

## Perspectives from a low vision clinic: Impaired ability to recognise faces and facial expressions

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### Introduction

Many patients attending low vision services report difficulties with perception of faces and facial expressions, often-overlooked aspects of visual impairment that may have important consequences on social interaction and quality of life. Depending on the underlying cause, faces may appear dull or distorted, even at close distance. In other instances, faces are seen clearly, but are not recognisable. Failing to recognise people's identity, facial expressions, emotional states, and nuances of expression can be a considerable cause of anxiety, which may not always be detected in busy eye clinics. Some patients report a fear of social interaction due to the apprehension of offending others or unintentionally ignoring people. This can lead to social disengagement and negatively impact upon quality of life.<sup>1</sup>

### Causes of impaired face recognition

Accurate recognition of faces and facial expressions relies on three factors: 1) The face needs to be clearly seen, 2) there needs to be a visual memory of the face, and 3) this memory needs to match the face that is perceived in real time. Ocular visual impairment can render it difficult to form a clear image of the face. In neurological visual impairment, there can be additional dysfunction in the higher visual processing pathways. Developmental or acquired prosopagnosia (Table 1) refers to a specific face recognition problem due to impaired function of the face area in the fusiform gyrus in the temporal lobe.

### Ocular visual impairment

Patients with age-related macular degeneration (AMD) and other conditions causing loss of central vision often struggle to recognise faces. Reduced contrast sensitivity and visual acuity are associated with impaired full-face discrimination.<sup>2</sup> For some patients, it is no

longer possible to discriminate fine detail around a person's eyes, which is important for understanding a person's emotional state.<sup>3</sup> When interacting with others, these patients tend to look at the lower part of the face instead.<sup>4</sup> In glaucoma, increased sensitivity to central crowding, reduced visual fields, and contrast sensitivity, may also cause problems with face recognition. Diabetic patients tend to develop reduced contrast sensitivity before the onset of ocular manifestations, suggesting a neurological underpinning.<sup>2</sup> This deteriorates with the onset of diabetic eye disease. Visual field loss and reduced visual acuity further impair face recognition in glaucoma.

### Prosopagnosia

The term prosopagnosia is reserved for dysfunction of a specific area in the fusiform gyrus of the temporal lobe, formally known as the fusiform face area<sup>5</sup>. Memories of faces and facial expressions are not formed and therefore, instant recognition cannot occur. Developmental prosopagnosia refers to the congenital form and has a genetic component.<sup>6</sup> It is relatively common with an estimated prevalence of over 2%.<sup>7</sup> Brain images and vision are often otherwise normal<sup>5,6</sup> as opposed to acquired prosopagnosia, which develops after brain injury. In both conditions, additional problems with route finding are common as the area for place recognition is adjacent to that for face recognition. Dutton<sup>8</sup> identified a number of families where members had prosopagnosia and topographic agnosia of different degrees and in different combinations. People with prosopagnosia particularly struggle to identify people when they are encountered in an unexpected place, although this can happen to anyone. Most people can remember an instance where they were approached by a person who seemed to know them and yet they were not able to place them or identify them. Carefully listening to the voice and the topic of conversation trigger identification. This can be tiring and yet, people with prosopagnosia rely entirely on strategies like these in social situations.

**Table 1: Impact of visual dysfunctions on perception of faces and facial expressions**

Underlying mechanism	Location	Impaired function	Impact on face recognition
Basic processing	From the eye to the occipital lobe	Visual acuity	Fine facial features and subtle nuances not perceived
		Contrast sensitivity	Facial features blend in with the background
		Colour Vision	Facial features blend in with the background
		Visual field	Part of the face is obscured
		Central distortion	Faces appear distorted
Prosopagnosia	Face area in fusiform gyrus	Storage of visual memories of faces and facial expressions	No instant recognition of faces and facial expressions
Higher processing	Temporal lobe: Ventral stream network	Storage of visual memories of faces and facial expressions	No instant recognition of faces and facial expressions
	Parietal lobe: Dorsal stream network	Inattention/neglect	Part of the face is obscured
		Integrative agnosia	Inability to see faces as a whole, despite being able to distinguish separate features
		Dyskinesia	Inability to see fast moving facial expressions and mouth patterns
		Simultanagnosia	Inability to focus on a person's face when there is a competing visual stimulus

## Neurological visual impairment

Neurological visual impairment can be acquired as a result of brain injury presenting with identifiable structural brain lesions, or it can develop during pregnancy, birth, or early years in which case it is usually referred to as cerebral visual impairment (CVI). Primary visual functions as well as higher visual processing functions can be affected, depending on the location of the brain damage as explained in Table 1. CVI has been associated with impaired face recognition in periventricular leukomalacia and altered brain development in pre-term children, children born small for gestational age and cerebral palsy. A common feature in children with impaired face recognition is impaired word processing. Sigurdardottir<sup>9</sup> attributed the combination of impaired face recognition, word recognition and complex object recognition to ventral stream dysfunction. In adult stroke patients, impaired face recognition and facial emotion recognition are relatively common with a higher incidence (up to 50%) after a right hemisphere stroke. Alzheimer's disease and brain tumours are widely reported in the literature in connection with impaired face recognition and impaired recognition of facial expressions. Although the face area in the fusiform gyrus may be the neurological underpinning of these problems in some cases, one has to remember that both ventral and dorsal stream dysfunction can cause similar presentations.

## Interventions

Impaired perception of faces does not tend to be the first presenting symptom when patients attend an ophthalmology clinic, where the focus is on visual function, rather than on functional vision. Ophthalmologists are primarily concerned with treating the underlying condition. If ocular pathology is the cause for the functional impairments, including impaired face recognition, it is wise to treat this first. In neurological conditions, such as stroke, recovery of function is experienced in a number of patients but may not always be possible.<sup>10</sup> At this point, one needs to consider rehabilitation with a view to reducing the impact of face recognition impairment on everyday living through compensatory strategies and remedial training. Remedial training relies on the potential neuroplasticity of the face area in the fusiform gyrus and concerns visuo-cognitive training. One has to bear in mind that holistic face processing systems emerge in babies as young as 3 months of age. However, further development of this mechanism is thought to continue in the early years and into adolescence and beyond.<sup>11</sup> Compensatory strategies, on the other hand, seek to maximise remaining vision and to utilise alternative strategies. Different strategies are effective for different patients, depending on the underlying cause of the face recognition impairment. For example, people with ocular vision impairment, such as those with loss of central vision, may benefit from eccentric viewing strategies, whereby the patient learns how to use an area of intact retina away from the centre. For reduced contrast sensitivity, one can offer advice about optimal positioning and lighting, avoiding back light scatter to improve facial contrast. In dorsal stream dysfunction, reducing clutter in the background and in the facial area facilitates processing of visual information. In patients with dyskinetopsia, faces might be easier to perceive in people who are not moving (Figure 1).

## Learning from the experts

The true experts in the field of compensatory strategies for face recognition impairment are patients affected by this condition. Many patients are keen to share their experiences in order to provide an insight into their visual world and the way they overcome everyday challenges. One patient with macular degeneration reported social withdrawal as a result of impaired face recognition. He felt awkward when he failed to recognise his friends in the street and was worried that he might be perceived as being rude. After a while he started to tell his friends about his visual impairment and asked his friends to introduce themselves to him when they met. He also started to look out for other cues, such as



**Figure 1: Impaired face recognition can be caused by dyskinetopsia**

the clothes they wear, the tone of their voice and the way they walk. Over time, he has learned to cope with his condition and is keen to advise others about his newly found strategies. Another patient, with learning disability and CVI, reported frequently getting into trouble with people because she could not understand facial emotions and sometimes failed to recognise people she ought to have known. She had reduced visual acuity, colour vision and contrast sensitivity and tunnel vision as well as dorsal stream dysfunction. All these factors combined, explained her difficulties and after an explanation of her limitations in terms of functional vision, she and her carer started to think of ways to improve her social interaction. It was decided that other people in her immediate environment would introduce themselves. The seating arrangements around the dinner table were adapted, so that other people would be within her field of view and her main carer started to give identity prompts when encountering other people. They also started to provide a description of people's emotions when she was unable to gauge other people's mood or intentions. A young person with congenital cataract and glaucoma reported that, although she had adapted very well to her impaired facial recognition, she was aware of her problem on a daily basis. In social situations, she would introduce herself with the hope that the other person would do the same. Sometimes she would start with small talk to buy herself time or listen out for conversational cues before joining in. She much preferred to meet on social media, rather than face-to-face encounters. On some occasions she would ask others for identity prompts. She often recognised people by their voice, gait, clothes, hair style and body shape. A little girl with impaired face recognition skills and impaired processing of facial emotions was greatly helped when she was given some advice following her Low Vision assessment. At school, name tags were introduced, so that she could identify her classmates. Her situation was explained to her parents and teachers as well as to the other children in her class, so that her situation was understood, and support was offered spontaneously by her peers. Her mother was advised to wait in a pre-arranged location at school pick-up times, wearing a recognisable scarf. The family had already adapted well in the home situation. Both her parents consistently used the same perfume, so she could recognise them instantly by their smell.

## Conclusion

Impaired face recognition is relatively common in people attending a hospital eye service. If it is not managed well, it can have a detrimental effect on social interactions, leading to social withdrawal and reduced quality of life. A first step towards supporting these patients is to acknowledge their impairment. A next step could be treating the underlying condition or suggesting strategies to overcome this problem. A referral to Low Vision services is another option as further support and strategies can be explored.

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