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| **Study** | **Literature review** | **Participants, Measures and analysis** | **Results** | **Discussion-Conclusions** |
| Quellas, R., Costa, M. (2009). Anxiety, depression and quality if life in Parkinson’s disease. *J Neuropsychiatry ClinNeurosci, 21*(4), 413-9. | -Clinically relevant depression in Parkinson’s disease is underdiagnosed and it is associated with increased disability and reduced quality of life. The mean incidence of depression in Parkinson’s disease is about 40% (Schrag, 2006; Ravina et al., 2007).  -The descriptive and clinical characteristics of depression and anxiety in Parkinson’s disease have not been carefully investigated (Mondolo et al., 2007; Mondolo et al., 2006). | 43 patients (two were excluded by missing values)  Mean age: 72 years (55-86 years)  Short form 36 health Survey questionnaire  Hospital Anxiety and Depression Scale  Hoem and Yahr degree of disability scale  Chi-square or Fishers’ exact test  Mann-Whitney test | -Anxiety was present in 55% of patients.  -Depression was present in 58% of patients.  -Moderate to severe degree of anxiety in 33% of patients and 84% of depression.  -Women had significantly higher anxiety and depression than males (z=-2.49 and -2.41).  -The presence of anxiety and depression led to lower quality of life (z=3.33 and 2.52). | -Parkinson’s disease affects not only motor functioning, but also all measured aspects of quality of life, including emotional well-being and social functioning.  -Anxiety and depression in Parkinson’s disease are not closely correlated with the severity of motor symptoms or degree of disability.  -The stronger predictor of quality of life of Parkinson’s disease patients was the Hospital Anxiety and Depression Scale score. |
| Suzuki, A., Hoshino, T., Shigemasu, K., Kawamura, M. (2006). Disgust –specific impairment of facial expression recognition in Parkinson’s disease. *Brain, 129,* 707-717. | -Parkinson’s disease causes a range of mild cognitive deficits and there is a growing interest in its role in impaired emotional and social behaviours (Benke et al., 1998; Saltzman et al., 2000; Pell and Leonard, 2003; Brand et al., 2004).  -Impairments of the recognition of emotional facial expressions have been previously noted in Parkinson’s disease patients (Beatty et al., 1989).  -To those on Parkinson disease, neurological reports on emotion-specific impairments in general have always been suspect owning to difficulty artefacts (Rapcsak et al., 2000). | 14 patients with idiopathic Parkinson’s disease  The recruitment criterion was the patient’s competency in understanding the nature of this study and being able to provide informed consent on his/her own behalf.  In order to investigate facial expression recognition, they used the method of evaluating ‘sensitivities to basic emotions in faces’ (patients viewed 72 grey-scale photographs of facial expressions with respect to the six basic emotions: happiness, fear, anger, disgust and sadness).  Statistical method: multivariate analysis | -The Parkinson’s disease patients displayed lower sensitivity scores than the healthy controls for corresponding emotions varied and a marked difference was observed with respect to the emotion of disgust (t(51)=-3.408, P=0.001).  -The performance of the two groups from the two conventional methods (Facial Expression Identification and Facial Expression Hexagon) was almost identical, although the largest difference was still observed in the case of the emotion of disgust F(6.46)=0.809 and F(6.46)=0.908. | -The Parkinson’s disease patients were selectively impaired in the recognition of facial expressions of disgust.  -That is, the sensitivity scores for disgust were significantly lower among the Parkinson’s disease patients than among the healthy controls, whereas the scores for happiness, fear, anger and sadness were not. |
| Loas, G., Krystkowiak, P., Godefroy, O. (2012). Anhedonia in Parkinson’s Disease: An overview. *The journal of Neuropsychiatry and Clinical Neurosciences, 24,* 444-451. | -Anhedonia is defined by a lowered ability to experience pleasure. It is recognized to be a core symptom of major depression, and approximately  30%–40% of subjects with Parkinson’s disease (PD) have  significant depression(Aarsland et al., 2009).  -Anhedonia, as well as other nonmotor symptoms of PD, is underrecognized and, consequently, undertreated. Moreover, nonmotor symptoms of PD lead to hospitalization and institutionalization (Chaudhuri&Schapira, 2009). | Articles were initially retrieved from the personal database established by the first author, who has regularly published  articles on anhedonia for several decades  PubMed database  keywords“anhedonia” or “anhedonia and Parkinson disease.” | -High incidence of depression in PD patients, characterized by anhedoniaexplained by damage to the reward-related systems.  -Patients with PD, Alzheimer’s  disease, or major depression have a distinct pattern of neuropsychological deficits  -PD patients with markedly  asymmetrical symptoms, more severe on the left side ofthe body (LHF), have greater anxiety and depressionthan PD patients with markedly asymmetrical symptoms | -Anhedonia is one of the most frequent psychiatricsymptoms in PD and cannot be totally explained by depression. |
| Bowers, D., Miller,K., Mikos, A., Kirsch-Darrow, L., Springer, U., Fernandez, H., Foote, K., Ojun, M. (2006). Startling facts about emotion in Parkinson’s disease: blunted reactivity to aversive stimuli. *Brain, 129*, 3356-3365. | -Although the cardinal features of the disease are motor in nature (tremor, rigidity, bradykinesia), changes in mood and emotion are common.  -Particularly prominent are depression, apathy and anxiety with estimates for depression ranging from 30 to 60% (Cummings, 1992; Slaughter et al., 2001; McDonald et al., 2003). | 23 non demented patients with Parkinson disease+ 17 healthy controls  The session began with the presentation of the 12 baseline startle stimuli.Picture stimuli consisted of 36 pictures (12 positive, 12 negative and 12 neutral) that were selected from the International Affective Picture Set. Eyeblinks were measured by recording EMG activity from the inferior arc of the orbicularis oculi muscle using Ag-AgClelectrodes.  Use of separate one-way analyses of variance (ANOVA). | -The primary results from the rating analyses indicate that the Parkinson’s disease patients and control group rated the affective pictures similarly in terms of pleasantness/unpleasantness. -However, the patients found the aversive pictures significantly less arousing than did the controls. This was a valence specific effect, since equally arousing pleasant stimuli were rated similarly by the patient and control groups. | -The key finding of this study was that Parkinson’s disease patients responded abnormally, in terms of startle reactivity, to aversive pictures depicting threat and unpleasant contents.  -While the control group showed the typical linear profile of emotion modulated startle (i.e. negative >neutral >positive), the Parkinson’s disease patients did not. |
| Dujardin, K., Blairy, S., Defebvre, L., Duhem, S., Noël, Y., Hess, U., Destée, A. (2004). Deficits in decoding emotional facial expressions in Parkinson’s disease. *Neuropsychologia, 42,* 239-250. | -Even though motor symptoms  dominate the clinical presentation of PD (HoehnYahr, 1967), several studies have shown that PD is associatedwith cognitive deficits which on the whole can be characterized as constituting a subcorticofrontal syndrome.  -It has been demonstrated that in addition to mood disorders (principally depression), a large proportion of PD patients suffers from anxiety disorders (Marsh, 2000).  -Few studies have addressed the issue of PD-related emotional information processing deficits (Adolphs, Schul, &Tranel, 1998; Breitenstein, van Lancker, Daum, & Waters, 2001; Jacobs, Shuren, Bowers, &Heilman, 1995a; Sprengelmeyer et al., 2003). | Eighteen non-demented patients (12 men & 6 women) participated in the study.  They had no history of neurological or  psychiatric illness, and their family history was negative for PD or parkinsonian symptoms.  A series of emotional facial expressions constructed by Hess &Blairy (1995)1 was used.  Specifically, these authors selected facial expressions corresponding to happiness,  anger, sadness, disgust and fear from a series of standardized EFEs.  During the same session, participants also completed a set of tasks assessing executive function.  Univariate (ANOVA) and, when appropriate, multivariate (MANOVA) analyses of variance were used | -Post-hoc analyses showed that healthy controls rated 70% intensity EFEs as easier to decode than 30% intensity EFEs (t(17) = 3.07, P = .006) while no differences emerged for the PD patients (t(17) = 0.32, n.s.). This suggests that in  contrast to healthy controls, the PD patients were not aware of how easy it is to decode 70% intensity EFEs  -Thus, untreated PD patients early in the course of the disease were significantly impaired in their capacity to decode EFEs and to perform a set of tasks evaluating different aspects of executive function.  -Although none of the PD patients met the depression criteria, the  group’s mean depression score was significantly higher than that of the healthy controls. | -Non-verbal, emotional information processing is disturbed early in the course of PD.  -PD patients were less accurate than healthy controls in decoding angry, sad and disgusted EFEs, regardless  of the expression’s intensity level (low or mild).  -The results observed that for healthy controls, the more intense the expressions, the less difficult the decoding task was perceived to be.  -Indeed,since it has been shown that executive function deficitscan appear in firstdegree relatives of patients with familial PD. |
| Sotgiu, I., Rusconi, M.L. (2013). Investigating emotions in Parkinson’s disease: what we know and what we still don’t know. *Frontiers in Psychology, 336*(4), 1-5. | -Over the last decade, there has been an increasing attention to the role played by emotional processes in PD. Specifically, important progresses has been made in understanding how PD impairs specific components of emotional processes (e.g., expressive, cognitive, subjective) and have also formulated interesting hypotheses about the underlying neurological mechanisms which could explain the emotional impairments observed in PD patients (Blonder and Slevin, 2011; Péron et al., 2012). |  | -Researchers investigating emotions in PD have devoted much of their efforts in three major areas: (1) facial and vocal expression of emotion, (2) recognition of emotional stimuli, (3) changes in PD patients’ affective tone and mood.  -Results showed that PD patients exhibited reduced levels of spontaneous and voluntary expressions in response to unpleasant olfactory stimuli as compared with controls.  -It was found that the performances of PD patients were poorer when the stimuli to be recognized referred to negative emotions (e.g., anger, disgust, sadness) as compared to positive ones (e.g., happiness).  -Recent prevalence studies (e.g., Aarsland et al., 2007; Kulisevsky et al., 2008; Nègre-Pagès et al., 2010; Siri et al., 2010) have documented that patients with PD frequently report or exhibit signs of anxiety, apathy, and depressed mood. | -More in detail, research on emotional expressions suggests that PD patients may exhibit significant deficits in the non-verbal communication, having difficulties in producing both emotional facial movements and affective prosody.  -From what has been said so far, it appears that investigating the emotional consequences of PD may shed light on the complex relationship between the neurobiological and the psychological aspects of the disease.  -Lastly, a great number of studies have shown that PD  patients frequently experience mood alterations and emotional  dysfunctions, including depression, apathy, anxiety, as well as alexithymia. |
| Gamble, K.M. (2010). Emotional state affects gait initiation in individuals with Parkinson Disease. (a dissertation presented to the graduate school of the university of Florida in partial fulfillment of the requirements for the degree of doctor of Philosophy). | -Given the recent evidence has demonstrated that pleasant states facilitate the initiation of gait in healthy individuals Gamble, Joyner, Coombes, Hass, & Janelle, in review), manipulating emotional state may be an efficacious strategy to enhance gait initiation parameters in persons with PD.  -PD is increasingly linked with emotional dysfunction. Individuals with PD exhibit impairments in affective recognition as indexed by both facial expressions and prosodic production (Smith, Smith, &Ellgring, 1996; Caekebeke, Jennekens-Schinkel, van den Linde, Buruma, & Ross, 1991). | 26 patients with idiopathic PD & 26 age matched controls  Picture viewing was used to include emotional states during experimental trials. Presented stimuli included 30 digitized photographs selected from the International Affective Picture System (IAPS).  During the gait initiation trials participants stood with their feet in a self-selected stance width, with both feet on one force platform.  Independent samples t-tests and ANOVA with repeated measures were used. | -Threatening pictures speeded the initiation gait for PD patients and healthy older adults, 2) pleasant emotional pictures (erotic and happy people) facilitated the anticipatory postural adjustments of gait initiation for PD patients and healthy older adults and 3) emotional pictures modulated gait initiation parameters in PD patients to the same degree as healthy older adults. | -The current findings indicated that emotion and movement systems in persons with PD are of moderate severity.  -These results support the long held premise that emotions are action dispositions and further support the neurobiological evidence suggesting the emotion and motor systems are integrated in primitive brain circuits to ensure appropriate motor reactions occur in response to environmental stimuli. |
| Gray, H., Tickle-Degnen, L. (2010). A Meta-Analysis of Performance on emotion Recognition tasks in Parkinson’s disease. *Neuropsychology, 24*(2), 176-191. | -There is reason to believe that individuals with Parkinson’s disease might be impaired in the recognition of emotion from facial cues. The basal gaglia more generally appear to play a role in recognising emotions from facial cues as part of a distributed network of cortical and subcortical strustures (Adolphs, 2002; Cancelliere&Kertesz, 1990).  -Depression itself is linked with deficits in identifying the emotional tone of faces (Feinberg, Rifkin, Schaffer, & Walker, 1986) and voices (Kan et al., 2004), it is possible that significant group differences in some past studies resulted from inadequate control of such individual difference factors. | They conducted database searches of PsycINFO and PubMed.  54 potentially eligible papers were read and 20 of these were excluded because they did not present emotional material to participants or did not include a non PD control group.  The 34 papers included in this meta-analysis contributed a total of 74 nonindependent comparisons. | -PD effects on emotion recognition as a function of stimulus modality: facial versus prosodic expressions. Participants with PD appear to be more impaired in judging emotion from prosodic expressions (g-0.70) than from facial expressions (g=0.48, p< .05).  -The level of deficits ranged from surprise to anger and tended to be greater for negative emotions than for the relatively positive emotions of happiness and surprise.  -A robust link between PD and impaired recognition of emotion form faces and voices was found. | -The level of emotion recognition deficit does not appear to be related to the level of motor disability. This suggests that motor disability and the deficit in emotion recognition may result from different forms of brain pathology.  -It is important to investigate whether any emotion recognition deficit in PD is secondary to depression, because of the high incidence of depression in PD and because depression itself is associated with emotion recognition deficits. |
| Vicente, S et al. (2009). Subthalamic nucleus stimulation affects subjective emotional experience in  Parkinson’sdiseasepatients. *Neuropsychologia, 47,* 1928-1937. | -Reports of changes of emotional behaviour have led researchers  to explore the effect of STN (subthalamic nucleus stimulation) stimulation on emotional processing.  - A number of studies have reported non-motor effects following STN stimulation, specifically in the cognitive, behavioural and emotional domains (for a review, see Voon, Kubu, Krack, Houeto, &Trφster, 2006). | 13 patients with advanced PD & 16 healthy controls  Two series of 6filmexcerpts eachwere used to elicit differentemotional feelings: happiness, anger, fear, sadness, disgust and neutral.  Comparisons of the three independent  Groupswere performed using the non-parametric Kruskal–Wallis statistic.  Mann–Whitney tests were carried out to determine which group differed from one another.  Analyses of the matrices of response patternswere performed using chi-square statistic (χ2). | - The post-operative group not only differed significantly  from the two other groups for the less intense reported feeling of fear but more generally for the less intense mixed feelings that may be induced by a film excerpt intended to induce primarily a feeling of fear as it is the case here for the feelings of anxiety and disgust.  -Moreover, the post-operative group reported a less intense feeling of sadness, as well as a less intense feeling of anxiety, during the film excerpt. | -The present results are in line with previous studies demonstrating impaired facial expression recognition after STN stimulation in PD patients, and more specifically, impaired recognition of negative emotions. |
| Clark, U.S., Neargarder, S., Cronin-Golomb, A. (2008). Specific impairments in the recognition of emotional facial expressions in Parkinson’s disease. *Neuropsychologia, 46*(9), 2300-2309. | -In Parkinson’s disease (PD), facial emotion identification deficits have been reported in several studies (Dujardin et al., 2004; Jacobs, Shuren, Bowers, &Heilman, 1995; Kan, Kawamura, Hasegawa, Mochizuki, & Nakamura, 2002; Lawrence, Goerendt, & Brooks, 2007; Sprengelmeyer et al., 2003), though not in all (Adolphs, Schul, &Tranel, 1998; Pell & Leonard, 2005).  -Kan and colleagues (2002) noted deficits in the recognition of fear and disgust in medicated PD participants. | 20 non-demented patients with  PD and 23 control participants relative to their performances on a non-emotional landscapecategorization test with comparable taskrequirements  Current levels of depression and anxiety were estimated using the Beck Depression Inventory, 2nd ed. (BDI) (Beck, Steer, & Brown, 1996) and the Beck Anxiety Inventory (BAI) (Beck, Epstein, Brown, & Steer, 1988).  The 16-item version of the Benton Test of Facial Recognition (Benton, Sivan, Hamsher, Varney, &Spreen, 1994) was administered to assess general face perception abilities.  64-item version of the Inventory of Interpersonal Problems questionnaire  (IIP), which is a self-report instrument that was designed to assess levels of distress in relationto interpersonal interactions.  ANOVAs, followed by posthoc analyses  when appropriate, and Pearson correlations using a conservative alpha level of .01. | -PD participants were normal  on the control task but exhibited selective impairments in the recognition of facial emotion,  specifically for anger (driven by those with right hemisphere pathology) and surprise (driven by thosewith left hemisphere pathology), even when controlling for depression level.  -PD participants, deficiencies in facial  emotion recognition correlated with higher levels of interpersonal distress. | - PD participants in this study displayed impairments in the recognition of angerand surprise facial expressions. |
| Smeding, M.M., Speelman, J.D., Huizenga, H.M et al. (2009). Predictors of cognitive and psychosocial outcome after STN DBS in Parkinson disease. *J NeurolNeurosurgPsychiatry, 82*(7), 754-60. | Bilateral deep brain stimulation of the subthalamic nucleus (STN DBS) is an effective surgical treatment to reduce motor symptoms in patients with advanced Parkinson’s disease (PD).(Krack et al., 2003; Esselink et al., 2004; Rodriguez-Oroz et al., 2005). The effects of STN DBS on cognition and behaviour, however, are still the subject of controversy (Voon et al., 2008; Parsons et al., 2006) | 105 patients and 40 PD patients  Neuropsychological evaluation before 12 months after surgery.  UPDRS scale  Changes in cognition, mood and quality of life detected. | The STN group showed a large improvement in quality of life  compared to the control group (Cohen’s d=0.9).  Thirty six percent (95% CI: 27 - 46) of the STN patients showed a profile of cognitive decline compared to the control group.  Impaired attention, advanced age and a low levodopa response at baseline predicted cognitive decline | STN DBS improves quality of life. However, a profile of cognitive decline can be found in a significant number of patients. |
| Pell, M.D., Leonard, C.L. (2005). Facial expression decoding in early Parkinson’s disease. *CognitiveBrainResearch, 23*, 327–340. | -Well-controlled studies have identified little evidence that emotional face processing is disturbed in a detectable manner by PD.  -The ability to label the six basic emotions from the Ekman series is intact in mild-moderate PD without  Dementia (Borod et al., 1990;Clair et al., Clair et al., 1998). | 21 individuals with idiopathic PD and 21 healthy individuals  The absence of dementia in PD  patients was established by the research team at study onset using the Dementia Rating Scale.  An inventory of face stimuli was developed and perceptually validated to achieve a highly controlledcomparison of how adults with PD process cues to emotion expression, facial speech, and emotional prosody from stimuli elicited from the same actors. | -The findings establish that emotional face recognition was broadly spared in PD.  -Neuropsychological reports contend that PD pathology is associated with  selective deficits in the encoding of emotional faces, more basic defects in the structural encoding. | -This investigation examined  how individuals with Parkinson’s disease derive information from unfamiliar human faces, focusing on how they analyze prototypical expressions of emotion and speech cues in this channel. |
| Vicente, S., Péron, J., Biseul, I., Ory, S., Philippot, P., Drapier, S., Drapier, D., Vérin, M. (2011). Subjective emotional experience at different stages of Parkinson's disease. *Journal of the Neurological Sciences, 310,* 241–247. | Most studies have focused on the  recognition of emotion from faces and from voices and have yielded  relatively uniform evidence of deficiencies associated to PD (Assogna et al., 2008; Schröder et al., 2010). | Participants reported the intensity of their emotional feelings on a scale consisting  of 10 emotional categories.  The procedure uses two series (A and B) of six film excerpts each, to elicit different emotional feelings: happiness, anger, fear, sadness, disgust and neutral. | Results indicated that PD patients at different stages of the disease did not  significantly differ from the controls in the self-reported emotional experience to the presented film excerpts. | -The main finding of the present study was that PD patients atdifferent stages of the disease (Early PD on-dopa and Advanced PD) did not significantly differ from HC in their emotional reactivity in terms of self-reported emotional experience – to the presentation of film excerpts intended to induce specific emotions.  -More generally, these findings are also in contrast to the numerous studies conducted in the domain of emotion recognition that demonstrated emotional processing deficiencies in PD (Assogna et al., 2008; Schröder et al., 2010;Sprengelmeyer et al., 2003). |
| [Péron J](http://www.ncbi.nlm.nih.gov/pubmed?term=P%C3%A9ron%20J%5BAuthor%5D&cauthor=true&cauthor_uid=22162004), [Dondaine T](http://www.ncbi.nlm.nih.gov/pubmed?term=Dondaine%20T%5BAuthor%5D&cauthor=true&cauthor_uid=22162004), [Le Jeune F](http://www.ncbi.nlm.nih.gov/pubmed?term=Le%20Jeune%20F%5BAuthor%5D&cauthor=true&cauthor_uid=22162004), [Grandjean D](http://www.ncbi.nlm.nih.gov/pubmed?term=Grandjean%20D%5BAuthor%5D&cauthor=true&cauthor_uid=22162004), [Vérin M](http://www.ncbi.nlm.nih.gov/pubmed?term=V%C3%A9rin%20M%5BAuthor%5D&cauthor=true&cauthor_uid=22162004). (2012). Emotional processing in Parkinson's disease: a systematic review.[*MovDisord.*](http://www.ncbi.nlm.nih.gov/pubmed/22162004)*27*(2), 186-99. | Parkinson’s disease constitutes a useful model for studying the neural substrates of emotional processing. | The databases were selected using Pubmed services with the following keywords: PD, emotion, facial expression, emotional prosody, subjective feeling, arousal. | -Researchers have reported deficits in several emotional components and processes in PD patients. These include not only changes in the emotional experience associating subjective feeling with physiological arousal, but also the impaired production and recognition of emotions conveyed by faces or voices. | -They have found a large body of evidence pointing to the existence of emotional disorders in PD. These concern several components of emotion, including subjective feeling, physiological arousal, motor expression and several input modalities. |
| [Kawamura, M](http://www.ncbi.nlm.nih.gov/pubmed?term=Kawamura%20M%5BAuthor%5D&cauthor=true&cauthor_uid=19131044)., [Kobayakawa, M](http://www.ncbi.nlm.nih.gov/pubmed?term=Kobayakawa%20M%5BAuthor%5D&cauthor=true&cauthor_uid=19131044).(2009). Emotional impairment in Parkinson's disease.[*Parkinsonism RelatDisord*.](http://www.ncbi.nlm.nih.gov/pubmed/19131044),*15*(1), 47-52. | Patients with Parkinson's disease (PD) may show emotional impairment in the early stages of the disease.  PD patients show disadvantageous decision-making, which is related to decreased emotional responses, as measured by skin conductance responses (SCRs). | I haven’t the full text so far…. | This pattern of decreasing SCRs is similar to that observed in amygdala-damaged patients. In facial expression recognition, PD patients did not show amygdala activation. | Emotional impairment in PD patients may reflect amygdala dysfunction in early PD. |