# DISCOURE IN PARKINSON'S DISEASE

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Reg. No. 12SLP015

A Masters Dissertation Submitted in part fulfillment of Final Year

Master of Science (Speech Language Pathology)

University of Mysore, Mysore

**ALL INDIA INSTITUTE OF SPEECH AND HEARING**

**MANASAGANGOTHRI, MYSORE-570006**

**May, 2014**

**CERTIFICATE**

This is to certify that the dissertation entitled "**Discourse in Parkinson's Disease"** is a bonafide work submitted in part fulfillment for the Degree of Master of Science (Speech Language Pathology) of the student (Registration no. 12SLP015). This has been carried out under the guidance of a faculty of this institute and has not been submitted earlier to any Universities for the award of any Degree or Diploma.

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# CERTIFICATE

This is to certify that the dissertation entitled **"Discourse in Parkinson's Disease"** has been prepared under my supervision and guidance. It is also certified that this has not been submitted earlier in other University for the award of any Degree or Diploma.

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## DECLARATION

This is to certify that this dissertation entitled "**Discourse in Parkinson's Disease"** is the result of my own study under the guidance of Dr. N. Swapna, Reader in Speech Pathology, All India Institute of Speech and Hearing, Mysore, and has not been submitted earlier in other University for the award of any Degree or Diploma.

Mysore **Register no:** 12SLP015

May, 2014

# ACKNOWLEDGEMENT

Look over the whole creation and the fabric that holds life together is Gratitude. To start with, I will remain forever indebted to the person who made this journey possible- The Director of AIISH, Dr. S. R Savithri

Another person who, having provided guidance all along has moulded me into the perfect brand ambassador of this Institute is my guide, Dr.N. Swapna. A big thank you to you, Ma'am.

I would be failing in my duties and customs if I did not thank my family- my mother and consoler, Geetha, my father Shridhara, my aunts, Veena and Lakshmi, my uncle, Radhakrishna and my darling sisters, Nidhi and Apoorva.

A good teacher can inspire hope, ignite the imagination and in still a love of learning. Hema Ma'am and Prema Ma'am has been one such guiding force throughout this course. Heartfelt thanks to you.

My interactions with the members of the *Basal Ganglia club* has given me a new perspective on Parkinson's disease for this I thank the all the members of this club.

Seniors are, in this course, those individuals who have been there, done that and are our co passengers with a good head start. I extend my gratitude to all my seniors, Amulya Di in particular. Thank you for being there!

With friends, life is tangier. My life has tasted sadness, frustration, and the joy that arises from friendship with people like Charu, Souji, Harsha,Shrikanth, Pragee, Appu, Juhi, Priya, Rida, Saryu, Srushti, Loui and a bunch of others. Thanks to all of you for being there!

Feeling gratitude and not expressing it is like wrapping a present and not giving it. Therefore, if I've left anyone out, I'd like to gift them my gratitude as well.

Thank you.

Nandita S Upadhyaya.

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# CHAPTER 1 - Introduction

Language can be viewed and studied in various ways among which ‘use of language’ is also one. Use of language requires a complex interplay of all the cognitive processes. Two of the effective ways to measure language in use is discourse analysis and pragmatic analysis. Pragmatic analysis uses a social approach to study language whereas discourse analysis aims to study and understand the use of language in terms of social and linguistic structures used by the speaker. It studies the context of use of language, use of mechanics of conversation like turn taking, topic initiation, relevance and maintenance, coherence of the topic, cohesion, information structure, clarification, conversation repair and use of prosody. It thus checks the grammaticality of an utterance with the socially appropriate use of it in a given context and with a given communication partner. Discourse analysis sheds light on how speakers create meaning by arranging chunks of information across a series of sentences and thereby indicate their semantic intentions and how the listeners interpret what they hear and respond to what has just been said (Johnstone, 2008). Thus discourse provides an in depth analysis of language in use and reflects the cognitive abilities that underlie human language use.

As highlighted above, language is a byproduct of cognition and subtle changes in any domain of cognition due to different neuropathological conditions can directly influence language and consequently lead to an improper language use. The occurrence of improper language use in several neurological conditions including Parkinson’s disease (PD) has been documented in the literature.

PD is a condition in which a progressive degeneration of dopaminergic cells of the substantia nigra of the basal ganglia leads to several motor, speech and language deficits (Middleton & Strick, 2000; Frank, 2005). The cardinal motor symptoms include bradykinesia, postural instability, rigidity, resting tremor and freezing (motor blocks). In conjunction to the above motor symptoms, they also exhibit non motor symptoms such as passivity, indecisiveness, fear and dependence, depression, cognitive disorders like dementia, sleep disorders, sensory symptoms and language deficits (Langston, 2006). Amongst the non motor symptoms, language deficits become particularly important to individuals with Parkinson's disease due its grave impact on functional communication. Language disorders are said to be associated with PD and often preclude the occurrence of motor symptoms by years (Hubble & Koller, 1995). Language deficits including impairment in comprehension and effective verbal expression (Grossman, Carvell, Stern, Gollomp & Hurtig, 1992; Owen, 2004), difficulty in naming, verbal fluency, sentence repetition, and auditory comprehension (Cummings, Darkins, Mendez, Hill, & Benson, 1988; Lewis, Lapointe, Murdoch, & Chenery, 1998; Beatty & Monson, 1998; Blonder, Gur, & Ruben, 1989) have been reported in persons with PD. Lewis, Lapointe, Murdoch, and Chenery (1998) described the subtle language impairment in subjects with PD on measures which were sensitive to frontal lobe language function.

Language is mediated through cognitive skills and there are studies which report of a deficit in cognitive skills such as psychomotor speed, memory, attention, visuospatial functions, language and executive functions like organization, reasoning, planning and problem solving **(**Graceffa, Carlesimo, Peppe, & Caltagirone, 1999; Grossman,1999; Sushma & Swapna, 2013**).** Since cognitive deficits are present and since language and cognition are interrelated, it is highly likely that language

functions are also impaired in persons with PD. The language dysfunction in PD has been demonstrated through several PET studies which revealed the activation of the thalamus and basal ganglia during completion of a language task such as picture naming (Price, Moore, Hymphreyas, Frackowiak, & Friston 1996a, cited in Murdoch, 2010) and word repetition (Price, Wise, Warburton, Moore, & Howard, 1996b). It has also been reported that the poor performance on execution of language tasks could be consequent to the dopamine deficiency in the basal ganglia which has an effect on the cortico-striatal-cortico information exchange (Bastiaanse & Leenders, 2009). Given the role of dopamine in cognitive function and the fact that language is mediated by cognitive skills, it is highly likely that the language function is also impaired in persons with PD.

A few reports in the literature indicate that discourse is one among the language domains that is severely affected in PD which in turn has a direct impact on the quality of life. Patients with PD exhibit significant impairment on measures of pragmatic communication abilities which included conversational appropriateness, speech acts, stylistics, gestures, and prosodics (McNamara & Durso, 2003). They also exhibit poor knowledge of the extent of their impairment. Evidence for unawareness of cognitive deficit and poor social communication has been previously reported in PD (McNamara, Obler, Au, Durso, & Albert, 1992; McNamara, & Durso, 2003). The poor awareness has been correlated as a frontal lobe deficit than a general cognitive decline. McNamara, Obler, Au, Durso, and Albert (1992) conducted discourse analysis in patients with PD and dementia due to Alzheimer's disease and found that patients with PD showed poor speech monitoring and were unaware of their conversational breakdown. They also made reduced attempts to correct conversational breakdown using repair strategies.

McNamara and Durso (2003) investigated the pragmatic functioning using a general conversational task with 20 individuals with idiopathic PD. They also examined the relation between pragmatic functions with measures of frontal lobe function by administering The (FAS) Verbal Fluency Test (Lezak, 1995) which used phoneme fluency task of generating as many words (proper names excluded) as they can beginning with the letter F within a minute. Then they were asked to do the same for A and S. Mini Mental State Exam (MMSE) (Folstein, Folstein, & McHugh, 1975) was also administered to measure the general cognitive status of the participants. Frontal lobe tests like the Stroop test and the Tower of London tests were also administered to check for divided and selective attention. The results of the study revealed that patients with PD reported positive pragmatic dysfunction with difficulties in conversational initiation, pause time between phrases, quantity/conciseness, feedback to speaker, speech intelligibility, and gestures and facial expressions. All the participants passed the MMSE scale thus indicating absence of a global cognitive deficit and ruling out its cause to the pragmatic dysfunction. All the PD patients showed affected scores on frontal lobe tests thus indicating a frontal lobe dysfunction. The investigators conclude that affected frontal lobe dysfunction can be a cause of pragmatic deficits in individuals with PD.

The phase two of the study aimed to test the effect of pragmatic dysfunction on the quality of life. It was also aimed to check the awareness of the pragmatic dysfunction among the individuals with PD. Eleven idiopathic PD individuals participated in the study. To measure self-awareness both individuals with PD and their spouses were asked rate themselves on specific pragmatic communication skills- the same skills assessed on the Prutting and Kirchner “Pragmatic Protocol” and the ratings were compared. Results revealed a clinically significant pragmatic

communication deficit in PD. With respect to the unawareness issue, patients consistently overestimated their communication abilities relative to spouse's ratings of these same abilities. Spousal-self rating differences were significant for speech acts, lexical selection, stylistics, and conversational appropriateness. The authors concluded that the poor awareness of the disorder lead to problems with communicating needs and desires and thus impairment in activities of daily living.

Hall, Ouyang, Lonnquisr, and Newcombe (2011) reported impaired pragmatic functioning in PD and have strongly correlated the dysfunction with the severity, mental state and the duration of the disease. PD scored significantly lower on eye contact, intonation, turn taking, response length, and conversation initiation on a pragmatic function scale.

Holtgraves and McNamara (2011) conducted a study to examine the extent to which people with PD comprehended specific speech acts. They conducted two experiments, were the first examined on-line speech act activation and the second used an off-line task to examine speech act recognition without a time constraint. Participants read scenarios addressing 8 assertive, 6 directives, 6 expressive, and 4 commissive speech acts and were asked to identify the presence or absence of the speech acts. The results indicated that the PD participants did not display on-line speech act activation. In the experiment two, speech act recognition was checked by asking the participants to read a scenario and corresponding remarks, and to then write down a single word that they believed described the action that the speaker was performing with the final remark. The results demonstrated a deficit in speech act recognition in PD that is independent of temporal constraints. That is, even without the time constraint, PD participants demonstrated a deficit in recognizing the speech acts performed with an utterance. They concluded that poor speech act recognition

and comprehension is seen in individuals with PD and is positively correlated with disease progression. The study attributed the comprehension deficits to reduction in executive functioning in PD.

Holtgraves, Fogle, and Marsh (2013) checked the degree of informativeness for a general conversation task in twenty individuals with PD. Language production measure was conducted through semi-structured interviews with each participant individually. The interviews consisted of questions regarding the interviewees' family, work history, daily activities, etc. for fifteen minutes. All interviews were recorded, transcribed for analyses and analyzed for informativeness and rated on a five-point coding scale. The results revealed that the participants with PD produced more utterances classified as under informative than the non-PD participants thus demonstrating reduced information content in the language of people with PD. They also correlated both speech act priming and utterance informativeness to a measure of executive control and concluded that the executive control deficits are related to the ability to both comprehend and produce conversational utterances.

In addition to the above, several researchers have also reported of deficits in contextual inferencing, humor appreciation, comprehending metaphors and lexical ambiguities and irony comprehension in persons with PD (Grossman, Crino, Reivich, Stern, & Hurtig, 1992; Bhat, Iyengar, & Chengappa, 2001; Copland, Chenery, & Murdoch, 2001; Berg, Bjornram, Hartelius, Laakso, & Johnels, 2003; Monetta, & Pell, 2007; Monetta, Grindrod, & Pell, 2008; Monetta, Grindrod, & Pell, 2009).

**Need for the study**

Affected discourse skills associated with poor self awareness of communication breakdown can hinder effective social communication in individuals with PD. Little research is focused on the discourse characteristics exhibited by this population and the social constraints they face during communication. Much less is known regarding the prevalence of the type and the extent of this dysfunction in this population. The literature also revealed that none of the studies have undertaken an in depth analysis of all the relevant discourse parameters. Further a grading of their severity has also not been carried out. In addition, no studies have addressed the changes in discourse skills, if any, across different stages of the condition although there are some studies that correlate the language dysfunction in general with the severity. Even in the Indian scenario, the research in this area is very scanty.

Discourse of an individual is highly influenced by the individual's language, ethnicity, region, social context and linguistic experiences (Johnstone, 2008). It is a well known fact that India has a variety of languages spoken in different dialects and has diverse social influences across regions. Due to this very reason it becomes essential and appealing to observe the influence of a specific language and dialect on discourse. Hence, there is a need to study discourse skills in persons with PD especially in the Indian context since western data cannot be generalized to the Indian languages as there are reports which state that there is a difference in the cognitive function across races. A study by Sosa, Albanese, and Prince in 2009 reported that the Chinese participants performed better and Indian participants worse, than those from Latin America in a task which included verbal fluency, word list memory (immediate recall) and recall tests. In another study by Dingman (1996), Caucasians scored significantly better than American Indian college students on verbal-sequential tests,

but not on visuospatial tests. Due to the paucity of work in this area, the present study was carried out to assess the discourse in persons with PD.

Further, it is reported that these deficits in PD may increase caregiver burden (Edwards & Scheetz, 2002), reduce quality of life (Global PD Steering Committee, 2002) and may compromise complex decision-making capacities around long term care. Considering this, it becomes imperative to study the discourse in persons with Parkinson's disease.

In addition, the changes in the quality of social interactions may predate the onset of overt extrapyramidal motor signs of PD by several years (Hubble & Koller, 1995) and often may go unnoticed. Hence the results of the study could throw light on the possible inclusion of the discourse skills in the assessment and treatment protocol of individuals with PD even in the early stages. Keeping this in view, the study was planned with the aim of studying the discourse skills in persons with PD.

**Aim of the study**

The aim of the study was to investigate the use of language in individuals with Parkinson's disease using discourse analysis. The specific objectives included the following:

1. To compare the discourse skills of individuals with idiopathic PD with a group of neuro-typical individuals.
2. To investigate the variation in discourse skills, if any, across early and middle stages of idiopathic PD.

## Implications

PD is known for the speech deficits it causes, however the language deficits have been studied only in the recent past. The results of the present study could provide an insight into the nature of discourse functioning in persons with PD. It would also provide data on the discourse skills in the different stages of the PD and help us track the change in nature of the disorder with severity of the discourse functioning, if any, thereby improving our understanding of the clinical picture of persons with PD. Further, quantifying the severity of discourse deficits, if any in different stages of idiopathic PD may also help in identifying the stage of the disease a particular individual is in. Knowledge of this aspect of language use in PD would help us in counseling the family members and early referral to support groups of the persons with PD.

# CHAPTER 2- Review of Literature

Parkinson's disease (PD) is a chronic and neurodegenerative condition characterized by progressive depletion of dopamine containing cells in the basal ganglia (Middleton & Strick, 2000; Frank, 2005). This results in dopamine depletion in striatal structures as well as in other areas of the brain. The basal ganglia are widely recognized as a network of nuclei supporting the planning and execution of movement. This condition is reflected in the form of disturbances in movements such as akinesia, bradykinesia, postural instability, rigidity and resting tremor. Slurred speech and other related speech problems are also seen which are referred to as hypokinetic dysarthria.

The reduction in dopaminergic cells can be caused due to various factors listed below. A classification based on the etiological factors was proposed by Fahn and Przedborski (2005) and Waters (2005). They grouped Parkinsonism into three major categories: *primary causes* (Idiopathic Parkinson Disease)*; secondary causes* (symptomatic Parkinson Disease)*;* and *Parkinson Disease plus syndromes.* According to them, the primary cause for Parkinson disease (PD) is unknown, i.e., *idiopathic* and it also includes sporadic disease and gene mutation cases which cause PD. The secondary causes include drugs (neuroleptic drugs), encephalitis, toxins (manganese, carbon monoxide, MPTP, cyanide), vascular insults, brain tumour, and head trauma. PD plus syndromes may be caused by a known gene defect and have distinctive pathology, which includes progressive supranuclear palsy, multiple system atrophy (pyramid and cerebellar type), dementia syndromes (Alzheimer's, normal pressure

hydrocephalous, frontotemporal dementia), and hereditary disorders that include Wilson disease and Huntington disease. The idiopathic PD is the most predominant disorder constituting 80% of the individuals with PD (Fahn & Przedborski, 2005).

**Course of PD**

The course of the PD can be subdivided into two distinct phases, the *presymptomatic* phase (early stage) where in the physiological changes have begun but no overt signs or symptoms of the disorder are observed and the *symptomatic* phase (middle to later stages) where the signs and symptoms are overt and the severity increases from the middle to later stages (Wolters et al., 2000; Del Tredici, Rüb, Vos RAI de., Bohl, & Braak, 2002; Braak et al., 2003a).

According to Braak and Braak (2000), the persons with PD pass through six neuropathological stages which can be divided under the two phases mentioned above. The presymptomatic stage includes the 1$^{st}$ and the 2$^{nd}$neuropathological stage of the PD where the pathology is confined to the medulla oblongata/pontine tegmentum and olfactory bulb/anterior olfactory nucleus. The symptomatic stage includes the 3$^{rd}$ stage to the 6$^{th}$ stage. In the 3$^{rd}$ and 4$^{th}$ stages the pathology initially extends to the substantia nigra and other nuclear greys, the midbrain and forebrain and then severe pathological changes occur. Most of the individuals at this stage cross the threshold point of the symptomatic phase of illness. Then the pathology extends to the mature neocortex and the disease manifests in its entire clinical dimension in the 5$^{th}$ and the 6$^{th}$ stages. Each of these stages is marked by the continuous development of spindle or thread like distinctive bodies called Lewy neuritis (LNs) within cellular processes and as granular aggregations or Lewy bodies (LBs) in the somata of the involved cell (Lowe, 1994; Takahashi & Wakabayashi, 2001; Apaydin, Ahlskog, Parisi, Boeve, & Dickson, 2002; Jellinger & Mizuno, 2003). Hence, as the pathology

gradually extends to different areas, the symptoms also progress, starting with motor symptoms in the initial stages to cognitive and language symptoms in the later stages. These symptoms also gradually increase in their severity as the disease progresses. Hence, PD is known to be a progressive neurodegenerative disorder.

Based on the progression of the disease, Hoehn and Yahr Scale (Hoehn & Yahr, 1967) was developed to gauge the severity of the disease. This scale was designed to provide a general estimate of clinical functioning in PD by combining functional deficits (disability) and objective signs (impairment). The scale was based on the two fold concepts that the severity of overall parkinsonian dysfunction relates to bilateral motor involvement and compromised balance/gait. Increasing parkinsonian motor impairment has been therefore charted from unilateral (Stage 1) to bilateral disease (Stage 2) without balance difficulties, to the presence of postural instability (Stage 3), loss of physical independence (Stage 4), and being wheelchair- or bed-bound (Stage 5). The above scale fails to consider the non motor symptoms associated with PD. Hoehn and Yahr motor staging of PD has been depicted in Table 1.1.

Table 1.1

*Motor Staging of PD by Hoehn and Yahr (1967).*

| Stage | Characteristics |
|---|---|
| 0 | Asymptomatic. |
| 1 | Unilateral involvement only. |
| 2 | Bilateral involvement without impairment of balance. |
| 3 | Mild to moderate involvement; some postural instability but physically independent; needs assistance to recover from pull test. |
| 4 | Severe disability; still able to walk or stand unassisted. |
| 5 | Wheelchair bound or bedridden unless aided. |

**Incidence and Prevalence of PD**

Epidemiological studies state that PD is the second most common neurodegenerative disorder in the developed countries. In the Western countries, in the past one decade, the prevalence of PD has increased. Rajput, Offord, Beard, and Kurland (1984) and Rocca, Bower, McDonnell, Peterson, and Maraganore (2001) reported incidences of approximately 16 to 19 per 100,000 per year. Dorsey et al. (2007) carried out a study estimating the growth in the number of individuals suffering from PD after 50 years of age from 2005-2030 in various countries like China, Brazil, US, Europe, India and others. According to them in 2005, overall around 4.1 to 4.6 million were suffering from PD and the number of individuals suffering from PD would double by 2030 (8.7-9.3 million).

The peak incidence of PD is between 70 and 79 years of age. The incidence continues to increase even in those of 80 years of age or older. The mean age of

symptom onset is around 60 to 65 years. The onset in men is often slightly earlier than in women and significantly greater incidence in men than women (ratio 1.5 to 2.0). The data of Marras and Tanner (2002) suggested that approximately 1 in every 200 individuals aged between 60-69 years and approximately 1 in every 100 individuals aged in 70's had PD in Western Europe and United States. Wirdefeldt et al. (2012) conducted an epidemiological review study and reported that males were affected more than females. They also found that the incidence of PD increased steeply after 60 years of age whereas reports of PD occurring below 40 years of age were less.

In India, PD was the third most commonest neurological disorder and movement disorder (86.5%) among the hospital based series of 2,34,021 new patients (Anand & Singh, 1993). Around 5-60% of total movement disorders constitute PD with variations in different geographical area (Razdan, Kaul, Motta, Kaul, & Bhatt, 1994; Das, & Sanyal, 1996; Gouri e-Devi, Gururaj, Satishchandra, & Subbakrishna, 1999). PD was observed to be more prevalent in rural areas (41/105) than in urban areas (14/105) and was more common in men than in women (Gouri e-Devi et al., 1999). In Bangalore, a study was carried out on elderly population (>60years), and it was found that around 24% of this population had parkinsonism, among which idiopathic PD was the most common (71%), followed by drug induced PD (2.5%), multiple system atrophy (2.5%), vascular parkinsonism (1.7%), progressive supranuclear palsy (0.8%) and unclassified (22%) (Ragothaman et al., 2006). Kadakol et al. (2012) who carried out an epidemiological study in PD in North Karnataka found out that men were more affected than women. Among the 557 subjects they had considered for their study, 191 were idiopathic, 359 were sporadic and 7 were familial. Urban population was affected more when compared to the rural population.

The onset of PD can be before 20 years of age (juvenile PD) or between 20-45 years (young PD) or after 45 years (idiopathic PD), but generally, the age of onset is peaked to sixth decade of life (Sanjay, 2012). The age specific rates increased from 28 in the fourth decade to 573 in the ninth decade (Das & Sanyal, 1996; Gouri e-Devi et al., 1999).

**Salient Characteristic Features of PD**

The onset of the features in PD is insidious in nature and can be broadly classified under two categories: motor symptoms and non-motor symptoms (Jankovic, 2008). The most salient motor features of PD are bradykinesia, rigidity, resting tremors, postural instability and freezing (Fahn, 1986, 1989). Bradykinesia is the unusual decrease in the amplitude and velocity of the movements which are voluntary in nature leading to loss of automatic movements as well as slowness of initiating a movement on command (DeLong, 1990). Bradykinesia is evident by mask like face, loss of spontaneous movements, drooling due to decreased rate of spontaneous swallowing, decreased eye blink, loss of spontaneous gesturing, small and slow handwriting (micrographia), loss of facial expression (hypomimia), difficulty with hand dexterity (for shaving, brushing of teeth etc), shuffling of gait with reduced hand swing and difficulty in getting up and out of a chair, car or bed (Jankovic, 2008; Theodoros & Ramig, 2011).

Rigidity refers to the unusual increase in the muscle tone resisting to the passive movements given in all directions and is manifested by a sudden “give” in the range of motion (cogwheel rigidity) (DeLong, 1990). This is caused due to the disinhibition of basal ganglia to the excessive cortical output (Adams & Victor, 1991) resulting in stooped posture at the neck and trunk level, loss of postural reflexes and

unsteadiness in gait, lack of balance (postural instability) with a tendency to fall (Adams & Jog, 2008). This combination of symptoms leads to a festinating gait with faster and faster small steps. (Theodoros & Ramig, 2011). This is usually manifested in the later stages of PD (Jankovic, 2008).

Resting tremors are unilateral in the early stages and bilateral later with a frequency of 4 to 6Hz involving the distal part of the extremities, lips, chin, jaw and legs which are caused due to the lesion in the thalamus (Fishman, 2008). The most common phenomenon is the pill rolling phenomenon which is the supination-pronation tremors of the distal parts of the extremities (Jankovic, 2008).

Freezing is a form of akinesia (Jankovic, 2008) and refers to the motor blocks (Fahn, 1986, 1989; Jankovic, 2008). This usually affects the lower limbs while walking but can also include arms and eyelids (Boghen, 1997). Freezing is manifested by hesitation or sudden inability to move in certain situations (Jankovic, 2008) leading to one of the major cause for frequent falls in individuals with PD (Bloem, Hausdorff, Visser, & Giladi, 2004). To diagnose an individual as having PD, at least two of the above salient features must be present. Among the two salient features, one of them has to be either tremor or rigidity (Theodoros & Ramig, 2011).

Consequent to the presence of the above symptoms i.e. rigidity, slowness of movement, reduced force and range of movement and rapid repetitive movements, speech disturbances occur in persons with PD. Darley, Aronson and Brown (1969) have termed the speech deficits associated with PD as “Hypokinetic Dysarthria”. The disease affects almost all the speech domains including respiration, phonation, resonance, articulation, and prosody, to varying degrees. The common abnormal speech characteristics include monopitch and monoloudness, reduced

stress/intonation, reduced loudness, imprecise consonants, inappropriate silences, a harsh and breathy voice, high or low pitch levels, variable speech rate (either too fast or too slow), short rushes of speech, repetition of phonemes, and difficulty with the initiation of speech (Darley et al., 1969a, 1969b). Although speech and voice changes, swallowing difficulty, shuffling gait and imbalance are common among majority of persons with PD, they are usually absent during the first year of the disease (Muller, Wenning, Verny, Mckee, Chaudhuri, Jellinger, & Litvan, 2001).

The non-motor symptoms include sleep disorders such as vivid dreams, sleep fragmentation, Rapid Eye Movement behaviour disorder, daytime drowsiness, restless legs syndrome; sensory symptoms such as anosmia, pain, parasthesia, pain (neck and shoulders) and ageusia(loss of taste fnctions in the tongue); psychological symptoms such as depression, apathy, fatigue, passivity, indecisiveness, fear and dependence and other behavioural and psychiatric problems; dysautonomia (constipation, urinary and sexual dysfunction, abnormal sweating, orthostatic hypotension, seborrhoea) and weight loss.

These non-motor symptoms vary from individual to individual and it has been well established that these symptoms are related to the severity of the disease (van Rooden, Visser, Verbaan, Marinus, & van Hilten, 2009b) and the duration of the disease (Steiger, Thompson & Marsden, 1996; Azuma, Cruz, Bayles, Tomoeda, & Montegomery, 2003). Martinez-Martin Schapira et al., (2007) administered non motor symptoms screening questionnaire (NMSQuest) on five hundred forty-five patients with PD. The NMSQuest is a self completed screening tool with 30 items designed to draw attention to the presence of nonmotor symptoms. The results indicated the most prevalent non motor symptom was the urinary domain (Constipation, bowel incontinence, bowel emptying incompletion) while depression/anxiety and

apathy/attention/memory were second and third most prevalent. Hallucinations/delusions were the dimension with the least frequency of symptoms. The study also indicated that the prevalence of the non motor symptoms increased with the exacerbation of the disease. Shulman, Taback, Bean, and Weiner (2001) also reported that many of these nonmotor symptoms are associated with advancing disability which fuels this cycle over the course of the illness. Majority of patients with PD have asymmetric symptoms and respond well to levodopa therapy for many years (Theodoros & Ramig, 2011).

The two other non motor symptoms reported are cognitive impairment and language deficits. Amongst the cognitive impairment the deficits in memory, executive functioning and attention are the most leading features. Cognitive disorders like dementia also often co-occurs with PD and is nearly universal in bed- bound individuals. Language deficits are also said to be associated with PD and often preclude the occurrence of motor symptoms by years.

**Language Deficits in Persons with PD**

Language deficits have been found to be associated with PD. These deficits become particularly important to individuals with PD due its grave impact on functional communication. Since three decades research efforts have focused on investigating the language problems in persons with PD. Language deficits including impairment in comprehension and effective verbal expression (Grossman, Carvell, Stern, Gollomp, & Hurtig, 1992; Owen, 2004), difficulty in naming, verbal fluency, sentence repetition and auditory comprehension (Blonder, Gur, & Ruben, 1989; Cummings, Darkins, Mendez, Hill, & Benson, 1988; Lewis, Lapointe, Murdoch, & Chenery, 1998; Beatty & Monson, 1998) have been reported in persons with PD. Lewis, Lapointe, Murdoch, and Chenery (1998) described the subtle language

impairment in subjects with PD on measures which were sensitive to frontal lobe language function.

The language dysfunction in PD has been demonstrated through several PET studies which revealed the activation of the thalamus and basal ganglia during completion of a language task such as picture naming (Price, Moore, Hymphreyas, Frackowiak, & Friston 1996a, cited in Murdoch, 2010) and word repetition (Price, Wise, Warburton, Moore, & Howard, 1996b). The poor performance on execution of language tasks could be consequent to the dopamine deficiency in the basal ganglia which has an effect on the cortico-striatal-cortico information exchange (Bastiaanse & Leenders, 2009).

Some of the studies which investigated the deficits in different language domains in individuals with PD have been described below:

***Semantics:*** Semantic knowledge was found to be impaired in persons with PD. Persons with PD report of difficulty in verbal generative naming tasks (tasks that require word generation on a specific rule). Zgaljardic, Borod, Foldi, and Mattis (2006) found an impairment in both category (list of animals) and phonemic (words beginning with letter‘t’) verbal fluency tasks. Persons with PD (non demented) have difficulty in creating categories and strategies, thus affecting their semantic language skills. Hough (2004) reported affected adjective generation task in PD due to ambiguous nature of adjective and reliance on contextual information to decode its meaning. She also reported that generative naming and adjective generation tasks were sensitive tools in early identification of cognitive-linguistic decline in PD.

Illes (1989) studied the persons with PD on certain language tasks. Open-ended, autobiographical questions were used as stimulus and samples obtained were

analyzed for different variables which included temporal, acoustic, syntactic, and lexical including words per minute, location of pauses, number of fluency disruptions of several types (non-word fillers, pauses, false starts, and word repetitions) per word, syntactic complexity, and proportion of open class words. She found that the PD groups did not vary from the control group on majority of the events. However the PD group showed more pauses and silent hesitations at the initiation of sentences and between main clauses and optional clauses than controls.

***Syntax:*** Complex linguistic constructions were also found to be impaired in persons with PD. Syntactic complexity of spontaneous speech deteriorates with the progression of the disease (Illes, Matter, Hanson, & Iritani, 1988).

Cummings, Darkins, Mendez, Hill, and Benson (1988) assessed the expressive language deficits in persons with PD. They considered three mild-to-moderate participants including persons with non demented PD, persons with demented PD and persons with dementia of the Alzheimer's type by examining the spontaneous speech samples. The results revealed that the persons *w*ith dementia of the Alzheimer type showed a decline in the percentage of syntactically correct sentences, reduced utterance length on language tasks than persons with PD. Non demented persons with PD had spared language with lower information content and less complex syntax compared to controls.

Grossman, Carvel, Goloomp, Stern, Vernon, and Hurtig (1991) reported syntactic comprehension and expression deficits in this population. They found grammatical complexity and semantic ambiguity to compromise sentence comprehension in nondemented PD but the result was found to be highly inconsistent across people and testing sessions.

On a written sentence generation task, Small, Lyons, and Kemper (1997) analyzed grammaticality, syntactic complexity, and information content of non demented PD, demented PD and a healthy control group. The results revealed that among the two PD groups, only the PD group with moderate dementia created shorter and grammatically less complex sentences with reduced information content compared to control group. However, no significant difference was found in sentence complexity or information content across control and non demented or mildly demented persons with PD.

Lewis, Lapointe, Murdoch, and Chenery (1998) investigated the cognitive and linguistic performance in 20 persons with PD, half with dementia, and 20 healthy age-matched adults using a battery of tasks, including the Boston Naming Test, the WORD test, Test of Language Competence, Word Fluency Test, and Dementia Rating Scale Tests. They assessed complex aspects of language, including the ability to identify synonyms and antonyms, incorporate specific words into grammatical sentences, define words, and interpret complex and figurative language. Compared to the healthy adults, those with PD performed worse on tests of complex language production, such as providing definitions for words and generating sentences that included specified target words. In addition, more severe dementia was associated with increasing impairment in picture naming, interpreting metaphors, processing ambiguous sentences, defining words, and generating sentences. Lewis et al. (1998) attributed the observed deficits in language use to cognitive impairment associated with frontal lobe dysfunction. The language tasks on which the PD group scored most poorly were those that required organization, planning, abstract thought, and integration of information, all functions associated with the frontal lobe.

Murray (2000) examined the spontaneous speech samples in persons with PD and compared the results with their cognitive profile (e.g., memory, attention, and lexical retrieval). They were asked to describe a picture verbally. He considered the variables like total number of utterances, grammaticality of sentences, syntactic complexity and informativeness. The results revealed that there was a significant difference between the disordered and control group on certain syntactic and informativeness measures of spoken language, while there were no significant differences between the disordered and control group in terms of the number of utterances they produced. There was also significant difference in terms of percentage of grammatical sentences between the PD and control group. With respect to syntax, PD produced a smaller proportion of grammatical sentences than the control group. In terms of informativeness measures, PD group showed smaller magnitude of correct information units (%CIUs) and informative utterances compared to age matched controls. Further, Murray correlated the language analysis with the cognitive profile and reported that utterance length and syntactic complexity is more if the persons with PD had better short term memory and better attention.

Conversational discourse was analyzed by Murray and Lenz (2001) in persons with PD and stated that syntax was not impaired in PD group. However, they found significant difference between length of utterances and sentence complexity in the PD group. The length of utterance and syntactic complexity was reduced in the PD group. The authors compared and contrasted this study with the previous study by Murray (2000) and concluded that persons with PD presented better performance in open ended tasks like conversation than in controlled tasks (e.g., picture description). The findings of Murray and Lenz lend support to the previous finding that syntactic complexity and sentence length are associated to cognition, especially the working

memory ability. Impairment in sentence production is also related to the abnormalities in the spread of activation within the semantic system. For instance, Copland, Chenery, and Murdoch (2000) and Copland (2003) concluded that persons with PD are impaired in inhibition of inappropriate meanings of words following long presentation intervals. In view of this, sentence production involves the selection of lexical items and sentence construction to fit in a non linguistically specified conceptual representation. This lack of ability to inhibit alternative word selection can interrupt the smooth flow of speech in PD.

Berg, Bjornram, Hartelius, Laakso, and Johnels (2003) assessed complex language production in 26 persons with PD and 26 control subjects with a test battery modelled after that used by Lewis et al. (1998). They tested sentence repetition, sentence production, and the ability to define words along with several receptive language tasks, using an instrument designed to test subtle impairments of complex language function in Swedish adults. Findings specific to complex language production were consistent with those of Lewis et al. (1998).

Accurate but slowed processing was found in non demented PD for sentences in which grammatical morphemes were omitted and when centre – embedded clauses were object- relative (non canonical sentences) rather than subject – relative (canonical sentences); (e.g., “The boy that hugged the girl is friendly” required more processing time than “The boy that the girl hugged is friendly”). This deficit is attributed to slower lexical retrieval and working memory (Angwin, Chenery, Copland, Murdoch, & Silburn, 2006).

The higher level language processes such as understanding metaphors and ambiguous sentences require inferencing and are challenging even for persons with

mild PD (Berg, Bjornram, Hartelius, Laakso, & Johnels, 2003). Several researchers have reported deficits in contextual inferencing, humor appreciation comprehending metaphors and lexical ambiguities and irony comprehension in persons with PD (Grossman, Crino, Reivich, Stern, & Hurtig, 1992; Bhat, Iyengar, & Chengappa, 2001; Copland, Chenery, & Murdoch, 2001; Berg, Bjornram, Hartelius, Laakso, & Johnels, 2003; Monetta, & Pell, 2007; Monetta, Grindrod, & Pell, 2008; Monetta, Grindrod, & Pell, 2009).

***Discourse and Pragmatics:*** There is neuropsychologic evidence which suggests that the neurocognitive systems thought to support pragmatic communication skills (Graceffa, Carlesimo, Peppe, & Caltagirone, 1999; Grossman, 1999; Zaidel, Kasher, Soroker, Batori, Giora, & Graves, 2000; Sushma & Swapna, 2013) are impaired in PD. These individuals exhibited significant impairment on measures of pragmatic communication abilities which include conversational appropriateness, speech acts, stylistics, gestures, and prosodics (McNamara & Durso, 2003). McNamara and Durso (2003) investigated the pragmatic functioning in 20 individuals with idiopathic PD. The study involved two phases. The phase one assessed the pragmatic communication abilities in patients with PD where the participants were asked to carry out a conversation with the investigator. The conversations were analyzed using "Pragmatic Protocol" (Prutting & Kirchner, 1987), a checklist of 30 general pragmatic abilities which are thought to be fundamental to social communication skills. It also aimed to examine the relation between pragmatic functions with measures of frontal lobe function. Here the participants were asked to carry out The (FAS) Verbal Fluency Test (Lezak, 1995) where they were asked to generate as many words (proper names excluded) as they can begin with the letter F within a minute. Then they were asked to do the same for A and S. Mean number of words produced across the three letter trials

was quantified. Mini Mental State Exam (MMSE) (Folstein, Folstein, & McHugh, 1975) was also administered to measure the general cognitive status of the participants. Frontal lobe tests like the Stroop test and the Tower of London tests were also administered to check for divided and selective attention. The results of the study revealed that PD patients reported positive pragmatic dysfunction with difficulties in conversational initiation, pause time between phrases, quantity/conciseness, feedback to speaker, speech intelligibility, and gestures and facial expressions. All the participants passed the MMSE scale thus indicating absence of a global cognitive deficit and ruling out its cause to the pragmatic dysfunction. All the PD patients showed affected scores on frontal lobe tests thus indicating a frontal lobe dysfunction. The investigators concluded that the affected frontal lobe dysfunction can be a cause of pragmatic deficits in individuals with PD.

The phase two of the study aimed to test the effect of pragmatic dysfunction on the quality of life. It was also aimed to check the awareness of the pragmatic dysfunction among the individuals with PD. Eleven idiopathic PD individuals participated in the study. To measure self-awareness both individuals with PD and their spouses were asked rate themselves on specific pragmatic communication skills- the same skills assessed on the Prutting and Kirchner “Pragmatic Protocol” and the ratings were compared. Results revealed a clinically significant pragmatic communication deficit in PD. With respect to the unawareness issue, patients consistently overestimated their communication abilities relative to spouse’s ratings of these same abilities. Spousal-self ratings differences were significant for speech acts, lexical selection, stylistics, and conversational appropriateness.

Holtgraves and McNamara (2011) conducted a study to examine the extent to which people with PD comprehended specific speech acts. They conducted two

experiments were the first experiment examined on-line speech act activation and the second experiment used an off-line task to examine speech act recognition without a time constraint. In the experiment one, participants read scenarios and subsequent utterances and then performed a lexical decision task. The scenarios were adapted from Holtgraves (2008) and consisted of a set of 48 scenarios (24 target scenarios and 24 filler scenarios). Each scenario (2-6sentences) addressing 8 assertive, 6 directives, 6 expressive, and 4 commissives speech act, described a situation between two people and was followed by a remark or remarks. The last remark was always the target utterance that either performed a specific speech act (speech act version) or did not perform that speech act (control version). Following the target utterance was a probe word naming the speech act performed with the target utterance (e.g., beg, brag, etc.). The participants were asked to indicate whether or not it was a word. The participants were analyzed on reaction time and accuracy of the response. Results indicated that the PD participants did not display on-line speech act activation i.e. their performance on the lexical decision task was independent of whether the prior utterance did (speech act version) or did not perform a speech act (control version).

In the experiment two, speech act recognition was checked by asking the participants to read a scenario and corresponding remarks, and to then write down a single word that they believed described the action that the speaker was performing with the final remark .There were no time constrains applied to this task. The participants' accuracy of rating was self evaluated using a seven point rating scale with 1 = Extremely Unconfident to 7 = Extremely Confident. The results of this experiment demonstrated a deficit in speech act recognition in PD that is independent of temporal constraints. That is, even without the time constraint, PD participants demonstrated a deficit in recognizing the speech acts performed with an utterance.

They concluded that poor speech act recognition and comprehension is seen in individuals with PD and is positively correlated with disease progression. The study attributed the comprehension deficits to reduction in executive functioning in PD.

Holtgraves, Fogle, and Marsh (2013) checked the degree of informativeness in PD for a general conversation task. Twenty individuals with Parkinson's disease constituted the experimental group and 20 individuals as control group. Language production measure was conducted through semi-structured interviews with each participant individually. The interviews consisted of questions regarding the interviewees' family, work history, daily activities, etc. for fifteen minutes. All interviews were recorded and transcribed for analyses. Analysis was done using a five-point coding scale for informativeness which was later collapsed to a three-point scale (under-informative; i.e., too little information provided; over-informative; i.e., too much information provided; appropriate level of information). The results revealed that the participants with PD produced more utterances classified as under informative than the non-PD participants thus demonstrating reduced information content in the language of people with PD. They noted the deficit to be evident during a naturally occurring verbal interaction rather than with a laboratory task. For the PD participants, this deficit occurred due to the inability to recognize others' speech acts, i.e. it was difficult to generate meaningful contributions to a conversation without understanding the intent and presupposition skills of the conversation partner. Finally they correlated both speech act priming and utterance informativeness to a measure of executive control. They concluded that the executive control deficits are related to the ability to both comprehend and produce conversational utterances.

Persons with PD also exhibited poor knowledge of the extent of their impairment. Evidence for unawareness of cognitive deficit and poor social

communication has been previously reported in PD (McNamara, Obler, Au, Durso, & Albert, 1992; McNamara, & Durso, 2003). The poor awareness has been correlated as a frontal lobe deficit than a general cognitive decline. McNamara, Obler, Au, Durso, and Albert (1992) conducted discourse analysis in patients with PD and dementia due to Alzheimer's disease and found that patients with PD showed poor speech monitoring and were unaware of their conversational breakdown. They also made reduced attempts to correct conversational breakdown using repair strategies.

Literature reports the 'use of language' to be affected in PD thus having a direct impact on the quality of life (Grossman, Crino, Reivich, Stern, & Hurtig, 1992; McNamara, Obler, Au, Durso, & Albert, 1992; Bhat, Iyengar, & Chengappa, 2001; Copland, Chenery, & Murdoch, 2001; Berg, Bjornram, Hartelius, Laakso, & Johnels, 2003; McNamara & Durso, 2003; Monetta, & Pell, 2007; Monetta, Grindrod, & Pell, 2008; Monetta, Grindrod, & Pell, 2009; Hall, Ouyang, Lonnquisr, & Newcombe, 2011; Holtgraves & McNamara, 2011; Holtgraves, Fogle, & Marsh, 2013).

**Influence of Severity of the Disease on Language Deficits**

A few studies also have investigated the variation in language deficits with severity. Lieberman, Kako, Friedman, Tajchman, Feldman, and Jiminez, (1992) tested forty patients with idiopathic PD to assess speech production, syntax comprehension, and cognitive deficits. A group of 20 moderate patients in stage III in the age range of 56 to 81 years and the 20 mild patients in stage I-II in the age range of 45 to 72 years were selected. The test battery included psychological tests such as The selective reminding test, the Odd man out, the New dot, Digit span-The digits forward and digits backwards, the Verbal fluency test and Syntax test: Rhode Island Test of Sentence Comprehension (Engen & Engen, 1983). The results showed that the

moderate group had higher error rates and longer response times than the mild group in the syntax test.

Illes, Metter, Hanson, and Iritani (1988) collected speech samples from individuals with mild-to-moderate PD. They examined speech rate, fluency, syntactic complexity, lexical production, and the relative distribution of content and grammatical phrases while reading the Grandfather passage and generating spontaneous speech. The results revealed that people with mild PD produced longer sentences than the age matched healthy control group because of the tendency to list numerous events within a single sentence that leads to a better proportion of content word phrases (i.e., noun, verb, and adjective phrases). However the moderately impaired PD group demonstrated sentences with less syntactic complexity and reduced sentence length with a relative increase in the production of filled hesitations when compared to mild PD.

Hall, Ouyang, Lonnquisr, and Newcombe (2011) reported impaired pragmatic functioning in PD and have strongly correlated the dysfunction with the severity, mental state and the duration of the disease. PD scored significantly lower on eye contact, intonation, turn taking, response length, and conversation initiation on a pragmatic function scale.

**Pragmatics as a function of cognition**

Language is commonly said to be a function of cognition. It is true to say that for language functions to be realized a strong cognitive framework is essential. Various cognitive and linguistic functions hold an obscure relationship and are very difficult to isolate one from another, for this reason a concept of cognitive – linguistic interaction was proposed (Hema & Shyamala, 2008). Closely controlled process such

as attention and various forms of memory are coordinated during comprehension of language. Various cognitive processes involved in language comprehension and production are working memory, attention and executive functions (Hema & Shyamala 2008).

Language deficits observed are a direct result of cognitive dysfunction in PD. Working memory, information processing speed, shifting attention, and coordination of several cognitive processes are all involved in normal sentence comprehension, and are affected in persons with PD (Graceffa, Carlesimo, Peppe, & Caltagirone, 1999; Grossman,1999). Lewis et al. (1998) tested PD with and without dementia with age-matched controls on tests of complex language production. Results revealed that compared to the healthy controls, PD performed worse. They concluded that frontal lobe dysfunction is associated with the observed deficits in language use which is related to the cognitive impairment.

Various other cognitive functions such as psychomotor speed, memory, attention, visuospatial functions, language and executive functions like organization, reasoning, planning and problem solving are found to be affected in persons with PD. A study was carried out in the Indian context by Sushma and Swapna (2013) who studied cognitive- linguistic functioning in nineteen Kannada speaking idiopathic PD and checked its variance across different stages of the disease i.e., stage I, II and III on Hoehn and Yahr stages for PD. The study used Cognitive-Linguistic Quick Test in Kannada (Vandana & Shyamala, 2011) to assess cognitive-linguistic processes i.e., attention, memory, executive function, visuospatial skills and language. The results of the study showed affected performance of individuals with PD on symbol cancellation, clock drawing, storytelling, design memory and design generation, implying a decline in the cognitive processes of attention, executive function,

visuospatial function and language. The study also indicated deterioration in cognitive functioning with advancement of disease. The results indicated that language is significantly affected from stage II, whereas, executive functioning, visuospatial skills and attention are affected significantly from stage I.

Researchers have correlated pragmatics as a function of cognition, specifically a frontal lobe function. McKinlay, Dalrymple-Alford, and Grace (2009) significantly correlated cognition with pragmatic functioning. Verbal working memory and processing speed, which are both frontal lobe functions are noted to be important aspects of cognition for the pragmatic functioning. They suggested that processing speed was a stronger determiner of pragmatic language performance than working memory. This conclusion was strengthened by fMRI findings (Gallagher, Happe, Brunswick, Fletcher, Frith, & Frith, 2000) that the understanding of metaphor in a joke scenario activates the medial prefrontal cortex, which is known to be involved in Theory of Mind tasks. McNamara and Holtgraves (2010) reported that frontostriatal systems are likely to contribute to normal speech act comprehension.

**Causes of Cognitive and Language Impairment in PD**

Alexander and colleagues have broadly classified basal ganglia thalamocortical circuits into motor and non motor or complex circuits (Alexander, Crutcher, & DeLong, 1990). The non motor circuits are composed of three major circuits all originating from the three areas of prefrontal cortex viz. dorsolateral prefrontal cortex, anterior cingulated cortex and orbitofrontal cortex. Each of these circuits follows similar projection topography of motor circuits i.e. they enter the basal ganglia circuit through striatum in basal ganglia and leave through the thalamus to looping back to their respectable cortical origin. All the pathways remain segregated throughout their projection. They receive inputs from multiple

neurotransmitter cell groups like dopaminergic, noradrenergic, serotonergic, and cholinergic cells (Tekin & Cummings, 2002). Cortico-striato-cortical circuits are involved in aspects of behavior that include motor control, learning, reasoning, planning, dual-task performance, obsessive–compulsive disorder, and mood (Lieberman, 2000, 2002). These circuits that link the basal ganglia with prefrontal cortex are also involved in regulating speech production and sentence comprehension. Several studies have shown that the dorsolateral caudate nucleus - Prefrontal Connection has a role in divided attention and monitoring of information within working memory (Levy, Goldman-Rakic, 2000, Petrides, 2002; Kostopoulos & Petrides, 2003; Wagner, Rihs, Mosimann, Fisch, & Schlaepfer, 2006). However the ventrolateral caudate nucleus - Prefrontal Connections appears to have a specific role in memory retrieval (Petrides, 2002; Kostopoulos & Petrides, 2003).

In PD, a neurochemical imbalance is created by reduced dopamine levels among the other neurotransmitters. The dopamine levels in the ventral striatum and frontal lobes of patients with PD were approximately 40% of normal dopamine levels (Javoy-Agid & Agid, 1980; Scatton, Javoy-Agid, Rouquier, Dubois, & Agid, 1983; Shinotoh & Calne, 1995). This causes a dysregulation among the prefrontal circuits. Dysregulation of prefrontal circuits are thought to be the underlying cause of cognitive and language changes in PD, particularly the poor performance of verbal fluency (De Gaspar, Siri, Di Gioia,, Antonini, Isella, & Pizzolato, 2006; Troster, Wood, & Fields, 2003). Scatton, Javoy-Agid, Rouquier, Dubois, and Agid (1983) have shown that patients with PD performed poorly on cognitive tests sensitive to frontal lobe suggesting dopamine to be associated with frontal lobe cognitive functions in PD.

Rinne, Portin, Ruottinen, Nurmi, Bergan, Haaparanta, and Solin (2000) studied the Fluorodopa uptake in the putamen, caudate nucleus and frontal cortex in PD and healthy controls using Fluorodopa position emission tomography. The uptake was further correlated with performance in the digit span (backward), verbal fluency, verbal immediate recall tests. Results indicated a positive correlation between performance in immediate and working memory and executive strategies and poor Fluorodopa uptake in the frontal cortex in PD.

Leha, Ptito, Chakravarty, and Strafella (2007) using Diffusion Tensor Imaging (DTI) Tractography have identified connections between the prefrontal lobe and the caudate nucleus and state that these prefrontal connections may represent the anatomical substrate underlying some of the symptoms associated with neurological conditions like Parkinson's disease involving basal ganglia and prefrontal cortex where executive dysfunctions have been associated with an impairment of these pathways (Monchi, Petrides, Doyon, Postuma, Parnetti, & Calabresi, 2006).

Given the role of dopamine in cognitive function and the fact that language is mediated by cognitive skills, it is highly likely that the language function is also impaired in persons with PD. It is now well accepted that cognitive decline in PD is the result of dysfunction in prefrontal non motor cortical areas (McNamara & Holtgraves, 2010).

**Impact of Aging on Language functions in the Neuro-typical Population**

Aging has a direct impact on the cognition in older adults and due to which there is a decline in the language functions such as language comprehension and production in them. Studies on language comprehension have consistently concluded that conceptual representations underlying the meaning of language at the word,

sentence or discourse level are well preserved during adulthood. Researchers have reported that older adults have richer semantic representations than young adults (Ackerman & Rolfhus, 1999; Beier & Ackerman, 2001). However, there is age-related decline in terms of speed of semantic retrieval. Under syntactic comprehension, older individuals perform better in online comprehension tasks such as comprehension of sentences measured in real than offline tasks that require individuals to answer questions about a text after it is real time (e.g., Kemper & Sumner, 2001; Van der Linden et al., 1999).

***Language production***

Kepner, Herman, and Lian (2005) studied age difference in sentence production task. Language production was studied in two experiments under controlled conditions. In the experiment 1, young and older adults were given two, three, or four words and were asked to compose a sentence using them. It was observed that older adults' responses were similar to those of young adults when given two or three words were given. However, when given four words were given, the older adults made more errors and their responses were shorter and less elaborate than the responses of the young adults. In the experiment 2, simple intransitive verbs (smiled), transitive verbs (replaced), and complement-taking verbs (expected) were contrasted and presented to the participants. The responses of older adults in this experiment were similar to those of young adults given intransitive and transitive verbs. Using these verbs, young adults produced complex sentences, whereas the older adults produced simpler, less complex sentences. It was also noted that the older adults made many errors than the younger adults, thus indicating a reduction in the syntactic complexity in the utterances of older adults.

Kemper (1999) studied longitudinal changes in linguistic ability in both neuro-typical older adults and older adults with dementia. Language measures were carried annually from neuro-typical older adults and semi-annually from older adults with dementia using language samples, vocabulary scores and digit spans. The language samples were scored for grammatical complexity and semantic content. The results showed that for the neuro-typical group, an age-related decline in grammatical complexity was observed. The decline was most rapid during the mid-70s. A similar pattern of decline in semantic content was also noted however the decline in this parameter was relatively less during the mid-70s than that for grammatical complexity.

Several studies show discourse production to be varying with age. Older individuals tend to exhibit poorer discourse production in terms of topic maintenance and topic coherence. Cooper (1989) studied changes in language as a function of the normal aging process in eighty adults between the ages of 20 and 78 using a picture description task. The results indicated an increased use of prepositional phrases and indefinite words and longer pauses among older persons. The investigator attributed indefinite wording to reflect word-finding or naming difficulty, and longer pauses to reflect cognitive slowing.

Glosser and Deser (1991) assessed discourse productions in middle-aged and elderly healthy subjects during an informal conversation task and found no significant age differences on microlinguistic measures such as syntactic complexity and syntactic and lexical production errors, use of lexical cohesive ties, such as anaphora. Older subjects, however, obtained significantly lower ratings on a macrolinguistic measure of global thematic coherence. Elderly subjects failed to maintain coherent reference to the general topic of discourse, although they preserved coherent meaning

relationships between contiguous utterances. Thus the results are compatible with the view that age-related performance declines on language tasks primarily reflect changes in macrolinguistic abilities that require integration of linguistic and non linguistic cognitive processes, rather than changes in language-specific cognitive processes.

Arbuckle and Pushkar Gold (1993) examined discourse of neuro-typical individuals of age range 60 to 95-year through an interview task and reported that the older adults produced more speech that was off the topic. This off-topic verbosity (OTV) was also found to increase with aging and was attributed to the inability of the participants to inhibit irrelevant information.

Dysfluencies are another common type of speech error that interrupt the flow of speech in aging adults. They are said to indicate word retrieval deficit. Kemper, Rash, Kynette, and Norman (1990) conducted a picture description task and found that older adults produced more lexical fillers (e.g., *you know*), non-lexical fillers (e.g., *um*), word repetitions (e.g., just on the left left side), lengthy pauses and empty words than young adults. These dysfluencies have been interpreted as devices to secure more time for word finding.

The above language deficits can be attributed to cognitive decline in older adults. Cognition in adults is described using theories such as resource theories, transmission deficits theory, and inhibition deficits theory. Resource theory explains age declines in performance by postulating that older adults have reduced and insufficient resources such as reduced processing speed, working memory, attention, and inhibition compared to young adults (Murphy, Craik, & Schneider, 2000). It is proposed that older adults suffer reductions in working memory capacity and this

constrains their ability to comprehend and produce complex semantic content and complex syntax (Kemper & Kempter, 1999).

Transmission deficit theory is based on a model with connectionist architecture (MacKay, 1987). It theorizes that connections among representational units in the network are strengthened by frequent and recent use and are weakened by aging. The strength among the connection weakens causing inadequate to activate connected representations leading to general processing deficits (Burke & MacKay, 1997).

Inhibition deficit theory stated that aging weakens inhibitory processes that regulate attention and the contents of working memory, leading to deficits in a broad range of cognitive performance such as comprehension and production of language (Hasher & Zacks, 1988). Inhibition deficit theory is able to explain several language processing and production issues in adults such as why older adults' performance suffers more from distracting stimuli during reading (Connelly, Hasher, & Zacks,1991) or listening (Tun, O'Kane, & Wingfield, 2002), and why older adults' conversations are more likely to go off topic (e.g., Arbuckle, Nohara-LeClair, & Pushkar, 2000).

**Analysis of language in use**

Common methods of studying language's relation to the context, text and its function are though discourse analysis and pragmatic analysis. Discourse analysis is a general term for a number of approaches to analyzing written, vocal, or sign language use or any significant semiotic event. Discourse can be defined broadly as language in use "in the large" or extended activities that are carried out via language (Clark, 1994). Pragmatic analysis is the analysis of all aspects of linguistic behaviours such as

linguistic functions, patterns of linguistic action, frames of knowledge, attitude, and belief, as well as discourse. It is the study of language in use (Bardovi-Harling, 2010).

Both pragmatics and discourse analysis study language use through different viewpoints. Pragmatic approach uses a socio-cultural perspective of analysis where, it analyses only the use of unspoken rules of maxims such as politeness, loyalty, apology etc, which are followed by the speakers in order to cooperate and be socially acceptable to each other. On the other hand, discourse analysis emphasizes on sociolinguistic perspective of analysis. Socio-linguistic analysis involves how social interactions have an impact on structuring linguistic framework of discourse, for example, influence of one speaker's expression on the other speaker's response. It not only understands the pragmatic use of language but also the linguistic structures used to emphasize the social use. On the whole, it looks at grammar, social structure and cultural patterns used by the individual. Discourse performs the following functions:

**Background knowledge:** Discourse analysis checks on the use of assumed background knowledge of the topic of conversation, cultural knowledge, general knowledge on areas of life, interpersonal knowledge like specific and possible knowledge about the history of the speakers themselves. This information plays a vital role in understanding the meaning of a word. The speaker's meaning is dependent on the assumption of knowledge that is shared by both the speaker and the listener. The speaker constructs the linguistic message and intents a meaning, and the listener interprets the message and infers the meaning (Brown & Yule, 1983; Thomas, 1995; Yule, 1996; Stilwell Peccei, 1999).

**Context**: This includes the study of meaning of words in context which can be obtained by analyzing the parts of meaning. It can be explained by the knowledge of

physical, social, and psychosocial factors influencing communication as well as the time and place in which the words are uttered or written.

Discourse analysis also checks on the use of situational context, which can communicate more information than just the use of words. For example use of gestures to communicate, e.g., “It’s this big a wound” with “this big” associated with a gesture to indicate big.

Discourse analysis also checks the text- Co-textual context. It is the context of the text itself, e.g., “Rama and Hari went walking. They had a long walk.” The use of ‘they’ to refer back to Hari and Rama who were already mentioned earlier in the text. The interlocutors assume that everyone in the conversation has enough knowledge of what they have been saying, and is able to infer who the ‘they’ include.

**Referencing:** The act of using language to refer to an entity in the context is known as reference. The speaker uses linguistic forms known as referring expressions, to enable the listener to identify the entity being referred to, which is in turn known as the referent. Deixis are words that point to the entity to be referred to. For example – I, you they etc. Deixis can take meaning from the inside and outside the context. There are three types of deixis: person, place and time.

1. Person deixis: The use of expressions to point to a person, with the personal pronouns ‘I’, ’you’, ‘he’.
2. Spatial or place deixis: This indicates the place/ location of the entity in the context. Demonstrative adverbs such as ‘there’, ‘here’, the demonstrative adjectives and pronouns ‘this’, ‘that’, ‘these’ and ‘those’ are used.
3. Time deixis: They are expressions used to point to a time as in ‘next day’, ‘then’ and ‘now’.

The referents can be placed within and outside the context. Exophoric reference is when the referencing expression is the first mention of the referent i.e. there is no previous mention of the reference in the preceding text. Exophora is dependent on the context outside the text, either in the situation or the background information.

**Coherence**: Discourse analysis functions to study the use of language. It checks how language is constructed by the speaker to become meaningful and unified in other words, coherent or relevant to the listener. Coherence is established by the use of cotexting, referencing and their relation using endophoric reference.

There are two types of endophora. The deixis that links the referent that has occurred before in the conversation are called anaphora and the other, cataphora is the opposite, the deixis that links forward of a referent that occurs later in the conversation.

**Function:** Discourse analysis helps to understand the intent of communication. This function is best explained using the speech acts theory. Speech acts consists of three major facets:

I. Locutionary act: The production of a meaningful linguistic production.
II. Illocutionary act: The action intended to be performed by a speaker in uttering a particular linguistic expression, explicitly or implicitly.
III. Perlocutionary act: The beginning about of the consequence through the uttering of a linguistic expression, such consequence or effects being special to the circumstances of the utterance.

Speech act comprehension is considered the core component of pragmatic competence as it is the listener’s ability to recognize and identify a speaker's intention. Many theorists have stated that intention recognition is the basis of

successful communication. Hence, identifying the intentions that others implement with their utterances is a critical component of successful language use.

**Social use:** Discourse analysis checks the influence of social transactions on the construction of discourse, influence of speaker's response on the conversation structure or what one speaker says can influence the next speaker's response. It checks social use of language through conversational interaction. Conversation is an activity which involves people taking turns. In these turns at speaking one has to pick up the completion point to take his/her turn to speak. This is conversational interaction. During the discourse we are not only are taking part in conversation but we are also analyzing the discourse simultaneously, so in the conversation turn taking helps us to successfully complete the discourse.

**Means of Discourse Analysis**

Discourse analysis can be divided into analysis at the microlinguistic level and macrolinguistic levels. Microlinguistic level of analysis includes the processing of phonological, lexical-semantic and syntactic aspects of sentences where syntactic complexity is measured. At macrolinguistic level, the ability to maintain conceptual, semantic and pragmatic organization at the suprasentential level is analyzed. The common methods of discourse analysis include:

Procedural discourse analysis: This method involves describing the procedures involved in carrying out an activity.

Expository discourse analysis: This method involves conveying information on a particular topic by a single speaker.

Narrative discourse analysis: This method includes a description of events.

Conversational discourse analysis: It focuses on a fine grained analysis of conversational discourse which involves process by which language is used to convey information. For example, how people reply to a spoken invitation or the use of a specific word or phrase, how speakers and listeners interact to convey information, exchange ideas, thoughts and feelings. Conversational discourse is argued to have a greater validity to real life scenarios because of which, it is one of the most common methods of discourse analysis. Conversation analysis uses both quantitative and qualitative methods of analysis. The qualitative method of discourse analysis for conversational discourse includes analysis through propositional and non propositional aspects of discourse. Propositional aspects of communication look for the presence of notion of relevancy, clarity of reference and coherence. It deals with the organization of discourse with respect to overall plan, theme or topic and how individual utterances are conceptually linked to maintain unity (Hartly, 1995). It includes discourse structure, communication intent, coherence, topic management, information adequacy, information content, message accuracy, vocabulary specificity, linguistic fluency, speech style, intonation, gaze efficiency, and response time. Non propositional aspects of communication analyses behaviors that reflect the reciprocal nature of conversation and joint co-operation required of the participant (McTear, 1985). It includes turn taking, conversational repair and revision behaviors.

To sum, a look into the literature revealed that studies on analyzing the discourse skills are limited in individuals with PD. The studies that have been conducted reported that discourse skills are affected in persons with PD, especially the conversational appropriateness, speech acts, stylistics, gestures, and prosodics. They scored lower on eye contact, intonation, turn taking, response length, and conversation initiation, and speech act recognition. They also reported that persons

with PD exhibited poor speech monitoring, were unaware of their conversational breakdown and made reduced attempts to correct conversational breakdown using repair strategies. The affected discourse skills and poor awareness of communication breakdown together pose a great threat to social communication skills in persons with PD. Further, much less is known regarding the type and the extent of discourse function in this population. No such studies have also been carried out in the Indian context. In addition, no studies have addressed the changes in discourse skills, if any, across different stages of the condition. Due to the paucity of work in this area, the present research has been planned to check the discourse in persons with PD. In addition, it is reported that pragmatic deficits in PD may increase caregiver burden (Edwards & Scheetz, 2002), reduce quality of life (Global PD Steering Committee, 2002) and may compromise complex decision-making capacities around long term care. Considering this, it becomes imperative to study the discourse in persons with PD. Consequently the present study aimed to study the use of language in individuals with PD using discourse analysis.

# CHAPTER 3 – Method

The present study was conducted to investigate the use of language in individuals with Parkinson's disease using discourse analysis. The specific objectives were to compare the discourse skills of individuals with idiopathic PD with a group of neuro-typical individuals and to investigate the variation in discourse skills, if any, across early and middle stages of idiopathic PD. The following method was adopted to investigate discourse:

## Participants

A total of ten individuals (9 males and 1 female) diagnosed with idiopathic PD in the age range of 60-85 years with native language Kannada (Mysore dialect) constituted the clinical group. The participants were considered based on the clinical diagnosis made by an experienced neurologist. They were further classified into early (inclusive of stage 1 and 2 in Hoehn & Yahr Staging) and middle stage (inclusive of stage 3 and 4 in Hoehn & Yahr Staging) of idiopathic PD based on the Hoehn and Yahr staging (1967) and a checklist to identify the stage of idiopathic PD based on speech, motor, and swallowing problems (Amulya & Swapna, 2012). The early stage PD subgroup consisted of 6 participants and middle stage PD subgroup consisted of 4 participants. The details of the participants have been provided in the table 3.1 below.

Table 3.1:

*Details of Participants in the Clinical group*

| Sl. No. | Age (years) | Gender | Duration of PD | Stage |
|---|---|---|---|---|
| 1 | 70 | M | 5 years | Early |
| 2 | 68 | M | 6 years | Early |
| 3 | 74 | M | 2 years | Early |
| 4 | 79 | M | 3 years | Early |
| 5 | 76 | M | 2 Years | Early |
| 6 | 70 | M | 2 years | Early |
| 7 | 80 | M | 7 years | Middle |
| 8 | 79 | F | 13 years | Middle |
| 9 | 77 | M | 6 years | Middle |
| 10 | 65 | M | 6 years | Middle |

**Inclusion criteria**

The following criteria were used to select the participants in the clinical group:

1. No history of encephalopathy/intake of neuroleptic drugs/exposure to toxins/vascular insults/brain tumour/head trauma.
2. No history of stroke/multiple system atrophy/progressive supranuclear palsy/dementia syndromes/hereditary disorders, which could co-occur with PD.
3. Absence of cognitive or language impairment which was ensured using MMSE (Folstein, Folstein, & McHugh, 1975). Individuals with a score more than 26 were included (Dubois et al., 2007).

4. Absence of visual or auditory deficits, which was ruled out by an informal assessment.
5. Absence of psychological issues such as depression, apathy etc. which was ensured using a 5 point rating scale from Movement Disorder Society - Unified Parkinson's disease rating score (MDS-UPDRS) (Goetz, Fahn, Martinez-Martin, Poewe, Sampio, Stebbins, & LaPelle, 2007).
6. Minimum education of up to SSLC.
7. Not enrolled in a speech therapy program.
8. Fair intelligibility of speech.
9. Under medication for PD.

Thirteen neuro-typical individuals matched on age, gender, education, socio-economic status, language, dialect and knowledge of other languages were selected to form the control group. The individuals in this group had no history of neurological disease or psychological illness and no history of cognitive, communicative and sensory deficits. This was ruled out through an informal assessment.

All the participants were matched on the socioeconomic status using NIMH-SES scale developed by Venkatesan (2009). The scale has sections on occupation and education of the parents, annual family income, property, and per capita income to assess the socioeconomic status of the participants. They were also matched on the knowledge of the second language using International Second Language Proficiency Rating (ISLPR) scale (Ingram, 1985a).

***Material used***

Discourse Analysis Scale for conversation task developed by Hema and Shyamala (2008) was used to assess the conversation task. A copy of the same has been included in the Appendix. The scale consists of conversation parameters

categorized under propositional and non-propositional aspects of discourse. The former includes the way in which discourse is organized with respect to overall plan, theme or topic and how individual utterances are conceptually linked to maintain unity and the later deals with the important categories of social communication behavior. The scale checks for the presence of behaviors that reflect the reciprocal nature of conversation and the joint co-operation required from the participants while carrying out a conversational discourse. This is a perceptual rating scale was formed on the basis of standardized Damico's Clinical Discourse Analysis scale (Damico, 1985) and Grice's Cooperative Principles for conversation (Grice, 1975), for differentiating discourse abilities between the groups of individuals with TBI and healthy talkers.

**The propositional parameters include**

**Discourse structure (DS):** It refers to the overall plan, theme or topic of utterance and how individual's utterances are linked to them. It is checked in terms of discourse organization and discourse forethought.

**Communication intent:** Communication intent evaluates the presence of behaviours such as greeting others and introducing self, starting a conversation, asking for information, asking for assistance in understanding conversation, criticizing the conversation by agreeing or disagreeing to a part in the conversation and understanding the advancers and blockers of communication.

**Coherence:** This parameter checks for the presence of good relationship between the meaning and context of verbalization with respect to both general topic of conversation (global coherence) and immediately preceding utterance produced by either the conversational partner or self (local coherence).

**Topic management:** Topic management is a process where a subject is constructed by the inputs from the conversational partners through series of turns. This section checks for the presence of behaviours such as introducing a topic, topic shift, topic changes, perseveration of topics, responses which expand the topic, use of minimal responses and minimal or excessive elaboration of topic.

**Information adequacy:** Information adequacy perceptually checks for the sufficiency of information in the speech of the individual.

**Information content**: This parameter checks for the meaningfulness and adequacy of information to all the questions asked in terms of initiating and sustaining the conversation.

**Message accuracy:** This parameter measures the presence of incorrect answers to the question and confabulation within the same question frame.

**Vocabulary specificity:** Vocabulary specificity checks for the specific vocabulary to describe specific information.

**Linguistic fluency:** This parameter checks for the presence of easy, smooth and effortless flow of speech.

**Speech style:** This parameter checks for the presence of appropriate use of appropriate dialectal structural forms, code switching and style shifting.

**Intonation:** The parameter assesses the presence of inappropriate rising, falling, and flat intonation with respect to a particular context of conversation.

**Gaze efficiency:** It checks for the use of appropriate eye gaze to the conversational context.

**Response time:** The parameter calculates the time taken to respond to any questions during conversation in seconds.

**Non propositional aspects of communication includes**

**Turn taking:** This parameter assesses the individual's ability to initiate turns, time taken to start a turn, contingency of the turn, ability to perceive prosodic cues for the purpose of turn taking, use of verbal and non verbal modes of communication and appropriate change from the listener to the speaker mode during conversation.

**Revision behavior:** The parameter checks for the presence of false starts and self interruptions in the entire context of conversation.

**Conversational repair**: This parameter checks for the use of adequate self repair strategies such as use of repetition, revision through clarification and use of other initiated repair in the instances of communication breakdown.

**Procedure**

In order to ensure that the participants are in the same physiological state and to reduce the effect of dopamine medication, the data collection was carried out an hour before the consumption of medications. Further it was also ensured that they will not be in the 'freezing' state. A rapport was built with the participant by engaging in a casual conversation. Following this, the assessment and screening procedures using MMSE, MDS-UPDRS, ISLPR scale (Ingram, 1985a) and NIMH-SES scale (Venkatesan, 2009) were carried out. The results of MMSE confirmed that all the participants in the clinical and control groups had no global cognitive abnormalities and had scores above 26 in the screening tool. MDS-UPDRS confirmed that none of the participants had psychological issues. All the participants considered belonged to upper middle class which was ensured using NIMH-SES scale developed by

Venkatesan (2009). In order to match them on the knowledge of second language, the International Second Language Proficiency Rating (ISLPR) scale developed by Ingram (1985a) was used to assess the proficiency of the second language in all the participants. All the participants knew English and Hindi and they were found to have a proficiency score between 3 and 2 respectively on the ISLPR scale.

The participants were instructed to carry out a general conversation on the topic provided by the investigator for 15 minutes. They were instructed to interact normally, as they would do under normal circumstances. The topic for conversation was decided by the investigator and was kept constant among all the participants. The conversation was audio-video recorded using a Digital Camera. Good rapport was established prior to the recording to overcome the shyness fear and awkwardness if any, associated with video recording. The participants were instructed to avoid the camera. The video camera was handled by the investigator. In this study the investigator was considered as the conversational partner. Only the participant and the investigator were encouraged to participate in the recording. To avoid visual distraction, recording was carried out by seating the participant against a wall. The recording was carried out in a room with less ambient noise. On an average each participant conversed for a duration of 10-15 minutes. On the whole, the overall time spent with each participant was around two to two and a half hours. A break of five to ten minutes was provided between the baseline measures. It was ensured that the participant was active and alert at the time of recording.

**Analysis:**

The investigator analyzed the video samples using Discourse Analysis Scale for conversation task (Hema & Shyamala, 2008). The parameters in the scale were perceptually rated using a 3 point rating scale ranging from 0= poor to 2= good. The scores were cumulated to obtain a total score and to calculate the discourse quotient.

**Inter-rater reliability**: Apart from the investigator, all the samples were further analyzed by two other judges. The judges were experienced speech-language pathologists who had a minimum of two years experience in the assessment and intervention of adult language disorders. The judges were familiarized on the operational definitions on various discourse skills assessed by the scale. The scoring of behaviors was also described. After familiarizing, the judges were blinded to the purpose study. Identity of the participants was not revealed. The recordings were shown to the judges and copies of the checklist were provided. Judges were given the freedom to watch the video as many times as they wanted. There was no time constraints applied to the judges for the analysis. The scores obtained from all the three judges (including the investigator) was calculated and assessed for reliability.

All ethical procedures were followed. An informed consent was obtained in writing from all the participant of the study. The participants were informed regarding the nature of the present study, the purpose, checklists administered and about video recording.

**Statistical Analysis**

The data obtained was tabulated for each participant from both the groups and was subjected to statistical analysis using the SPSS software version 17.0. Both descriptive and inferential statistics were carried out. Descriptive statistics was carried

out to obtain mean, median and standard deviation for both the groups. Due to a small sample size, non parametric tests such as Kruskal Wallis test and Mann Whitney U test were used to check for the significant difference, if any, across the groups and also between early and middle stages of PD. Reliability measures was determined using Cronbach's alpha coefficient.

## CHAPTER 4 - Results and Discussion

The present study aimed to investigate the discourse function in Kannada speaking individuals with idiopathic Parkinson's disease (clinical group) by comparing them with a matched group of neuro-typical individuals (control group) and also to check for variations in the discourse function if any, across the different stages of the disease. A total of ten and thirteen participants constituted the clinical and the control group respectively. The participants in the clinical group were further divided into early stage (six participants) and middle stage (four participants) subgroups based on the severity of the disorder. An audio-video database was collected for a conversational task from both the clinical and the control group. The samples were analyzed using the Discourse Analysis Scale for conversation task developed by Hema and Shyamala (2008). The scores obtained for each parameter on the scale were totaled for the participants in both clinical and the control group. The scores were further sub grouped under propositional and non propositional parameters of discourse and analyzed using the SPSS software 17.0. The following statistical procedures were used:

1. Cronbach's alpha test was obtained to determine the test-retest reliability.
2. Descriptive statistics was carried out to obtain the mean and standard deviation
3. Mann-Whitney test was administered to test the significant difference if any, between the control group and the clinical group for the performance in each of the parameters on the Discourse Analysis Scale.

4. Non parametric tests: Kruskal Wallis test was employed to find the significant difference if any, between control group and different stages of PD (early stage and middle stage) for the performance in each of the parameters on the Discourse Analysis Scale. Mann-Whitney test was used to find the stage wise significant difference if any that existed among the groups.

The results obtained for each group has been presented and discussed in this chapter under the following sections:

I. Reliability.
II. Comparison of performance on the discourse quotient and the total score on the propositional and non propositional aspects of the discourse across the clinical and the control group.
III. Comparison of discourse quotient between the control group, early stage PD group and the middle stage group.
IV. Comparison between the control group, early stage PD group and the middle stage PD group w. r. t propositional and non propositional parameters.

## I. Reliability

The samples collected from both control and clinical groups were re-examined by two other judges apart from the investigator. The test-retest reliability was calculated using Cronbach's alpha test, which was found to be greater than 0.70 for the total of propositional and non propositional aspects of the discourse for both the groups. This suggested that there was an adequate level of agreement between the judges in scoring the behaviours on the scale for both the clinical and control group.

**II Comparison of performance on the discourse quotient and the total score on the propositional and non propositional aspects of discourse across the clinical and the control group**

The performances of both the groups as a whole on all the parameters of the scale were analyzed. The scale included discourse structure, communication intent, coherence, topic management, information adequacy, information content, message accuracy, vocabulary specificity, linguistic fluency, speech style, intonation, gaze efficiency and response time under propositional aspects of discourse and turn taking, revision behaviour and conversational repair under non propositional aspects of discourse. The data was subjected to descriptive statistical methods to obtain the mean and the standard deviation. Table 1 depicts the mean, median and standard deviation (SD) values of the different parameters of the Discourse Analysis Scale.

On comparison of the overall mean values for the different parameters, it was seen that the mean value of the clinical group was 70.50 (SD=5.04) which was lesser than the mean value of the control group, which was 75.69 (SD=3.28). This indicated poorer performance of the clinical group in comparison to the control group. To check if this difference was statistically significant, the mean scores were subjected to non parametric tests. Mann-Whitney test was administered and a significant difference (/z/=2.12, $p<0.05$) between the overall values of the two groups was found. The results indicated that the clinical group performed significantly poorer than the control group.

The raw total scores from propositional and non propositional aspects of discourse were cumulated and a percentage was derived to obtain Discourse Quotient. This parameter indicated the overall discourse functioning of the individual. The clinical group obtained a lesser mean percentage of 90.38 compared to the control

group which obtained a mean percentage of 97.04. The mean and standard deviation values have been depicted in Table 4.1. Mann-Whitney test showed a significant

Table 4.1:

*Mean, standard deviation (SD), median and /z/ values for clinical and control groups for different parameters on the Discourse Analysis Scale for Conversation task.*

| **Parameters on Discourse Analysis scale for conversation task** | **Groups** | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Clinical group** | | | **Control group** | | | |
| | **Mean** | **SD** | **Median** | **Mean** | **SD** | **Median** | **/z/value** |
| Discourse Structure | 3.50 | 0.85 | 4.00 | 3.85 | 0.55 | 4.00 | 1.32 |
| Communication Intent | 14.00 | 0.94 | 14.00 | 15.77 | 0.83 | 16.00 | 3.51*** |
| Coherence | 4.00 | 0.00 | 4.00 | 3.77 | 0.59 | 4.00 | 1.27 |
| Topic Management | 14.30 | 1.76 | 14.50 | 15.23 | 1.09 | 16.00 | 1.38 |
| Information Adequacy | 1.80 | 0.42 | 2.00 | 2.00 | 0.00 | 2.00 | 1.65 |
| Information Content | 1.70 | 0.48 | 2.00 | 1.92 | 0.27 | 2.00 | 1.37 |
| Message Accuracy | 1.90 | 0.31 | 2.00 | 2.00 | 0.00 | 2.00 | 1.14 |
| Vocabulary Specificity | 1.60 | 0.51 | 2.00 | 1.69 | 0.48 | 2.00 | 0.45 |
| Linguistic Fluency | 1.10 | 0.56 | 1.00 | 1.69 | 0.48 | 2.00 | 2.38** |
| Speech Style | 2.00 | 0.00 | 2.00 | 2.00 | 0.00 | 2.00 | 0 |
| Intonation | 1.50 | 0.52 | 1.50 | 2.00 | 0.00 | 2.00 | 2.81** |
| Gaze Efficiency | 2.00 | 0.00 | 2.00 | 1.85 | 0.37 | 2.00 | 1.27 |
| Response Time | 1.90 | 0.31 | 2.00 | 2.00 | 0.00 | 2.00 | 1.14 |
| Total of Propositional Aspect | 51.30 | 3.77 | 52.50 | 55.76 | 3.21 | 56.00 | 2.95** |
| Turn Taking | 11.90 | 0.31 | 12.00 | 12.00 | 0.00 | 12.00 | 1.14 |
| Revision Behaviour | 1.70 | 0.48 | 2.00 | 1.92 | 0.27 | 2.00 | 1.37 |
| Conversational Repair | 5.60 | 0.84 | 6.00 | 6.00 | 0.00 | 6.00 | 1.65 |
| Total of Non-Propositional Aspect | 19.20 | 1.47 | 20.00 | 19.92 | 0.27 | 20.00 | 1.45 |
| Total | 70.50 | 5.03 | 72.00 | 75.69 | 3.27 | 76.00 | 2.89** |
| Discourse Quotient | 90.38 | 6.46 | 92.30 | 97.04 | 4.20 | 97.43 | 2.89** |

**p < 0.05, ** p < 0.01, *** p < 0.001*

difference among the groups (/z/ = 2.89; p=0.01). The mean score of both the groups on the discourse quotient has been depicted in figure4.1

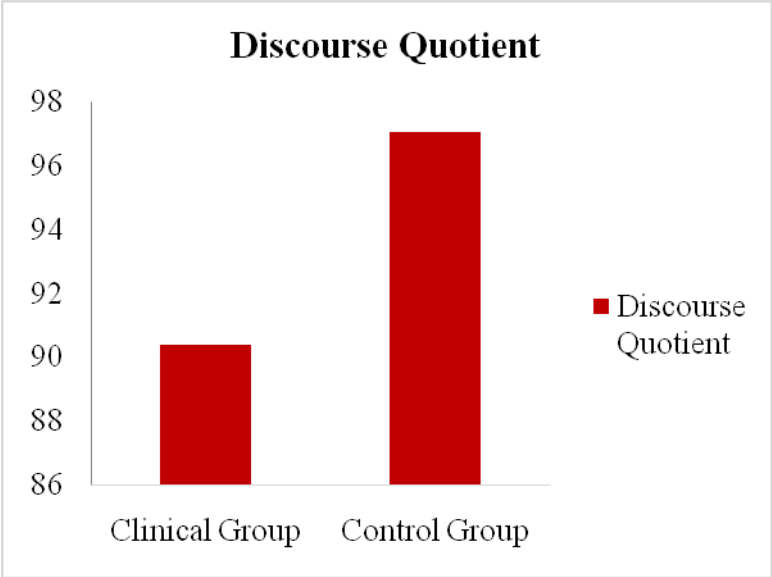


*Figure 4.1*. Discourse Quotient for clinical and control group.

When the propositional parameters were compared between the groups, the clinical group obtained a mean value of 51.30 (SD=3.77) and the control group obtained a mean score of 55.77 (SD=3.22). The lower mean score obtained by the clinical group indicated that they performed poorer than the control group for propositional aspects of discourse. However it was observed that the control group did not obtain 100% scores on this parameter. Mann- Whitney test was administered and a significant difference (/z/=2.95, p=<0.01) was found. The parameters of propositional aspects of discourse indicating a significant difference were communication intent, linguistic fluency and intonation. The mean score of both the groups on the propositional aspects of discourse has been depicted in figure 4.2.

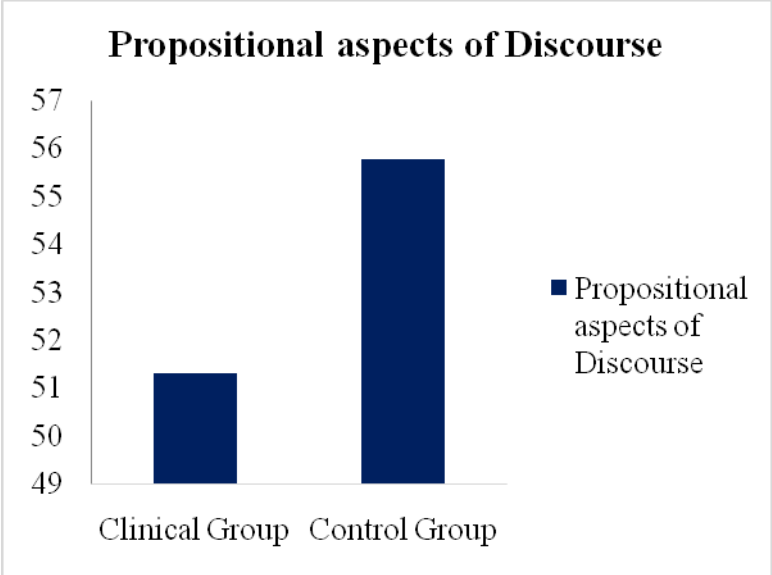


*Figure 4.2.* Mean for propositional parameters of discourse in the clinical and the control group.

When the non propositional parameters were compared between the clinical and the control group, the control group exhibited a mean and standard deviation of 19.92 (SD=0.28) whereas the clinical group showed a mean and standard deviation of 19.20 (SD=1.47). It was observed that both the groups had obtained almost similar mean scores. Although there was no variation in the mean scores, it was observed that the control group too had reduced scores. Mann-Whitney test revealed no significant difference (/z/=1.45, $p>0.05$) between the groups. The mean score of both the groups on the non propositional aspects of discourse has been depicted in figure 4.3.

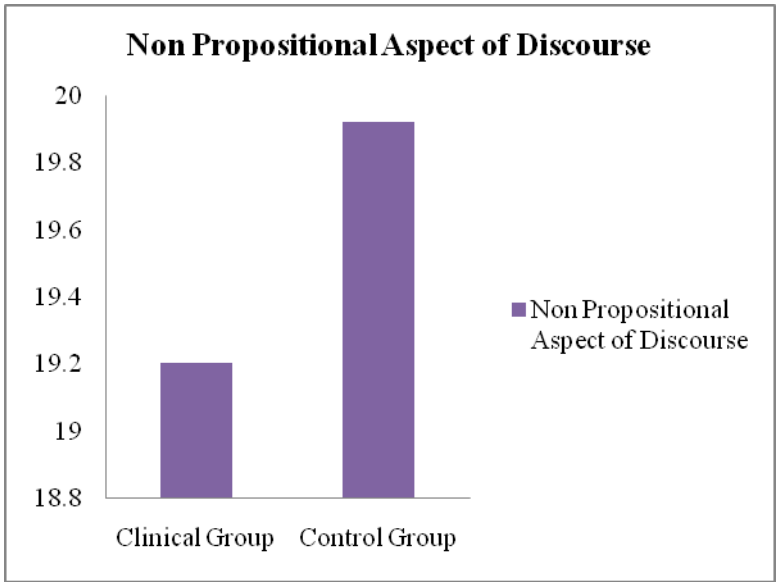


*Figure 4.3.* Mean for non propositional parameters of discourse in the clinical and the control group

The results of the present study that the clinical group performed poorer than the control group on discourse parameters is in agreement with the reports in literature. Several studies have reported that the discourse of the individuals with PD and neuro-typical individuals are affected with individuals with PD reporting greater deficits than neuro-typical individuals (Illes, Metter, Hanson, & Iritani, 1988; McNamara, Obler, Au, Durso, & Albert, 1992; McNamara & Durso, 2003; Hall, Ouyang, Lonnquisr, & Newcombe, 2011; Holtgraves, Fogle, & Marsh, 2013). The reduced discourse skills can be observed due to both cognitive deficits and motor speech disorders observed in PD (Bastiaanse & Leenders, 2009; Darley, Aronson, & Brown, 1969; Graceffa, Carlesimo, Peppe, & Caltagirone, 1999; Grossman, 1999; Illes, 1989; McNamara & Durso, 2003; Lewis et al. 1998; Sushma & Swapna, 2013).

Even though there was no significant difference observed between neuro-typical individuals and individuals with PD on the non propositional aspects, individuals with PD had affected scores on this parameter indicating a deficit in this

parameter. This result is in agreement the findings in the literature which documents the presence of non propositional deficits in discourse only in the individuals with PD and not in the neuro-typical individuals (McNamara, Obler, Au, Durso, & Albert, 1992; McNamara & Durso, 2003; Hall, Ouyang, Lonnquisr, & Newcombe, 2011; Holtgraves, Fogle, & Marsh, 2013).

It was observed that neuro-typical individuals obtained reduced scores in the domains of certain propositional parameters of discourse such as coherence (control group: Mean= 3.77, SD= 0.59; PD group: Mean=4.00, SD=0.00) and gaze efficiency (control group: Mean= 1.85, SD= 0.37; PD group: Mean=2.00, SD=0.00). However, these differences were not found to be statistically significant.

Certain propositional parameters and non propositional parameters of discourse such as vocabulary specificity (control group: Mean= 1.69, SD=0.48; PD group: Mean= 1.60, SD=0.51), topic management (control group: Mean=15.23, SD=1.09; PD group: Mean=14.30, SD =1.76) and revision behaviours (control group: Mean= 1.92, SD= 0.27; PD group: Mean=1.70, SD=0.48) were affected in both control and PD groups. These differences were not found to be statistically significant; however, both the groups obtained lower means in these domains.

These findings are attributed to the effect of aging in both neuro-typical individuals and individuals with PD. Several researchers such as Cooper (1989), Glosser and Deser (1991), and Kemper (1993) have demonstrated deterioration in discourse skills with the advancement of age.

Cooper (1989) studied changes in language as a function of the normal aging process and the results indicated an increased use of prepositional phrases and indefinite words and longer pauses among older persons. The investigator attributed

indefinite wording to reflect word-finding or naming difficulty, and longer pauses to reflect cognitive slowing. In the present study similar findings were obtained. Both the neuro-typical individuals and individuals with PD exhibited word finding difficulties leading to linguistic dysfluencies like excessive audible pauses. This can be attributed to word finding deficits in aging (Kemper, Rash, Kynette, & Norman, 1990).

In the present study, there was an occurrence of reduced local thematic coherence, a macrolinguistic change in the participants of the study thus leading to excessive topic shifts during conversation. There was poor self awareness of this behaviour in both the groups and they made reduced or no attempts to return to the topic of conversation. Thus it can be concluded that due to the cognitive deficits accompanied with aging, individuals exhibit macrolinguistic changes in discourse (Glosser & Deser, 1991; Arbuckle & Pushkar Gold, 1993; Kemper, 1993; Pushkar Gold & Arbuckle, 1995).

Due to the above cognitive deficits, individuals in both the groups reported excessive use of revision behaviours. Literature also reports the presence of error in formulating syntactic structures (Kepner, Herman, & Lian, 2005). Planning an utterance involves an individual to undergo a series of cognitive processes like retrieval of semantic concepts from the long term memory, placing it in the working memory and organizing the syntactic units within the working memory to formulate a syntactically appropriate sentence. Simultaneously, the individual must have adequate sustained attention to prevent the selection of unwanted but similar semantic units (Hasher & Zacks, 1988; Burke & MacKay, 1997; Murphy, Craik & Schneider, 2000).

**III. Comparison of discourse quotient between the control group, early stage PD group and the middle stage group**

The discourse quotient which is a percentile score obtained by cumulating scores from propositional and non propositional parameters on the scale was the least for the middle stage group (Mean=84.94%, SD= 6.89) and the highest for the control group (Mean=97.04%, SD= 4.20). The early stage PD group obtained a discourse quotient values which were in between the values obtained for the control and the middle stage group (Mean=94.02%, SD=2.64). The mean and standard deviation values for the three groups have been depicted in the Table 4.2. The mean percentage discourse quotient scores for all the three groups have also been depicted graphically in the figure 4.4.

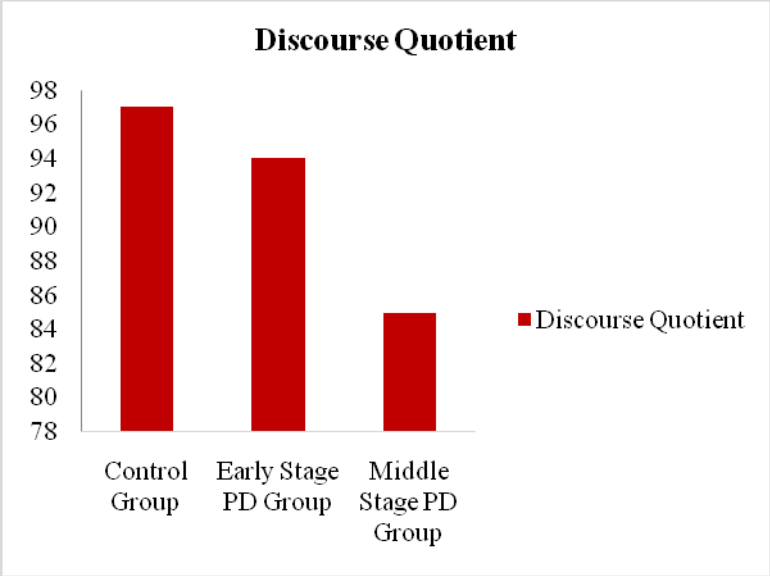


*Figure 4.4.*Discourse quotient for the control group, early stage PD group and middle stage PD group.

The Kruskal Wallis test indicated a significant difference of F= 10.11(2), p= <0.01. The results obtained indicated a decline in discourse skills in individuals with PD with increase in the severity of the disorder and is in accord with the findings in the literature. (McNamara & Durso, 2003; Holtgraves, Fogle, & Marsh, 2013).

Holtgraves and McNamara (2011) concluded that poor speech act recognition and comprehension is seen in individuals with PD and is positively correlated with disease progression. Hall, Ouyang, Lonnquisr, and Newcombe (2011) also reported impaired pragmatic functioning in PD and have strongly correlated the dysfunction with the severity, mental state and the duration of the disease. PD scored significantly lower on eye contact, intonation, turn taking, response length, and conversation initiation on a pragmatic function scale.

**IV Comparison between the control group, early stage PD group and the middle stage PD group w. r. t propositional and non propositional parameters.**

This section compares the propositional and non propositional aspects of discourse across the control group, early stage PD group and middle stage PD group. A comprehensive table (table 4.2) is given to show the mean, median, standard deviation values and chi square values for the clinical (early stage and middle stage PD) and control groups for the different parameters on Discourse Analysis Scale for Conversation task.

Table 4.2:

*Mean, median, standard deviation (SD) values and Chi square values for clinical (early stage and middle stage PD) and control groups for parameters on Discourse Analysis Scale for Conversation task.*

| **Parameters on Discourse Analysis scale for conversation task** | **Groups** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Neuro-typical group** | | | **Early stage PD group** | | | **Middle stage PD group** | | | |
| | **Mean** | **Std Deviation** | **Median** | **Mean** | **Std Deviation** | **Median** | **Mean** | **Std Deviation** | **Median** | **Chi-Square values** |
| Discourse Structure | 3.85 | 0.55 | 4.00 | 3.67 | 0.81 | 4.00 | 3.25 | 0.95 | 3.50 | 3.20 |
| Communication Intent | 15.77 | 0.83 | 16.00 | 14.00 | 0.00 | 14.00 | 14.00 | 1.63 | 14.00 | 12.45** |
| Coherence | 3.77 | 0.59 | 4.000 | 4.00 | 0.00 | 4.00 | 4.00 | 0.00 | 4.00 | 1.60 |
| Topic Management | 15.23 | 1.09 | 16.00 | 15.00 | 1.54 | 16.00 | 13.25 | 1.70 | 13.50 | 5.10 |
| Information Adequacy | 2.00 | 0.00 | 2.00 | 2.00 | 0.00 | 2.00 | 1.50 | 0.57 | 1.50 | 9.95* |
| Information Content | 1.92 | 0.27 | 2.00 | 2.00 | 0.00 | 2.00 | 1.25 | 0.50 | 1.00 | 10.86** |
| Message Accuracy | 2.00 | 0.00 | 2.00 | 1.83 | 0.40 | 2.00 | 2.00 | 0.00 | 2.00 | 2.83 |
| Vocabulary Specificity | 1.69 | 0.48 | 2.00 | 1.83 | 0.40 | 2.00 | 1.25 | 0.50 | 1.00 | 3.64 |
| Linguistic Fluency | 1.69 | 0.48 | 2.00 | 1.33 | 0.51 | 1.00 | 0.75 | 0.50 | 1.00 | 7.46* |
| Speech Style | 2.00 | 0.00 | 2.00 | 2.00 | 0.00 | 2.00 | 2.00 | 0.00 | 2.00 | 0 |
| Intonation | 2.00 | 0.00 | 2.00 | 1.83 | 0.40 | 2.00 | 1.00 | 0.00 | 1.00 | 17.31*** |
| Gaze Efficiency | 1.85 | 0.37 | 2.00 | 2.00 | 0.00 | 2.00 | 2.00 | 0.00 | 2.00 | 1.61 |
| Response Time | 2.00 | 0.00 | 2.00 | 2.00 | 0.00 | 2.00 | 1.75 | 0.50 | 2.00 | 4.75 |
| Total of Propositional Aspects | 55.76 | 3.21 | 56.00 | 53.50 | 1.87 | 53.50 | 48.00 | 3.55 | 47.00 | 10.49** |
| Percentage of Propositional Aspect | 96.15 | 5.54 | 96.52 | 92.24 | 3.22 | 92.24 | 82.75 | 6.13 | 81.03 | 10.49 |
| Turn Taking | 12.00 | 0.00 | 12.00 | 12.00 | 0.00 | 12.00 | 11.75 | 0.50 | 12.00 | 4.75 |
| Revision Behaviour | 1.92 | 0.27 | 2.00 | 1.83 | 0.40 | 2.00 | 1.50 | 0.57 | 1.50 | 3.64 |
| Conversational Repair | 6.00 | 0.00 | 6.00 | 6.00 | 0.00 | 6.00 | 5.00 | 1.15 | 5.00 | 9.95* |
| Total of Non-Propositional Aspects | 19.92 | 0.27 | 20.00 | 19.83 | 0.40 | 20.00 | 18.25 | 2.06 | 18.50 | 4.54* |
| Percentage of Non-Propositional Aspect | 99.61 | 1.38 | 100.00 | 99.16 | 2.04 | 100.00 | 91.25 | 10.30 | 92.50 | 4.54* |
| Total | 75.69 | 3.27 | 76.00 | 73.33 | 2.06 | 73.50 | 66.25 | 5.37 | 65.50 | 10.11 |
| Discourse Quotient | 97.04 | 4.20 | 97.43 | 94.01 | 2.64 | 94.23 | 84.93 | 6.89 | 83.97 | 10.11** |

**p < 0.05, ** p < 0.01, *** p < 0.001*

**Propositional parameters**

The raw scores obtained for the propositional aspects of discourse data was subjected to descriptive statistical methods to obtain the mean and the standard deviation. The overall mean obtained for propositional aspects of discourse in the control group, early stage PD and middle stage PD group was 55.76 (SD=3.21), 53.50 (SD= 1.87) and 48.00 (SD= 3.55) respectively. The mean and the standard deviation values have been depicted in the Table 4.2. The groups performed in the following hierarchical order control group> early stage PD group > Middle stage PD group. The mean scores obtained for the propositional aspects of discourse in the three groups are graphically depicted in figure 4.5.

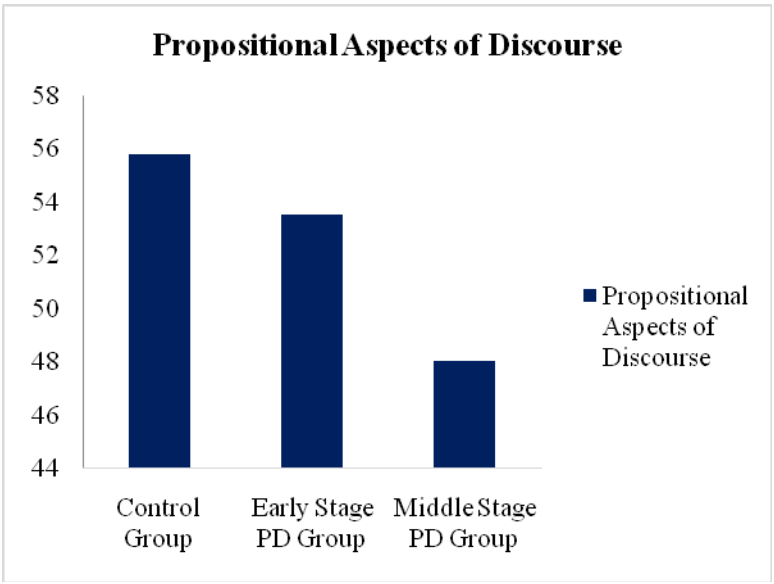


*Figure 4.5.*Propositional aspects of discourse across control, early stage PD and middle stage PD groups.

Chi-square values obtained on Kruskal–Wallis test was F (2) =10.49, $p<0.005$ indicating a significant difference between all the three groups. On administration of

Mann Whitney test among the groups, a significant difference of /z/= 2.16, p= <0.05 between control and early stage groups, /z/= 2.03, p= <0.05 between early stage and middle stage of PD and /z/= 2.68, p= <0.05 between middle stage and control groups was obtained. Thus it can be concluded that the propositional aspects of discourse were significantly different across the groups and decreased with increase in severity. The results also revealed that the discourse deficits were observed in the early stages of the disease despite the absence of overt cognitive deficits. This result is in agreement to the findings in literature (Illes, Metter, Hanson, & Iritani, 1988; Lieberman, Kako, Friedman, Tajchman, Feldman, & Jiminez, 1992).

The various parameters of propositional aspects of discourse indicating significant difference were communication intent, information adequacy, information content, linguistic fluency and intonation. These parameters have been discussed in detail below. Table 4.3 shows the /z/ values obtained for the various propositional aspects of the discourse.

Table 4.3.

*/z/ values for different parameters on propositional discourse for the three groups.*

| **Propositional discourse parameters** | **/z/values between** | | |
|---|---|---|---|
| | **Neuro-typical and early stage PD groups** | **Early stage PD and middle stage PD groups** | **Neuro-typical and middle stage PD groups** |
| Communication Intent | 3.42*** | 0 | 2.59* |
| Information adequacy | 1 | 1.84 | 2.63* |
| Information content | 0.68 | 2.41* | 2.69* |
| Linguistic fluency | 1.43 | 1.58 | 2.56* |
| Intonation | 1.47 | 2.44* | 4.00*** |
| Total of propositional aspects | 2.16* | 2.03* | 2.67** |

**p < 0.05, ** p < 0.01, *** p < 0.001*

**Communication intent**

Communication intent was assessed by checking the presence of behaviours such as greeting others and introducing self, starting a conversation, asking for information, asking for assistance in understanding conversation, criticizing the conversation by agreeing or disagreeing to a part in the conversation and understanding the advancers and blockers of communication. The mean values of the control group were higher than the mean values of the early stage and the middle stage group. However, there was no difference in the mean values between the early stage and the middle stage group. The results of the Mann whitney test revealed that a significant difference existed between the control group and the early stage PD group and between the control group and the middle stage PD group indicating poor communication intent among individuals with PD. The /z/ value shave been depicted in table 4.3. Through this result, it can be postulated that deterioration of communication intent starts in the early stages in the disease.

Deterioration in communication intent can be neurophysiologically associated with affected subcortical and brainstem structures in PD. PD involves depletion of dopamine of the mesocorticolimbic pathway. This pathway is responsible for reward based learning including initiating a desire for communication and cognition (Cools, Barker, Sahakian, & Robbins 2001).

From the above finding it can be concluded that individuals with PD have reduced communication intent due to the neuropathology seen in them.

**Information adequacy**

Information adequacy was checked perceptually by checking the sufficiency of information in the speech of the individual. On comparison of the mean values, it was seen that there was no difference in mean values between the control group and the early stage group. However, there was a difference in the mean values between the control group and the middle stage group, i.e., the middle stage group obtained lower mean values compared to the early stage group. These mean and standard deviation values have been depicted in the Table 4.2. The results of the Mann whitney test revealed that a significant difference existed only between the control group and the middle stage PD group indicating that this parameter deteriorates only in the middle stage of the disease. The /z/ values have been depicted in table 4.3.

It was observed during the data collection that the individuals in the control group and early stage PD group were able to answer to all the questions during conversation at word/single sentence level/ multiple sentences whereas two out of four individuals in middle stage PD group answered to fewer questions in the conversation. There are studies in the literature that support this finding and report that individuals with PD have adequate informational content and the degree of informativeness when compared to normal age matched population. However, they reported that there was a reduction in number of syntactic structures to convey the content.

Murray (2000) concluded from his study that the participants with PD produced a smaller proportion of grammatical sentences and less information than the control subjects. Murray also reported that individuals with PD who had better short term memory and better attention produced longer, more syntactically complex utterances.

Further, participants with PD who were more cognitively intact overall, as measured by dementia ratings scores (DRS), produced more information.

However, a study by Illes, Matter, Hanson, and Iritani (1988) reported that people with PD tended to produce longer sentences than healthy older adults due to a tendency to list several events within a single sentence, leading to a greater proportion of content word phrases (i.e., noun, verb, and adjective phrases) than in the healthy older adult group.

These discrepancies in results can be attributed to difference in the methodology employed in the studies. The present study employs perceptual rating of the behaviours on a 3 point ordinal scale. Quantitative measures may provide a better picture of adequacy of information and content of information in PD during conversation.

**Information content**

The informational content is dependent on the cognitive functioning of the individuals. Information content checks for the meaningfulness and adequacy of information to all the questions asked in terms of initiating and sustaining the conversation. On comparison of the mean values, it was seen that the early stage group scored the highest followed by the control group. The mean obtained by the middle stage group was the lowest. These mean and standard deviation values have been depicted in the Table 4.2. The results of the Mann whitney test revealed that a significant difference was observed across neuro-typical and middle stage PD and early stage and middle stage PD, indicating that this parameter deteriorates only in the middle stage of the disease. The /z/ values have been depicted in table 4.3. These results indicated that individuals with

middle stage PD exhibited fewer meaningful and adequate information due to poor communication intent compared to control group to questions asked in terms of initiating and sustaining the conversation. They used excessive yes/no answers while talking and hence were unable to contribute to the topic and sustain the conversation. However, this parameter was relatively preserved in the early stage PD group indicating that this population had better communication intent than individuals with middle stage PD.

**Linguistic fluency**

This parameter checked for the presence of easy, smooth and effortless flow of speech. On comparison of the mean values, it was seen that the control group scored the highest followed by the early stage group. The mean obtained by the middle stage group was the lowest. These mean and standard deviation values have been depicted in the Table 4.2. The results of the Mann whitney test revealed that a significant difference existed only across the neuro-typical and middle stage PD groups was observed indicating that this parameter also deteriorates only in the middle stage of the disease. The /z/ values have been depicted in table 4.3.

Dysfluencies in PD can be attributed to both the dysarthric component and reduced cognitive abilities observed in them. Recent evidence also suggests that impairments at the level of speech motor programming may add to the neuromuscular difficulties in individuals with PD (Spencer & Rogers, 2005). That is, some of the commonly encountered speech signs of PD may be related to impaired ability to maintain a speech motor program (e.g., abnormally placed pauses, difficulty with progression through an utterance, and difficulty initiating articulation) or to switch from one motor program to another (e.g., repeated phonemes, marked hesitations between movement

segments, and occasional inability to switch from one to another movement). Increased number of pauses can also be a compensation strategy used to overcome the motor impairment. It can also be credited to reduced concept formulation leading to increase in time taken to retrieve a word for conversation. Illes et al. (1988) also examined speech rate, fluency, syntactic complexity, lexical production, and the relative distribution of content and grammatical phrases in 10 persons with PD (5 early stage, 5 middle stage) and 10 age-matched controls while reading the Grandfather passage and producing spontaneous speech. The results reported distinct dysfluencies in the speech of PD. The dysfluencies were marked by more pauses per word than the speech of the healthy older adult group.

**Intonation**

The parameter assessed presence of inappropriate rising, falling, and flat intonation with respect to a particular context of conversation. On comparison of the mean values, it was seen that the control group scored the highest followed by the early stage group. The mean obtained by the middle stage group was the lowest. These mean and standard deviation values have been depicted in the Table 4.2. The results of the Mann Whitney test revealed that a significant difference existed between early stage PD and middle stage PD and neuro-typical and middle stage PD groups, which indicated that a significant deterioration of intonation occurred by the middle stage of the disease. When individual scores in the scale was examined, one out of six participants in the early stage PD group and all the four participants in the middle stage PD displayed abnormal intonational patterns which included flat intonation and inappropriate rising and falling of intonation.

The present finding is in consonance with the literature which reports abnormal intonation patterns as a result of the motor speech impairment in PD. Hall, Ouyang, Lonnquist, and Newcombe (2011) considered various speech factors such as vocal fold adduction, reduced laryngeal synergy, and muscle fatigue that account for voice abnormalities in PD and may contribute to the presence of intonation abnormality (Darley, Aronson, & Brown, 1969).

**Other propositional parameters:**

Even though on parameters such as topic management and response time, there was no significant difference between the groups, the clinical group showed lower mean values than the control group. There were variations in the individual scores among the participants in the scale.

Topic management: Descriptive statistics for topic management showed a mean of 15.23 and SD = 1.09 for the control group, a mean of 15.00 and SD = 1.54 for the early stage PD group and a mean of 13.25 and SD = 1.70 for the middle stage PD group. These mean values indicated that the topic management skill worsened with an increase in the severity of the disease. During the course of data collection it was observed that individuals in the middle stage PD had poor topic maintenance when compared to control group and early stage PD group and used excessive ‘yes’ or ‘no’ responses and exhibited under elaboration of the topics. Impaired topic management can be a consequence of reduced working memory capacity commonly observed due to aging and poor self monitoring skills in PD. Topic maintenance requires the ability to monitor the target topic, to keep the target topic in working memory and to resist interference from other salient topics capturing attention. It also involves self-monitoring skills to prevent the

tendency to shift to other similar topics. If this does happen, it requires the use of conversational repair strategies to return to the topic of conversation (McNamara & Durso, 2003). Due to reduced working memory span, individuals with PD showed frequent topic shifts and were unable to monitor the shifts and use strategies to maintain communication.

Response time: Descriptive statistics for response time showed a mean of 2.00 and SD = 0.00 for the control group, a mean of 2.00 and SD = 0.00 for the early stage PD group and a mean of 1.75 and SD = 0.50 for the middle stage PD group. On evaluation of individual scores on the scale for response time, all the participants except for one in the middle stage group had a good response time ranging from 0.5 to 2 seconds. One participant in the middle stage of severity of PD had a response time ranging from 3 to 5 seconds. This finding can be related to the speech initiation deficits due to bradykinesia.

**Propositional parameters of discourse those were unaffected in PD:** Parameters like message accuracy and speech style were unaffected in all the groups.

Message accuracy: The descriptive statistics (Control group: Mean= 2.00, SD=0.00; early stage PD group: Mean=1.83, SD=0.40; middle stage PD group: Mean= 2.00, SD=0.00 ) and individual scores of the participants indicated that all the groups attempted to communicate by providing correct answers to all the questions without any confabulation or inaccurate information within the same question frame.

Speech style: The descriptive statistics (Control group: Mean=2.00, SD=0.00; early stage PD group: Mean=2.00, SD=0.00; middle stage PD group: Mean=2.00,

SD=0.00) and individual scores of the participants indicated appropriate use of dialectal structural forms, code switching and style shifting during conversation.

Gaze efficiency: The descriptive statistics (Control group: Mean= 1.85, SD= 0.37; early stage PD group: Mean=2.00, SD=0.00 middle stage PD group: Mean=2.00, SD=0.00) and individual scores of the participants indicated that all the participants in the clinical group were able to use appropriate eye gaze to the conversational context. This finding contradicts the reports in the literature which states the presence of poor eye contact in individuals with PD when compared to neuro-typical individuals (Hall, Ouyang, Lonnquisr & Newcombe, 2011).

Local coherence: Both the descriptive statistics (control group: Mean= 3.77, SD=0.59; early stage PD group: Mean=4.00, SD=0.00; middle stage PD group: Mean=4.00, SD=0.00) and individual scores of the participants indicated a good relationship between the meaning and context of verbalization with respect to both general topic of conversation (global coherence) and for the utterance produced by the conversational partner or self (local coherence).

**Non propositional parameters**

This aspect of the scale tests for the behaviours that reflect the reciprocal nature of conversation and the joint co-operation required of the participants in successfully carrying out a conversation. The section addresses behaviours like turn taking, revision behaviours and conversational repair strategies. The mean and the standard deviation and chi- square values for these parameters have been depicted in the Table 4.2.

When the non propositional parameters were compared between the control, early stage PD group and middle stage PD groups the following mean and standard deviations were obtained: 19.92 (SD=0.27), 19.83 (SD=0.40) and 18.25 ( SD= 2.06) respectively. It was observed that there was no variation of means between the groups, i.e. the means obtained by the different groups were almost similar. Kruskal-Wallis test was administered and there was no significant difference [(F (2) =4.54, p=>0.05)] found. The mean scores for the non propositional aspects of discourse across control, early stage PD and middle stage PD groups have been graphically depicted in figure 4.6.

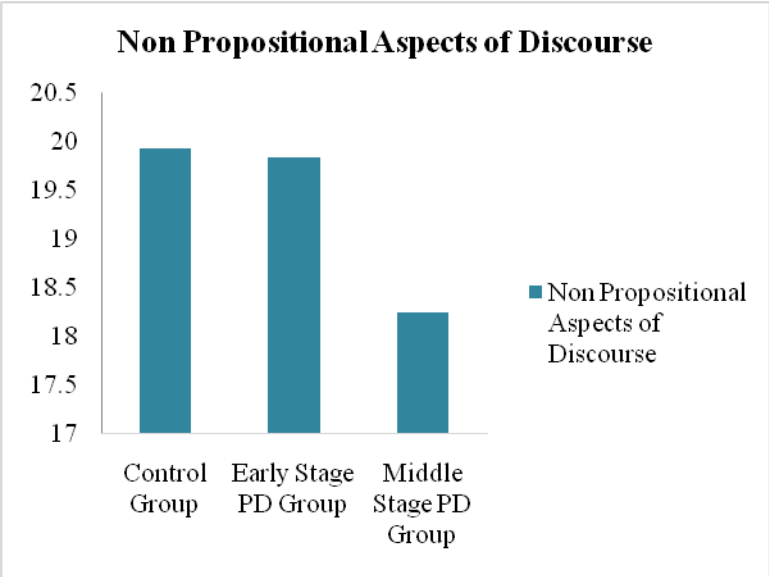


*Figure 4.6.* Non propositional aspects of discourse across control, early stage PD and middle stage PD groups

The results indicated that the non propositional aspects of discourse were not severely affected as propositional aspects in the clinical group and were evident only in the later stages (middle stage) of the disease. Even though there was no significant difference between the groups for this parameter, the clinical group, especially the middle

stage PD group exhibited lower mean scores than the control group. There was a variation in the individual scores for parameters such as turn taking, revision behaviours and conversational repair.

**Turn taking**

This parameter assessed the individual's ability to initiate turns, time taken to start a turn, contingency of the turn, ability to perceive prosodic cues for the purpose of turn taking, use verbal and non verbal modes of communication and appropriate change from listener to speaker mode during conversation. On comparison of this parameter between the control group, early stage PD group and middle stage PD groups the following mean and standard deviations were obtained: 12.00, SD= 0.00, 12.00, SD= 0.00 and 11.75, SD= 0.50 respectively. On comparison of mean values, it is seen that there is minimal variations in mean across the groups. On evaluation of individual scores on the scale, all the participants except for one in the middle stage group had reduced scores in this domain.

The phonatory and prosodic impairments of PD such as a reduced amount of words per breath reduced vocal volume, short phrases, short rushes of speech and increased pauses (Duffy 2005) have the probability to disrupt turn taking and turn design and construction in conversation. Taking frequent pauses to inhale due to motor initiation problems, for instance, could leave a speaker vulnerable to foregoing a turn at talk. Others may infer that a PD speaker's turn is finished when it is still in progress or that the person with PD, having been selected as next speaker, is rejecting the obligation to talk. The PD speaker may also be unable to indicate through intonation that a turn is still in progress. The sequential consequences of these impaired communication resources on a

turn-by-turn basis in conversation have as yet been unexamined. Conversational turn-taking also like topic maintenance may require the ability to monitor the target topic and to keep the target topic in working memory, to resist interference from other salient topics capturing attention and to self-monitor for the tendency to not yield the floor.

**Revision behaviour**

Descriptive statistics in this parameter indicate a mean of 1.92 and SD of 0.27 in the control group, mean of 1.83 and SD of 0.40 in the early stage PD group and mean of 1.50 and SD of 0.57 in the middle stage PD group. This indicates a very minimal change of means among the groups. On evaluation of individual scores on the scale, all the groups had affected scores in this domain. One individual out of thirteen in the control group, one individual out of six in the early stage PD group and two out four individuals in the middle stage PD group showed false starts and self interruptions in some contexts of conversation. This behaviour can be attributed to the decline in cognitive abilities in PD and normal population with age. Planning an utterance involves an individual to undergo a series of cognitive processes like retrieval of semantic concepts from the long term memory, placing it in the working memory and organizing the syntactic units within the working memory to formulate a syntactically appropriate sentence. Simultaneously, the individual must have adequate sustained attention to prevent the selection of unwanted but similar semantic units. Due to the affected frontal lobe functions in PD such as affected executive functions, reduced attention and memory individuals with PD are unable to construct syntactically appropriate sentences in one attempt hence exhibit repeated revision behaviours to address the problem. The problem in PD can be

exaggerated due to the effects of aging on cognition (Glosser & Deser, 1991; Cooper, 1989; Kemper, 1993).

**Conversational repair**

This parameter checked for the use of adequate self repair strategies such as use of repetition, revision through clarification and use of other initiated repair. Descriptive statistics indicated a mean of 6.00 and SD= 0.00 for the control group, mean of 6.00 and SD= 0.00 for the early stage PD group and mean of 5.00 and SD= 1.15 for the middle stage PD group. Although there was no significant difference among the group, there was a reduction in mean of the middle stage PD group. Individual scores for two individuals in the middle stage PD group exhibited poor scores in this domain.

Reduced conversational repairs in PD can be attributed to the unawareness in the breakdown of communication. McNamara and Durso (2003) evaluated self-awareness of the communication breakdown by individual PD patients and their spouses. It was concluded that PD patients were less aware of their communication problems. It can be concluded that PD patients have a problem in their monitoring system and, thus, are not aware of their errors or, are unable to identify a communication breakdown in communication and use adequate repair strategies.

McNamara et al. (1992) reported a reduced capacity to simultaneously speak and monitor one's own speech resulting in mildly to moderately impaired PD patients thus leading to self-monitoring impairments during narrative discourse. They also tested overt speech monitoring in narrative discourse of patients with PD, picture description task and found that PD patients made three times more errors than the age-matched control

speakers. There was use of repair strategies, but the frequency of the usage was relatively less than the control speakers. According to the authors, this significant unawareness of speech errors is related to attentional dysfunctioning in PD.

To sum, the results of the present study revealed that the conversational discourse skills are affected in persons with PD. They had significantly reduced propositional aspects of discourse such as communication intent, intonation, linguistic fluency, information adequacy and information content, thus leading to the conclusion that organizational parameters of discourse are affected in individuals with PD. The results of the study also revealed that the discourse parameters deteriorated with increasing severity of the disease. Among the above parameters, communication intent was significantly affected in the individuals with PD and manifested in the early stage of the disease. Hence, communication intent can be considered as a useful measure in the assessment and intervention of PD. Other propositional parameters such as vocabulary specificity, coherence and gaze efficiency showed reduced scores in both control and clinical population, indicating the effect of aging on the these skills. Parameters such as message accuracy and speech styles were preserved in both the clinical and control groups. On comparison of non propositional parameters, there were no significant differences among the groups; however the lower means were obtained for the clinical group than the control group for the parameters such as turn taking, revision behaviours and communication repair. Thus it can be concluded from the study that discourse is affected in individuals with idiopathic PD and deteriorates with the severity of the disease.

# CHAPTER V-Summary and Conclusions

The study measured the use of language in the individuals with mild and moderate PD compared to neuro-typical adults on conversation task using discourse analysis. The specific objectives of the study were to compare the discourse skills of individuals with idiopathic PD with a group of neuro-typical individuals and to investigate the variation in discourse skills, if any, across early and middle stages of idiopathic PD.

Studies in the literature document that persons with PD exhibit a significant impairment on measures of communication abilities which include conversational appropriateness, conversational initiation, speech acts, stylistics, gestures, prosodics, pause time between phrases, turn taking, quantity/conciseness, feedback to speaker, speech intelligibility, eye contact, intonation, response length, gestures and facial expressions. They also report to exhibit poor knowledge of the extent of their impairment and make reduced attempts to correct conversational breakdown using repair strategies. The deficits are attributed to frontal lobe dysfunction in individuals with PD. There are very few studies which have focused on the language characteristics exhibited by this population and the social constraints they face during communication. This study is a first attempt in the Indian context to check variation in discourse parameters in PD. The study also checks the variation in discourse with the increase in severity of PD.

A standard group comparison was made by considering ten individuals in the clinical group and thirteen in the control group under the age range 60-85 years. The participants were included in the study based on certain set of inclusion criteria such as:

No history of encephalopathy/intake of neuroleptic drugs/exposure to toxins/vascular insults/brain tumour/head trauma/ stroke/multiple system atrophy/ progressive supranuclear palsy/dementia syndromes/hereditary disorders, which could co-occur with PD, absence of cognitive impairment, language deficits, visual or auditory deficits, psychological issues such as depression, apathy etc. The participants with a minimum education of up to SSLC, with knowledge of Kannada, English and Hindi languages, higher middle class society, with a fair intelligibility of speech and under medication for PD were considered for the study. The presence of the above criteria was checked using detailed general history, formal assessments such as Mini Mental State Examination (MMSE), Movement Disorder Society - Unified Parkinson's disease rating score (MDS-UPDRS), International Second Language Proficiency Rating (ISLPR) scale and NIMH-SES scale and informal assessments and informal assessments.

The participants carried out a general conversation on the topic for 15 minutes with the investigator. It was ensured that all the participants were in the same physiological state by recording the sample half an before the intake of PD medications. The conversation was audio video recorded using a digital camera and was subjected to analysis by the investigator using The Discourse Analysis Scale for conversation task (Hema & Shyamala, 2008). The sample was further analysed by two other judges to determine inter-rater reliability. The data was subjected to statistical analysis and the following results were obtained.

Discourse skills were affected in individuals with PD and it deteriorated with the severity of the disease. Propositional parameters such as communication intent, intonation, linguistic fluency, information adequacy, information content were

significantly different from the control group. These parameters showed an effect of severity on the clinical population. Owing to the effect of aging, some propositional parameters such as vocabulary specificity and topic maintenance during conversation were found to be affected in both clinical and control group indicating an effect of aging in the deterioration of scores in both the groups. Parameters such as message accuracy, speech style, eye contact and coherence were unaffected in the clinical group. There was no significant difference found between control and clinical group for the non propositional parameters of discourse such as turn taking behaviours, turn taking, revision behaviours and conversational repair strategies. However, individuals with PD obtained reduced means in these parameters.

Thus to conclude, this study verifies the finding in the literature for occurrence of non motor symptoms such as subtle language deficits like reduced communication intent, information content and accuracy before the occurrence of overt speech symptoms. Discourse was found to be affected in individuals in PD and progressed with the severity of the disease. It can be inferred from the study that the discourse can be used as a tool for the assessment and intervention of language deficits in individuals with PD.

**Clinical Implications**

The study has two major implications. The first implication is its contribution towards increasing the existing database about communicative use of language in PD. The results of the present study provide an insight into the extent and nature of language functioning in persons with PD. It also provides data on the variation in language functioning through discourse analysis in the different stages of the PD. The second implication of the study is its contribution in the assessment and management of PD. The

research throws a light on the importance of assessment and management of non motor aspects such language and cognition in PD. It also discusses employment of discourse as a tool for assessment of language functions in PD. Even though discourse analysis is tedious and time consuming, it gives information on the individual's cognitive, linguistic and social functioning, thus providing a holistic communicative profile of an individual. It provides an insight on the early intervention approaches for PD with the use of strategies like improving the communication intent, awareness communication breakdown and use of repair of strategies to overcome it and in turn improve the quality of life in persons with PD. The study can also be used as a guideline for counseling the caregivers and recommend early referral to support groups of the persons with PD.

**Limitations and future recommendations**

Owing to a reduced number of participants in the clinical group, the present study is unable to generalize the results to the population. The study also contained higher number of male participants in the clinical group than female participants i.e. 9 males and 1 female. This uneven distribution of participants was in view of the fact of increased prevalence of PD in males than females. Due to this reason, sampling bias and gender bias may have occurred leading to poor representation of the population. Because of the poor availability of the participants, the clinical population was not matched to the control group on educational qualifications. It is considered that educational achievements have an effect on the cognitive reserve of an individual. This can lead to discrepancy in the data.

The study employed a qualitative measure to achieve discourse analysis; further research needs to be carried out to explore quantitative linguistic variations among the

groups during discourse. The study used only a conversational task for analysis, hence further studies focusing on lexical related tasks with restricted language environment must be done. It would also be interesting to observe variation of discourse across L1 and L2 in monolinguals and bilinguals with PD.

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**APPENDIX- 1**

**Discourse Analysis Scale for conversation task**

(Hema & Shyamala, 2008)

**Points to be considered while using Discourse Analysis Scale:**

The parameters of propositional and non-propositional aspects of conversation are quantified with few general instructions to the evaluator as follows:

1. Initially read the keys provided in the sub headings which explain the exact meaning of the parameters to be scored as good, fair and poor with respect to the particular context of conversation.
2. Scoring procedure involves the use of rating scale. Three points perceptual rating scale is used to evaluate each parameters.
3. Each appropriate behavior *(normal)* is given a *higher score* and the inappropriate behavior *(abnormal)* is scored *low*.

***Propositional aspects of communication*.**

This includes the notion of relevancy, clarity of reference and coherence of information. It deals with how discourse is organized with respect to overall plan, theme or topic and how individual utterances are conceptually linked to main theme/topic.

**1) Discourse Structure**

**Good**- The discourse is organized with respect to overall plan, theme or topic and how individual utterances are conceptually linked to maintain unity.

**Fair**- The discourse is partially confusing even if it's organized with respect to overall plan, theme or topic and how individual utterances are conceptually linked to main theme/topic.

**Poor**- The discourse is completely confusing since it is unorganized with respect to overall plan, theme or topic and how individual utterances are conceptually linked to each other.

a) Discourse forethought----------→ (  )

[Score: 0-Poor, 1-Fair, 2-Good]

b) Organizational planning ----------→ (  )

[Score: 0-Poor, 1-Fair, 2-Good]

**2) Communication intent**

This parameter can be evaluated using frequency count, so check for the presence or absence. If present, make a note whether an individual uses this parameter only in required circumstances or in all the circumstances.

**Good**- Individuals using this parameter in all required circumstances.

**Fair**- Individuals using this parameter inconsistently in the required circumstances.

**Poor**- This parameter is absent in the entire context of conversation.

a) Greets others and introduces self:
-By themselves----------→ (  )

[Score: 0-Poor, 1-Fair, 2-Good]

-In response to other's greeting----------→ (  )

[Score: 0-Poor, 1-Fair, 2-Good]

b) Starts a conversation----------→ (  )
[Score: 0-Poor, 1-Fair, 2-Good]

c) Asks information----------→ (  )
[Score: 0-Poor, 1-Fair, 2-Good]

d) Asks for assistance in understanding conversation----------→ (  )
[Score: 0-Poor, 1-Fair, 2-Good]

e) Criticizes the conversation by agreeing or disagreeing to a part in the conversation----------→ (  )
[Score: 0-Poor, 1-Fair, 2-Good]

f) Imagines events correctly----------→ (  )
[Score: 0-Poor, 1-Fair, 2-Good]

g) Understands advancers and blockers in the conversation----------→ (  )

[Score: 0-Poor, 1-Fair, 2-Good]

**3) Coherence**

a. Global coherence----------→ (  )

**Good**- Presence of good relationship between the meaning and context of verbalization with respect to the general topic of conversation.

**Fair**- Presence of partial relationship between the meaning and context of verbalization with respect to the general topic of conversation.

**Poor**- Relationship between the meaning and context of verbalization with respect to the general topic of conversation is completely absent.

[Score: 0-Poor, 1-Fair, 2-Good]

b. Local coherence----------→ (  )

**Good**- Presence of good relationship between the meaning and context of verbalization with that of the immediately preceding utterance produced either by interviewer or participant.

**Fair**- Presence of partial relationship between the meaning and context of verbalization with that of the immediately preceding utterance produced either by interviewer or participant.

**Poor**- Relationship between the meaning and context of verbalization with that of the immediately preceding utterance produced either by interviewer or participant is completely absent.

[Score: 0-Poor, 1-Fair, 2-Good]

**4) Topic management**

a) Introducing topic----------→ (  )

**Good**- Correctly introducing the topic.

**Fair**- Partial but correct introduction to topic.

**Poor**- Irrelevantly introducing topic or no response.

[Score: 0-Poor, 1-Fair, 2-Good]

b) Topic shift----------→ ( )

**Good**- Staying within the given topic.

**Fair**- Gradual shift from the given topic.

**Poor**- Rapid shift from the given topic.

[Score: 0-Poor, 1-Fair, 2-Good]

c) Topic changes----------→ ( )

**Good**- Coherent topic change where the topic is within the context of verbalization.

**Fair**- Partially inappropriate topic change but still the topic is within the main context of verbalization.

**Poor**- Non coherent topic change is present.

[Score: 0-Poor, 1-Fair, 2-Good]

d) Perseveration in the topics----------→ ( )

**Good**- Perseveration not present.

**Fair**- Perseveration partially present.

**Poor**- Perseveration continuously present.

[Score: 0-Poor, 1-Fair, 2-Good]

e) Responses which expand topics----------→ ( )

**Good**- Responses which expand topics is consistently present.

**Fair**- Responses which expand topics is partially present.

**Poor**- Responses which expand topics is absent.

[Score: 0-Poor, 1-Fair, 2-Good]

f) Minimal responses (Giving only Yes/No responses)----------→ ( )

**Good**- Minimal use of yes/no response.

**Fair**- Yes/no responses partially present.

**Poor**- Only yes/no responses present.

[Score: 0-Poor, 1-Fair, 2-Good]

g) Minimal elaboration----------→ ( )

In presence of prompts from the investigator, the participants attempting to give yes/no responses along with very few sentential level discourse to elaborate the topic.

**Good**- Minimal elaboration appropriately present in all required circumstances

**Fair**- Minimal elaboration partially present in all required circumstances.

**Poor**- Minimal elaboration absent in required circumstances or minimal elaboration only present throughout the context of conversation.

[Score: 0-Poor, 1-Fair, 2-Good]

h) Elaboration of topics----------→ (  )

**Good**- Adequate elaboration of topic.

**Fair**- Partial elaboration of topic.

**Poor**- Extra elaboration of topic.

[Score: 0-Poor, 1-Fair, 2-Good]

**5) Information adequacy**

**Good**- Answers to all the questions during conversation at word level/ single sentence level/ multiple sentence level.

**Fair**- Answer to few questions during conversation at word level/ single sentence level/ multiple sentence level.

**Poor**- No answers / response to any of the questions during conversation.

a. Word level/ Single sentence level/ Multiple sentence level---------→(  )
Underline the level at which the participant is positioned.

[Score: 0-Poor, 1-Fair, 2-Good]

**6) Information content**

**Good**- Meaningful and adequate information to all the questions in terms of initiating and/or sustaining conversation.

**Fair**- Meaningful and adequate information to only few question in terms of initiating and/or sustaining conversation or if you know what the person is talking about, even if the information doesn't appear to be available.

**Poor**- Nonmeaningful and inadequate information to all the questions in terms of initiating and or/sustaining conversation.

a. Meaningful and adequate information----------→( )

[Score: 0-Poor, 1-Fair, 2-Good]

**7) Message Accuracy** ----------→( )

**Good**- An attempted communication involving correct answers to the question without any confabulation or any inaccurate information within the same question frame.

**Fair**- An attempted communication involving correct answers to the question and few accurate information without any confabulation within the same question frame.

**Poor**- An attempted communication involving incorrect answers to the question with confabulation within the same question frame with all inaccurate information.

[Score: 0-Poor, 1-Fair, 2-Good]

**8) Vocabulary specificity**----------→ ( )

**Good**- Using specific vocabulary when specific information is required.

**Fair**- Partially using specific vocabulary when specific information is required.

**Poor**- Overuse of generic terms such as "thing" and “stuff" when more specific information is required.

[Score: 0-Poor, 1-Fair, 2-Good]

**9) Linguistic fluency** ----------→ ( )

**Good**- Fluent discourse without any repetition, unusual pauses or hesitations.

**Fair**- Partially fluent discourse with very few repetitions, unusual pauses or hesitations.

**Poor**- Presence of repetition, unusual pauses, hesitations

[Score: 0-Poor, 1-Fair, 2-Good]

**10) Speech Style** ----------→ (  )

**Good**- Appropriate use of any dialectal structural forms, code switching and style-shifting.

**Fair**- Inappropriate use of dialectal structural forms, code switching, style-shifting is partially present.

**Poor**- Presence of totally inappropriate dialectal structural forms, code switching, style-shifting.

[Score: 0-Poor, 1-Fair, 2-Good]

**11) Intonation** ----------→ (  )

**Good**- Absence of any inappropriate or abnormal rising, falling, flat intonation with respect to a particular context of conversation.

**Fair**- Inappropriate or abnormal rising, falling, flat intonation with respect to a particular context of conversation is partially present.

**Poor**- Presence of inappropriate or abnormal rising, falling, flat intonation with respect to a particular context of conversation.

[Score: 0-Poor, 1-Fair, 2-Good]

**12) Gaze Efficiency** ----------→ (  )

**Good**- Consistent use of appropriate eye gaze to the conversational context.

**Fair**- Partially consistent eye gaze to the conversational context.

**Poor**- Not appropriate or restricted eye gaze to the conversational context.

[Score: 0-Poor, 1-Fair, 2-Good]

**13) Response time**----------→ (  )

Time taken to respond to any questions during the conversation which is measured in terms of seconds.

**Good**- Response at 0.5-2sec.

**Fair**- Response at 3-5 sec.

**Poor**- Response delayed beyond 6-8 sec.

[Score: 0-Poor, 1-Fair, 2-Good]

**Non propositional or Interactional aspects of communication**

This is one of the important categories of social communication behavior. These behaviors reflect the reciprocal nature of conversation and the joint co-operation required of the participant.

The following subcategories are considered:

**1) Turn taking**

a) Initiation of turn----------→ ( )

**Good**- Present at required circumstances of the entire conversation.

**Fair**- Present at half of the required circumstances of the entire conversation.

**Poor**- No initiation of turn taking in any circumstances of the entire conversation.

[Score: 0-Poor, 1-Fair, 2-Good]

b) Time to start a turn----------→ ( )

**Good**- Not taking time to start a turn.

**Fair**- Partially taking time to start a turn.

**Poor**- Completely taking time to start a turn.

[Score: 0-Poor, 1-Fair, 2-Good]

c) Contingency of the turn ----------→ ( )

**Good**- Presence of contingent turns where it fulfills the semantic or informational expectation of the previous turn, but shares the same topic.

**Fair**- Partially non- contingent turns are present where it does not fulfill the semantic or informational expectation of the previous turn, but shares the same topic. This also

includes "don't know," "yes," and "no" responses *when used to avoid* maintaining a topic, and echolalia.

**Poor**- Non-contingent turns present.

[Score: 0-Poor, 1-Fair, 2-Good]

d) Unable to take prosodic cues ----------→ ( )

**Good**- Able to take the prosodic cues in the entire conversational context for the purpose of turn taking.

**Fair**- Partially able to take the prosodic cues in some conversational contexts for the purpose of turn taking.

**Poor**- Unable to take the prosodic cues in the entire conversational context for the purpose of turn taking.

[Score: 0-Poor, 1-Fair, 2-Good]

e) Mode of conversation ----------→ ( )

**Good**- Using appropriate verbal or non verbal mode without any abrupt/rapid shift from verbal and non verbal mode during turn taking.

**Fair**- Partially using appropriate verbal or non verbal mode with abrupt/rapid shift between verbal and non verbal mode during turn taking.

**Poor**- Not using appropriate verbal or non verbal mode with rapid shift between verbal and non verbal mode during turn taking at all.

[Score: 0-Poor, 1-Fair, 2-Good]

f) Listeners or speakers mode----------→ ( )

**Good**- Appropriate change from speaker to listener mode or listener to speaker mode with reference to the entire context of conversation.

**Fair**- Partially appropriate change from speaker to listener mode or listener to speaker mode with reference to some contexts of conversation.

**Poor**- Inappropriately persistent in speaker or listener mode with reference to the entire context of conversation.

[Score: 0-Poor, 1-Fair, 2-Good]

**2) Revision behaviors** ----------→ ( )

**Good**- Absence of false starts and self interruptions in the entire context of conversation.

**Fair**- Presence of false starts and self interruptions in some contexts of conversation.

**Poor**- Continuous presence of false starts and self-interruptions in the entire context of conversation.

[Score: 0-Poor, 1-Fair, 2-Good]

**3) Conversation repair**

This parameter can be evaluated using frequency count, so check for the presence or absence. If present, make a note whether an individual use this parameter only in required circumstances or in all the circumstances.

**Good**- Individuals using this parameter in all required circumstances.

**Fair**- Individuals using this parameter inconsistently in the required circumstances.

**Poor**- Individuals not using this parameter at all in the entire context of conversation.

a) Use of self repair through repetition----------→ ( )
Repeating themselves and correcting the discourse without the investigators help.

[Score: 0-Poor, 1-Fair, 2-Good]

b) Use of revisions through clarification----------→ ( )
Requesting the investigator to modify the discourse and use the corrected version of discourse to continue the topic of conversation.

[Score: 0-Poor, 1-Fair, 2-Good]

c) Use of other initiated repair ----------→ ( )
Participants not able to find the right word, so the investigator fills it with the correct word to continue the topic of conversation.

[Score: 0-Poor, 1-Fair, 2-Good]

Finally, one can find discourse quotient, using the total score on propositional and non-propositional aspects of communication which should be divided by total scores of

all the features of propositional and non-propositional aspects of communication. This must be multiplied with hundred to get the score in percentage.

*Example*: The participant's score is 54

**Discourse Quotient** = 54/58+20= 54/78 x 100= 69.23