flexion

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Cognizance Of School Teachers Toward Communication Disorder In School Going Children Of Twin City, Odisha

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ABSTRACT:

Background: Regular school teachers have awareness regarding different types of communication disorder in school going children.
Methodology: Total 312 regular school teachers (156 primary and 156 secondary) had participated in the study, and they were given a questionnaire based on features of different types of selected communication disorder seen in school going children.
Aim and Objectives: The study was aimed to investigate Cognizance as well as the awareness of primary and secondary school teachers regarding the occurrence of various communication disorders in school going children.
Result: Mean ± SD and percentile score for common features of selected communication disorder was calculated. A two-way ANOVA along with post hoc analysis using unpaired t test was used from statistical point of view. The result indicated that $p<.0001$, a statistically significant difference between primary and secondary school teacher.
Discussion: All the teachers participated, had cognizance, and had observed the features belonging to selected communication disorders but no cent percent result could obtain, which state that they were not aware of all of them as well as of various other communication disorders prevailing in school going children, hence it was concluded that, there is limited awareness and cognizance related to communication disorders in children among regular school teachers i.e. both primary and secondary.
Conclusion: So, it could be suggested that more survey like the present study can be considered to carry out among more numbers of regular school teachers belonging to different geographical part of our country where programs can be organized in order to sensitize them regarding communication disorders in school going children.

INTRODUCTION:

Communication disorder is a broad umbrella term which covers different types of disorders under it, (Ruscello, Louis & Mason, 1991) which can be noticed at the level of comprehension or production of speech sounds (i.e. consonants and vowels), words, phrases, or sentences (ASHA, 2006). The spectrum of communication disorders

include problems in speaking, hearing and thinking such as voice disorders, phonological and articulation disorders, fluency disorders (Stuttering & Cluttering), language disorders, delayed and/or arrested speech and language development due to hearing impairment, behavioral disorders like attention deficit disorders (ADD), Autistic spectrum disorders (ASD); mental retardation and other problems (Paul, 2009), which are reported to be found majorly in school going children.

Parents, primary caregivers, and teachers are critical for rich stimulation of children's communication as well as play an important role in the early identification of communication disorders by observing the primary school going children, which if not identified and treated early, it may also pursue in secondary school age children. Hence, it is important to acknowledge how much regular school teachers (both primary and secondary) are aware about the same, as a lack of awareness regarding communication disorders in children may lead to delay in their management. However, the statistical information which can estimates the magnitude of awareness of communication disorders in children among primary and secondary school teachers in twin city of Odisha i.e. Bhubaneswar and Cuttack are scarce.

AIMS AND OBJECTIVES:

To investigate and compare the primary and secondary school teachers' cognizance as well as the awareness regarding the occurrence of various communication disorders in school going children.

MATERIALS AND METHODS

A cross sectional study was conducted among 312 regular school teachers were divided into two groups i.e. group-I consist of 156 primary school teachers (PST) and group II with 156 secondary school teachers (SST) from both English and Odia medium schools of Bhubaneswar and Cuttack, Odisha. Hence forth all the primary school teachers or group-I will be viz PST and secondary school teachers or group-II as SST for rest of the article. All the school teachers having teaching experience of minimum 10years andteaching different subjects were included. Less than 10years experienced teachers for both the groups were excluded.

An ethical approval consent was taken from the higher authority of selected schools for primary and secondary education with prior permission. A survey was done by visiting the selected primary and secondary schools(government and private), in order to make an approach for the participants to participate in the survey. All the teachers who were interested in the survey, were introduced with the aims and the objectives of this study and a written consent and permission were sought from them for their approval.

Based on primary features of the selected communication disorders like hearing impairment, articulation disorder or speech sound error, fluency disorder/stuttering, Learning Disorder including reading, writing and mathematics difficulty, Attention and Behavioral problems related to autism and ADHD, occurring very commonly among school going children, a close ended structured questionnaire was constructed initially in English by investigators and validated by 5 experienced ASLPs. The questionnaire was further translated into Odia language by native speakers and then back translated along with proofread to ensure that the meaning of the content remains the same.

The features of each selected disorder in the close ended questionnaire were explained to the teachers participated in the study and they were asked if they had experienced or observed any of these features present in any children in their teaching career. They were instructed to put atick "√" mark to the correct response given as the

either 'yes' or 'no'.The duly filled questionnaires were collected and the responses were noted down which were further compiled for statistical analysis.

The recorded data were documented in Microsoft excel 2018 and analyzed using Statistical Package for Social Sciences (SPSS) version 18.0.0. In order to summarize the overall score of both the groups, Mean ± SD and percentile score for each factor under every selected parameters were calculated.

To determine the effects of the communication disorders as well as combined effect of primary and secondary school teachers, two-way ANOVA was applied along with post hoc analysis using unpaired t test in order to check the difference between subgroups.

RESULTS:

The information was collected from 156 primary school teachers (PST) in group I and 156 secondary school teachers (SST) in group II. The details of participants were given in Table.1

Table-1: Depicts details of teachers (Number and Mean Age Range)

Group	Male	Female	Total	Mean Age Range (Years)
PST (Group- I)	72	84	156	39.6
SST (Group- II)	76	80	156	46.3

The descriptive statistics associated with awareness of communication disorders prevailing in children across the two groups of teachers i.e. primary and secondary, were reported in Table.2.

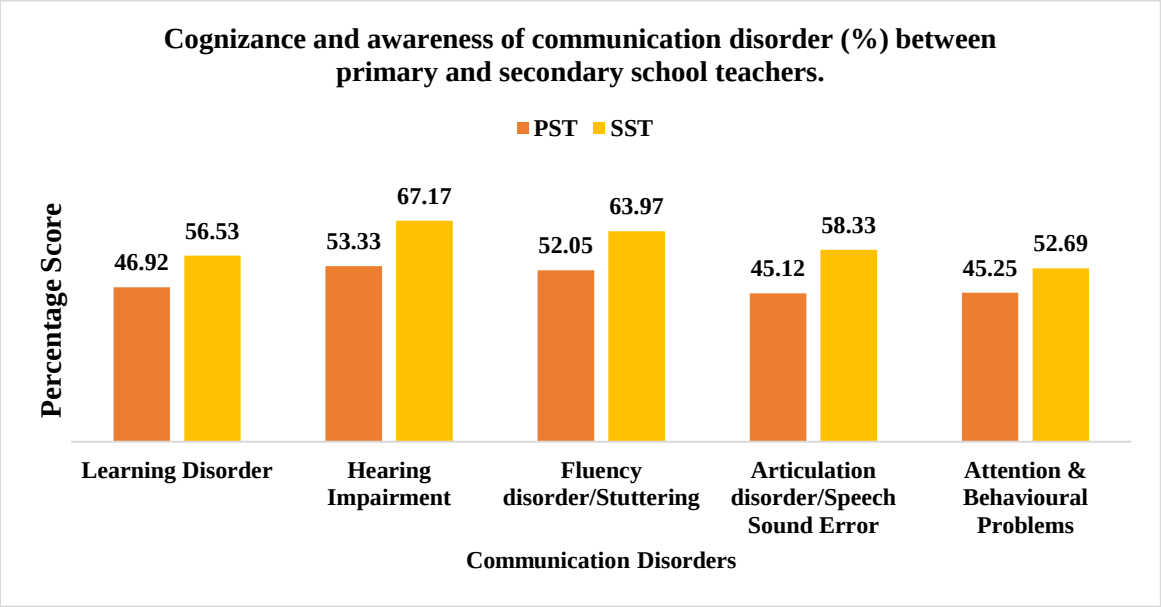
Table-2: Depicts descriptive statistics of selected communication disorder awareness between two groups of teachers.

Communication Disorders in children	Schoolteachers	Mean	Standard Deviation	Standard Error
Learning Disorder (Reading, writing & mathematics difficulty)	PST	2.3462	0.5407	0.0433
	SST	2.8269	0.8437	0.0675
Hearing Impairment	PST	2.6667	0.6256	0.0501
	SST	3.359	0.5322	0.0426

Fluency disorder/Stuttering	PST	2.6026	0.5976	0.0478
	SST	3.1987	0.5839	0.0467
Articulation disorder/Speech sound error	PST	2.2564	0.6104	0.0489
	SST	2.9167	0.4814	0.0385
Attention & Behavioural problems	PST	2.2628	0.7371	0.059
	SST	2.6346	0.8657	0.0693

The study results regarding the awareness of each communication disorders among teachers were presented in terms of percentile score as given in graph 1where more than 50% of the SST, participated in the study were aware of communication disorders in school going children. Both primary (PST) and secondary (SST) school teachers were more aware of features related to hearing impairment and fluency disorder/stuttering, as a reason behind communication problems in children.

Graph-1: Depicts percentage of awareness of communication disorders in primary and secondary school teachers.



It is well surprising fact that PST and SST were aware of learning disability causing communication disorder and helps in identifying the same. They were somewhere aware of the term dyslexia and dyscalculia. Regarding attention and behavioral problem in children,

features related to autism and attention deficit disorder were recognized by the teachers. They had experienced with children having features like less and/or no eye contact, not answering the question, cannot sit at a place, not paying attention to teachers talk or activities going in the class.However, both PST and SST could not adequately differentiate between ADHD and autism. In case of speech sound disorder, primary school teachers as well as secondary school teachers had addressed their input suggesting that they have seen these features in children studying during third to sixth standard.

During the interaction with teachers of both groups, one interesting information regarding delayed language development in the children, yield an impact result where more than half of the total teachers have a positive firm regarding the same for more children with hearing impairment and attention and behavioral problems. However, it was also documented that the overall, teachers had observed the prevalence of delay language in rest of the communication disorders.

However, no cent percent SST and PST could display cognizance toward the features of selected communication disorders in school going children.

In order to determine the influence of two independent variables (PST & SST) on Cognizance and awareness of communication disorders i.e. Specific Learning Disorder, Hearing Impairment, Fluency Disorder, Articulation Disorder, Attention and Behavioural problem, a two-way analysis of variance was conducted where all the effects were statistically significant at the .05 significance level. The main effect for PST & SST yielded an F ratio of F (1, 1559) = 286.42, p=0.000, indicating a significant difference between Group I- PST with mean and standard deviation (±) were for Specific Learning Disorder: 2.34 (±0.54); for Hearing Impairment: 2.66 (±0.62), for Fluency Disorder: 2.60(±0.59), for Articulation Disorder: 2.25 (±0.61), for Attention and Behavioural problem: 2.26(±0.73); and Group II- SST for Specific Learning Disorder: 2.82 (±0.84), for Hearing Impairment: 3.35(±0.53), for Fluency Disorder: 3.19(±0.58), for Articulation Disorder: 2.91(±0.48), for Attention and Behavioural problem: 2.63 (±0.86)[Table 2]. The main effect for Cognizance and awareness of communication disorders yielded an F ratio of F (4, 1559) = 41.38, p=0.000, indicating a significant difference. The interaction effect was significant, F (4, 1559) = 3.21, p=0.012 [Table 3].

A post hoc analysis using unpaired t test with $p<0.0001$, suggested that the selected five parameters were significantly differing from each other along with a significant difference between PST & SST [Table 4]. At Bonferroni Correction p= 0.01. $p<0.01$ suggest that all the selected communication disorders were significantly different from each other in PST as well as in SST.

Table-3: Depicts of two-way ANOVA result regarding awareness of communication disorder between primary and secondary school teachers.

ANOVA						
Source of Variation	**SS**	**df**	**MS**	**F**	**p-value**	**F crit**
PST & SST	122.416	1	122.416	286.4267	0.000000000	3.847465
Communication Disorders	70.74744	4	17.68686	41.38338	0.000000000	2.377669
Interaction	5.503846	4	1.375962	3.219449	0.012122017	2.377669
Within	662.4551	1550	0.42739			

Total	861.1224	1559	

Table- 4: Depicts post hoc analysis using unpaired t test with applied Bonferroni correction for comparisons of communication disorders with each other in primary and secondary school teachers.

Communication disorders	Mean Difference		p- value	
	PST	SST	PST	SST
Learning Disorder- Hearing Impairment	-0.3205	-0.5321	<.0001	
Learning Disorder - Stuttering	-0.2564	-0.3718		
Hearing Impairment- Articulation Disorder	0.4103	0.4423		
Hearing Impairment- Attention & Behaviour	0.4038	0.7244		
Stuttering- Articulation Disorder	0.3462	0.2821		
Stuttering- Attention & Behaviour	0.3397	0.5641		
Articulation Disorder - Attention & Behaviour	-0.0064	0.2821	0.003	0.0002
Learning Disorder- Articulation Disorder	0.0897	-0.0897	0.001	0.003
Learning Disorder -Attention & Behaviour	0.0833	0.1923	<.0001	0.002
Hearing Impairment- Stuttering	0.0641	0.1603	0.002	0.005

DISCUSSION:

Any kind of limitation or breakdown in the process of learning communication skills can significantly hinder a child's development, specifically speech or language development, effecting the child's social and behavioral skills as well as the academic abilities, caused due to communication disorder [4,5]. Earlier mitigation of problem will further help the children in improving their social as well as academic (reading and writing) skills, in school [6,7,8].

The present study result is all about scoring the cognizance and awareness of various communication disorders among regular school teachers of primary and secondary school. On a closure look to the distribution of different types of communication disorder, we found more than half of the secondary school teachers (SST-56.53%) and primary school teachers (PST-46.92%) display knowledge toward the primary features of learning disorder. This result however differs from the study result of Lopes and Crenitte (2012) [9], where they had found that 78% teachers do not have knowledge on learning disorders, but with effective orientation and training marked alteration in data with 52% teachers started to classify and understand the manifestations as learning disorder, which is similar to present study result.

Another interesting finding of this study is that more than half of the teachers had reported that they had experience with students having similar features that of learning difficulty as given in the questionnaire, however they could not differentiate between learning disability, its type and slow learners, which was weigh up as one of the reasons to consider learning disorder instead

of accurate learning disability which needs to be diagnosed by professionals.

One of the interesting findings of this study is the highest percentile score for teacher's cognizance regarding the communication disorder was hearing impairment where both SST (67.17%) and PST (53.33%) had identified the features of hearing impairment present in students. However, it has also been observed that many of teachers have no information regarding the same. The result of the present study can be correlated with the study by Chishty et al., (2014) [10], who had observed that the peak prevalence of hearing loss was found at 8 years of age, again declining after that from 20.43 % to 5.38 % by 12 years of age, i.e. main school going age. According to another survey on attitudes of teachers on hearing impairment, 85% & 15% teachers were strongly agree & agree respectively that hearing loss occur with different degree whereas 72.2%, 22.2% & 5.5% of the teachers reported that they agree, somewhat agree & somewhat disagree agree with respective to "children with HI have variation in hearing loss levels [11].According to 76th round of The National Sample Survey (NSS) in 2018 [12], 28.45% hearing disability in children since birth had been documented in Odisha. Hence, it became crucial for teachers to be conscious regarding the occurrence of hidden disability like hearing impairment in children which can lead to early intervention if identified and reported early.

In the current study, cognizance of teachers toward the stuttering/fluency disorder is the second largest percentile score as one of the recognized communication disorders (SST - 63.97%; PST-52.05%). This could be due to visibility of speaker's fluency disturbance which hamper the communication skills. The present study results can be generalized with the primary school teacher's survey done in Mumbai and South African schools. A study in Mumbai, suggested that 72.4% primary teachers, had taught at least one or more children who stuttered, over their teaching career. 3.5% teachers had taught four or more children whereas 27.5% teachers had never taught a child with stuttering [13]. In South African Schools, Abrahams et al., set forth that 83.7% teachers reported that they personally knew someone who stutters while 25.6%teachers currently had someone in their class who stutters. It was also concluded that, majority of teachers had experience with stuttering, however, they indicated that they knew the least about stuttering [14].

Compiling both the studies along with present study reports, it can be concluded that teachers are aware of stuttering as a communication disorder, but they are still clueless about in depth of stuttering. Teachers participated in the present study have also added information like they become helpless when other students try to tease and/or imitate the student stuttering.

The present study result figure for speech sound error or articulation disorder clearly visualizes that SST (58.33%) and PST (45.12%) are aware of the facts related to the same. Speech sound error or articulation disorder is described as production of imprecise articulation affecting speech intelligibility of an individual. A Yazd-Iranian study found that 13.8% speech sound error prevails in primary school children[15]. It was also noticed that primary teachers were more concerned for children with speech sound error as being young children, they themselves were deprived of communicating with their peers due to poor intelligibility of speech. Secondary school teachers have also reported that students having articulation disorder being teased by their classmates. Hence, it became a challenge for teachers to handle such situation.

A study supporting this information has been tracked down which display those schools and teachers face challenges while promoting and supporting the educational development of children with speech sound disorders [16]. Both autism and ADHD are believed to have onset during early childhood, although diagnosis is typically determined in the school age years. The

last but not the least interesting finding of this study was awareness of attention and behavioral problems in school going children which constitute the features related to autism and ADHD. The results suggest that PST and SST were also aware of these features present in the children. Our study result is reconcilable with the international and national studies done separately for autism and ADHD.

Arif (2013)[17] conducted studies on primary school teachers of Karachi, Pakistan and concluded that 55% teachers knew about autism through the media and 9% through formal training. But the present study report results cannot be generalized with study done by Al-Sharbati et al.,[18] where it was observed that autism awareness was low among Osmani teachers and there are several misconceptions about autism among the teachers.As observed by Shetty and Rai (2014) [19], 62% teachers were aware of the term ADHD and their knowledge of ADHD ranged from poor to adequate with 9% of teachers had prior training. Only 29% of the teachers had a good understanding of ADHD.

One of the domains of this study was that there were differences in the rate of awareness of various communication disorders between secondary and primary school teachers. Reddy. Badam (2019) [20] found that primary school teachers were better aware of most of the communication disorders. But there is still scarcity of studies at far indicating the importance of regular secondary school teacher's knowledge and role toward communication disorders as there are children with communication disorder attending secondary and higher secondary education. Hence, it provided another need to study the cognizance of SST on communication disorder awareness.

To the best of authors knowledge, this is the first field survey carried out in Bhubaneswar and Cuttack like cities addressing the awareness of communication disorder between secondary and primary school teachers. The present study stipulate that SSTs are more aware of communication disorder with respect to PSTs with statistically highly significant difference. Hence, a proposal for special training program should be directed for all regular school teachers including primary and secondary with the aim to acknowledge them regarding various communication disorder in children. This can empower the school authorities and teachers for their role in early identification and guiding parents for further management of the child.

FUTURE OF THE STUDY:

The current study can be taken forward as another survey not only including the awareness part but also as a part of teacher's vision regarding the management of challenges faced by children with communication disorders in their academics. Secondly, more numbers of regular school teachers can be taken into consideration as a part of survey belonging to different geographical part of our country, providing a better outlook towards awareness of communication disorders in school going children. Programs can be organized for teachers to sensitize them regarding communication disorder.

CONCLUSION:

There is clear visibility of limited awareness and cognizance of various communication disorders in children among regular school teachers i.e. both primary and secondary. It is important for primary school teachers to acknowledge the occurrence of various communication disorder as the symptoms started to visible at early childhood when the child starts for primary school. This alertness in primary school teachers can be beneficent toward child's early identification of disorder and its management which can reduce future stumbling blocks, so that the child can achieve secondary educations.

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Management of Tinnitus: A Comparative Study

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Introduction: 'Tinnitus' is derived from a Latin word 'tinnire' which means to tinkle or ring like a bell. Mcfadden (1982) defines tinnitus as "the conscious experience of sound that originates in the head".

According to Jastreboff (1995) "tinnitus is the perception of sound that results from activity within the nervous system without any corresponding mechanical, vibratory activity within the cochlea, and not related to external stimulation of any kind".

Various tinnitus treatment techniques are available which include medical and surgical management, psychological management, acoustic therapy, and habituation therapy.

Habituations therapy for tinnitus management aims at filtering and blocking the tinnitus related neuronal activity from reaching the area of brain that is responsible for consciously perceiving tinnitus.

Acoustic or sound therapy uses external sounds to provide relief to patients suffering from tinnitus and is said to be useful to any other treatment options (Jastreboff & Hazell, 2004). It is based on tinnitus masking procedures using different prosthetic aids for the management of tinnitus and it includes hearing aids, sound generators or tinnitus maskers.

Regardless of the form of treatment, generally, broadband noise is used in one way or another to distract attention from the tinnitus and to reduce the brain's perceived need for stimulation (Jastreboff & Hazell, 2004).

TRT has been proven to provide great relief to the patients suffering from chronic tinnitus (Henry et al., 2006). Though TRT is a structured management technique, this can only be carried-out by the audiologist who has undergone a formal training (Henry, Jastreboff, Jastreboff, Schechter & Fausti, 2002). In addition, TRT is time consuming.

Hence, the present study aimed to evaluate the effect of tinnitus masking, through an audiometer by delivering white noise to provide tinnitus masking therapy, in the clinical set up, through the earphones.

Need of the study: To measure the efficacy of two intervention Procedures for Tinnitus sufferers.

Aim: The present study aimed to evaluate the effect of tinnitus masking, through an audiometer by delivering white noise to provide tinnitus masking therapy, in the clinical set up, through the earphones.

Objective: The objective of the study is to measure the efficacy of two intervention procedures for tinnitus sufferers, Notched Music Therapy and White Noise Therapy. Using psychoacoustic measurement of tinnitus loudness using loudness matching procedure and tinnitus severity index questionnaire (TSIQ) given by Falmer, 2002.

Method: Two groups with 5 participants each, with chronic tonal tinnitus were included in the study in the study. Each of the two therapy groups had 5 participants who received therapy for 20 sessions of one hour each. For evaluating the efficacy of two therapy techniques, the measures considered were :1) tinnitus loudness measured through loudness matching procedures and 2)TSIQ.

Participants who were willing to attend therapy were randomly assigned into two groups. First group receiving notched-music therapy and the Second group receiving white noise therapy.

Case history: A detailed case history regarding their tinnitus was obtained prior to the assessment of tinnitus. This included the type of tinnitus (continuous/intermittent), nature of tinnitus, the onset of tinnitus, any associated events and lateralization of tinnitus, etc.

Procedure for tinnitus therapy Procedure for white noise therapy: For white noise therapy, Madsen Orbiter 922 diagnostic audiometer was used to generate and present white noise. The patients were comfortably seated and supra aural earphones (TDH-39) were placed.

The white noise was presented to both the ears at 20 dB SL (Jastreboff, 1995). The therapy was carried out for the duration of 60 minutes per session. Each patient underwent therapy for 20 sessions.

Procedure for notched-music therapy: For notched music therapy, Indian instrumental music was chosen.

Result and Discussion: The results revealed that both the therapy techniques provided significant benefit in treating tinnitus. However, Notched Music Therapy was found to provide more benefit than White Noise Therapy.

It can be observed from the that the tinnitus loudness has reduced for three subjects after therapy, whereas, two of the subjects (Subject 1 & Subject 4) had complete inhibition of tinnitus. Hence, during the statistical analysis of post-therapy data, only data from three subjects were considered. Friedman's test was used to evaluate the benefit of notched music therapy.

Its shown the mean and standard deviation of tinnitus loudness for Notched music therapy. As it can be seen in the table, there was decrease in the tinnitus loudness as the therapy progressed. To investigate whether this change was significant, Wilcoxon Signed Rank test was carried-out.

t there is no statistically significant difference ($p>0.05$) between the two therapy techniques for tinnitus loudness and the questionnaire scores.

The subjects receiving Notched music therapy had greater improvement and two of the five subjects receiving Notched music therapy reported complete inhibition of tinnitus.

The above mentioned observation is in support of the notion that tinnitus loudness can be significantly diminished by custom tailored notched music treatment (Okamoto, et al., 2010).

Tailor-made notched music treatment strategy helps in complete suppression of tinnitus by reorganizing the maladaptive auditory cortex (Rauschecker, 1995; Blood & Zatorre, 2001; Elbert & Rockstroh, 2004) even in subjects with normal/near normal hearing sensitivity.

In Okamoto et al. (2010), the therapy using the tailor-made notched music treatment was given over a period of 12 months. However, in the present study, only with 20 hours of therapy, there was an improvement seen. This could be attributed to the peripheral loss that the subjects in Okamoto, et al's study had, which might have led to more maladaptive cortical reorganization.

The comparison between the two therapies revealed no statistical significant difference which may be because only data from three subjects receiving Notched music therapy were considered for analysis. However, subjective analysis of individual data revealed a difference in the tinnitus loudness and questionnaire scores.

This revealed that subjects receiving Notched music therapy showed greater improvement when compared to White noise therapy. Hence, Notched music which is tailor made for each subject, might be a better option to treat tinnitus when compared to White noise.

Conclusion: It can be concluded that both the therapy techniques provided significant benefits in supressing tinnitus. Hence, White Noise Therapy in a clinical set up can be considered as an option of tinnitus treatment at least to supress tinnitus, to some extent. It can also be concluded that even tinnitus subject who have near normal hearing sensitivity have maladaptive cortical re-organisation which can be corrected with tailor-made Notched Music Therapy. Further, Notched Music Therapy was found to provide more benefit than White Noise Therapy.

OUTCOMES OF HEARING AID AND CHALLENGING SITUATIONS IN LISTENING: A CROSS-SECTIONAL STUDY ACROSS RURAL AND URBAN AREAS

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INTRODUCTION:

Societies are characterized by patterns of relationships (social relations) between individuals who share a distinctive culture and institutions; a given society may be described as the sum total of such relationships among its constituent members. In the social sciences, a larger society often evinces stratification or dominance patterns in subgroups.

The main such stratification is rural society and urban society. The nature and life styles of people living in these two societies are also different whereas life in the city is not simple but very complex and complicated.

The notion of aural rehabilitation has changed across the time. Previously thoughts were more concerned with making person to hear by providing amplification, but the present day thoughts are about how hearing aids assist the person in outweighing the inability caused by hearing loss, making a better lifestyle out of his disability, providing rehabilitation such that patient appreciates the outcomes.

The outcomes from the hearing aid can be assessed by different methods. Most commonly used are i) Subjective tests, such as aided pure tone audiometry, speech detection or recognition scores, ii) Objective tests, which involves use of auditory evoked potentials such as Aided Slow cortical potentials, the drawbacks of these tests are their inability to generalize the results and limitation of reflecting the real-life situations which are completely different from these laboratory conducted tests. iii) Self-reported questionnaires such as COSI, HHQ4, IOI-HA5, SAC6, PS (participation scale), APHAB, SADL etc. These questionnaires have advantage over lab-based tests by the nature of their administration. Patient reports his/her observations from real life situations unlike other two methods which are lab based.

HHQ4 hearing handicap questionnaire is an instrument to measure hearing disability as defined by WHO's international classification of functioning, disability and health (ICF). This questionnaire has 12 questions and uses a 5-point scale from never to almost always as a

response option. Emotional distress and uneasiness, social withdrawal and participation restrictions are the domains measured by this instrument. HHQ is reported to be having good Cronbach's alpha (internal consistency) for both the emotional (0.95) and social scale (0.93).

IOI-HA5 the International Outcome Inventory for Hearing Aid aims to assess the effectiveness of hearing aid rehabilitation. It is a seven-item self-report questionnaire evaluating seven different hearing aid outcome domains, including: i) hearing aid use; ii) benefit; iii) activity limitations (residual); iv) satisfaction; v) residual participation restriction; vi) impact on others and vii) quality of life. The original version of IOI-HA is in English and was developed by Cox and colleagues. This questionnaire has now been translated into thirty different languages and is used worldwide. The psychometric properties of the English version on veteran hearing aid users indicate good internal consistency 0.83 (Cronbach's alpha) and high test-retest reliability (0.94).

SAC6 self-assessment of communication is also one of the hearing aid outcome questionnaires developed based on WHO-ICF. In this questionnaire, the first five questions focus on disability and later four questions target participation restriction. Similar to IOI-HA, it is a brief and comprehensive measure recommended by the American Speech-Language-Hearing Association (ASHA) for screening the hearing disability in adults using hearing aids. SAC was one of the top five self-report measures used by audiologists in the United States.

These are only scales available in Hindi along with Participation scale and AQoL - 4D and these are the most used scales for outcomes in developed countries. These scales are interrelated to each other and it asses in domains which are more concerned with daily activities which are hampered by hearing impairment.

Need for the study

Measuring hearing aid outcome is an important indicator of audiological rehabilitation (Cox et al., 2000; Dillon et al., 1999; Dillon & So, 2001). In a community, there is a need to assess the subjective outcome measures for successful benefit of hearing aid which makes the rehabilitation process more useful. Thus the questions mentioned below needs to be answered:

- What are the expectations of a client from hearing aids?
- Whether the use of hearing aid reduced his disability?
- Whether the aural rehabilitation provided is useful?
- Are we providing according to the needs of patient? Etc.

As lifestyle varies across these two societies expectations of person from aural rehabilitation also varies. Knowledge of the outcomes of different population helps the audiologists to understand their expectations thereby guiding the audiologists in providing better rehabilitation.

Aim of the study

The main aim of the study was to find the differences in outcomes of hearing aids and challenges in listening situations across rural and urban population. In addition, relationship between hearing aid use, listening situations and strata of society was examined.

Objectives of study

- To study the outcomes of hearing aid.
- To elicit the differences in outcomes of hearing aid across rural and urban population.
- To see how differently hearing aids benefit these populations
- To explore the needs and challenging listening situations in these units.

METHODOLOGY

The study was conducted to find the differences in outcomes of hearing aids and challenges in listening situations across rural and urban population. In addition, relationship between hearing aid use, listening situations and strata of society was also examined.

Inclusion criteria

- Total of 100 subjects with acquired hearing loss ranging from moderate to severe hearing loss of sensorineural and mixed types were considered for the study.
- Individuals using digital behind the ear hearing aid/s at least for three months were chosen.
- Aided speech identification scores of the participants were at least 60%.
- Age range of participants were 18 to 59 years which were divided in two units, individuals residing in the rural and urban set-ups.
- Irrespective of their native area, individuals living in urban/rural area for more than a year were considered to be hailing from area where they are currently living.
- Definition of rural and urban areas as per Registrar General & Census Commissioner, Ministry of Home Affairs, Government of India, New Delhi, IN.

Urban areas (2011):

- All places with a municipality, corporation, cantonment board or notified town area committee, etc.
- All other places which satisfied the following criteria
- A minimum population of 5,000;
- At least 75 per cent of the male main workers engaged in non- agricultural pursuits; and
- A density of population of at least 400 per sq. km.

Rural areas (2011):

- All other areas or places which does not fall under urban units are classified as rural areas.

Exclusion criteria

- Naive hearing aid users were not considered for the study
- Individuals with congenital hearing loss were excluded.
- Individuals who had other co morbid disorders like tremors, psychological problems were not considered.

Procedure

- The information collection involved the survey through personal and telephone interviewing procedure.
- Subjects were selected from different audiological set-ups such as national level institute funded by Government of India, private clinics and private institutions to avoid biasing.
- Study was done in Bhagalpur (Bihar) and its surroundings using cross sectional study design.
- Hindi version of HHQ4, IOI-HA5 and SAC6 were administered by the researcher himself.
- This was done either through personal interview or through telephone interview.
- Two units were made based on their place of residence, units consisting of hearing aid users henceforth called as urban units and rural areas units, each group consisted of 50 Hindi speaking adult individuals giving a total population of 100 subjects.

RESULT AND DISCUSSION

This study was carried out to explore the differences if any in challenging situations in hearing and differences if any in hearing aid outcomes across rural and urban population using Hindi adaptation of Hearing Handicap Questionnaire (HHQ) Patients self-assessment of communication (SAC) and International Outcome Inventory for Hearing Aid (IOI-HA) from English. The participants of the study were Hearing impaired Hindi speaking adult individuals hailing from rural and urban units. A total of 100 individuals with an age range of 18 years to 59 years participated in the study.

HHQ (Hearing Handicap Questionnaire) is a questionnaire to measure hearing disability as per the guidelines of WHO. It is a questionnaire with 12 questions and scored on 5-point rating scale from never to almost always as a response option, left being never experienced difficulty to right being always experienced difficulty. For questions from 2 -12 higher the score is indicative of higher degree of being handicapped or difficulty experienced, question 1 is indicative of awareness and higher is the score, better is the awareness. Questions 1-7 are concerned with emotions of hearing impaired individual and Questions 8 to 12 are concerned with interaction of hearing impaired with society.

IOI-HA (International Outcome Inventory for Hearing Aid) is a questionnaire which has 8 questions, providing the outcomes of hearing aid usage. Each item of first seven questions has been scored from 1 to 5 for the responses being left (worst) to right (best) respectively excluding the eighth question which was scored from 1 to 5 for the responses being right (worst) to left (best) respectively. For first 7 questions the higher score is indicative of a better outcome and for the 8th question better outcome is indicated by the lowest score.

SAC (Self-Assessment of Communication) is a questionnaire which asses the benefits of hearing aid fitted on hearing impaired individual. It has 12 items with each being scored on 5-point rating scale with responses on left indicating poor outcome and right indicating better except for question number 9, 11 and 12. Question number 9 better the score carries better peer support (scores on right side are indicative of better peer support). In question number 11 and 12 more are the scores on right side better are the responses.

The responses obtained in the study were analyzed to cover the two objectives of the study. To explore the differences in challenges in listening situations and differences in outcomes of the hearing aids among urban and rural population under these sections.

1. To observe the differences in handicap experienced by individuals hailing from rural and urban areas.
2. To observe the differences and similarities found in outcomes of the hearing aid usage among individuals and association of rural and urbans units with the hearing aid outcomes.
3. To see the differences in self-assessment of communication between rural and urban dwellers

SUMMARY AND CONCLUSION

1. Urban groups were more aware about their hearing difficulties than rural group and urban group faced more uncomfortable and nervousness than rural groups.
2. Affected levels of individual's confidence were more among urban population than rural population.
3. People living in urban setting were more worried and anxious due to hearing difficulties than people living in rural settings.
4. The participants from urban group experienced embarrassment significantly more than participants from rural group.
5. People with hearing difficulties rarely faced tiredness or stress irrespective of urban or rural groups.
6. Participants from urban group faced more restrictions in their works or things they do. Rural population faced lesser restrictions.
7. Urban population were more felt inconvenience more often than rural population. Participants from urban group avoided social situations more than rural group participants.
8. Hearing difficulties has imposed more restrictions in personal or social life of urban population than in personal or social life of rural population. Urban participants felt that they were more cut off from things they do than rural population due to their hearing difficulties.
9. Both urban and rural groups used their hearing aids more than 4 hours per day with majority using 8 hours per day.
10. Hearing aids have more helped rural group than urban group. Hearing aids were successful in helping majority of participants at least quite lot times.
11. Residual activity limitation was more found in urban population than rural population.

12. There were higher rates of satisfaction among rural groups than urban group but was not significant. Hearing aids have moderately fulfilled expectations majority of participants.

In a nut shell urban population had more perceived handicap and more difficulty in challenging listening situations than rural population. Challenges in listening situations vary across type of areas where the subjects are hailing from. Outcomes measure of hearing aids shown that majority had moderate level of satisfaction from their hearing aids with slightly more number of rural participants having higher rates of satisfaction. Among those who were very satisfied urban population had upper hand.

Implications of the study

1. The study will be helpful in supporting need of customized hearing aid fitting procedures.
2. Helps clinicians/audiological practitioners to understand differential needs of hearing impaired and to modify current fitting approaches which are mainly based on simple speech score testing approach.
3. Helps us to understand setting programmes differently for people based in their social strata (urban or rural).
4. Results of this study can be useful for the clinician/ audiological practitioner to understand the problems and needs of hearing aid users and provides guidelines to counsel and determine the benefits from hearing aids.
5. The study will also give some insight about relationship between hearing aid use, listening situations and social strata (urban and rural) which can assist the professional to plan more efficient aural rehabilitation plans.

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Efficacy of NAL-NL1 Prescription for the First-Time Hearing Aid users: A Follow up Study

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INTRODUCTION:

A Prescriptive approach to hearing aid fitting is one in which the amplification characteristics are calculated from the hearing characteristics of an individual. There are several prescriptive procedures for hearing aid selection, some for linear hearing aids such as prescription of gain and output (POGO), National Acoustic laboratories formula- revised (NAL-R), NAL non-linear 1 (NAL-NL1).

The first prescriptive formula by National Acoustic Laboratories (NAL) was published in 1976. NAL procedure is a threshold-based prescription for linear hearing aids that aims at maximising speech intelligibility.

This includes equalization, rather than normalization (preservation) of the loudness relationships among the speech frequencies.

The reason the NAL-NL1 method deviates from the approach of preserving the unaided loudness relationships among the different frequency elements of speech is because the "preserving" approach has not been shown to improve speech intelligibility (Dillon, Byrne, Ching, Katsch, Keidser and Brewer, 2000).

Killion and Revit (1993) have cautioned that even accurate calculations, carefully computed coupler transfer functions, and rigid standards of manufacturing the hearing aid might not yield the perfect results when measured on an individual probe microphone.

The present study aims at evaluating the efficacy with which NAL-NL1 prescribes the hearing aid parameters for persons with varying types and degrees of hearing loss.

It also aims at finding out the changes observed in the preferred amplification parameters by the hearing aid users after the first 6 to 8 weeks of hearing aid fitment, and the extent by which they deviate from the target prescribed by NAL-NL1.

NEED OF THE STUDY: The need of the study was to find out the changes in the amplification parameters preferred by hearing aid users in the terms of after the first 6 to 8 weeks of hearing aid use.

AIM: The aim of the study was to evaluate the efficacy with which NAL-NL1 prescribes the hearing aid parameters for person with varying type of degree of hearing loss.

OBJECTIVES: The objective of the study aimed to evaluating the extent of deviation of amplification parameters from the target prescribed by NAL-NL1.

METHOD: Participants- 20 participants in the age ranging from 45-80 years. The participants were divided into a group based on the degree and type of hearing loss.

All the participants were first-time hearing aid users and had no previous experience of hearing aid use. The data were collected after they used the hearing aid for a period of at least 45 days to six months.

All the participants had post-lingual onset of hearing loss, with the duration of hearing loss not greater than five years, and they spoke Hindi fluently. All the participants of the study used only digital BTE hearing aid monaurally.

The aided thresholds with the selected hearing aid programmed for these individuals were within the speech spectrum.

Instrument used: A calibrated two channel sound filled audiometer with two loudspeakers to perform the aided sound filled testing. Personal computer was used along with HIPRO, NOAH 3 AND Hearing aid fitting software for programming the digital hearing aid.

A calibrated hearing aid analyzer was used for performing the insertion gain measurements. A questionnaire for fine tuning of hearing aid, the „fine tuning questionnaire‟ was used. Participant's own hearing aid was used for the study.

They either used model „A‟ or „B‟ or „C‟. All the three models of the hearing aid were manufactured by the same company and had the features as mentioned below: o A two channeled fully digital BTE hearing aid suitable for hearing loss from mild to profound degree, with three programmable memories, Automatic Gain Control - Input (AGC-I) compression and output limiting or o A two channeled fully digital BTE hearing aid suitable for moderate to

severe degree of hearing loss, with three programmable memories, AGC-I compression and output limiting.

Speech Material Recorded phonemically balanced bi-syllabic word lists on a CD, developed by Yathiraj and Vijayalakshmi (2005) were used. Four out of the eight lists in the test material were used. Each of the lists had 25 bi-syllabic words.

Procedure The testing was carried out in a two room sound treated environment. The procedure was as given below in three phases for each participant. They are: Phase I: Programming the participant‟s own hearing aid for three test conditions

Phase II: Measurement using subjective tests

Phase III: Measurement using objective tests

RESULT AND DISCUSSION:

The result indicated an improved performance in subjective measures with fine tuning settings compared to the other two conditions. These findings prove that fine tune programme provides better results when compared to NAL-NL1.

In all the three groups, i.e., moderate, moderately severe, and severe, P1 also showed equal or better thresholds than P2, though not statistically significant, for most of the frequencies (more so in the moderate and moderately severe groups), as can be noted.

This goes on to prove that participants in the study, even with no previous experience, preferred a hearing aid setting that provided them with improved thresholds when compared to the NAL-NL1 setting, except at 250 Hz and 500 Hz.

Results revealed no significant difference in SRS across the three programs, even at 0.05 level of significance, except for SRS in those with severe hearing loss. In this group, the SRS was significantly higher with P3 than with NAL-NL1.

This implied comparable speech recognition provided by the three program settings used in the experiment with all the three programs in groups with moderate and moderately-severe hearing loss.

This can also be attributed to „ceiling effect‟, i.e., the hearing aids had reached their optimum performance with the first program itself and hence no statistically significant improvement

was noted in SRS, though there were changes in aided threshold across programs. For the group with severe hearing loss, significant difference (at $p<0.05$).

Friedman‟s test was administered for the group of participants with severe hearing loss to examine if there was any significant difference in REIG at different frequencies. Significant difference was seen at 250 Hz and 8 kHz. Further, at 200 Hz, the Wilcoxon‟s test revealed a significant difference between the preferred setting (P1) and NAL-NL1 setting (P2).

Also significant difference between preferred setting (P1) and fine tune setting (P3). Similarly, at 8 kHz, significant differences were noted between P1 and P2, and also between P2 and P3.

The overall results of this study stand at odds with the study by Keidser and Dillon (2006), where they reported NAL-NL1 as being too loud for the first time hearing aid users. As can be noted from REIG and RESR results, the insertion gain as well the saturation response at the time of initial fitting, i.e., with P1, was greater than the gain prescribed by NAL-NL1 (P2), indicating an acceptance of greater loudness than that prescribed by the generic formula in question.

Though this difference cannot be proved statistically, which could be attributed to the lesser number of participants in the study, it is recommended that further research be carried out to confirm these results. However, current study gains support from the work of Arlinger, Lyregaard, Billemark, and Oberg (2000), where they found no correlation between preference and audiological variables.

Conclusion: The importance of follow up and fine tuning can be emphasized for obtaining greater benefit from the hearing aid. The information on the importance of fine tuning will be useful for hearing aid dispensing.