Journal of Case Reports and Medical History

(ISSN: 2831-7416) *Open Access*

Case Report Volume 3 – Issue 9

Learning to Play the Piano Can Greatly Improve the Lives of Children on the Autism Spectrum

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Received date: 17 Nov, 2023 | **Accepted date:** 30 Nov, 2023 | **Published date:** 05 Dec, 2023

Citation: Proietto J and Proietto D. (2023) Learning to Play the Piano Can Greatly Improve the Lives of Children on the Autism Spectrum. J Case Rep Med Hist 3(9): doi https://doi.org/10.54289/JCRMH2300141

Introduction

Autism is a neurological disorder with clear clinical behavioural features. These include difficulties interacting and communicating with other people, showing restricted interests, indulging in repetitive behaviours and lack of imaginative play. While the above are required to have a diagnosis of being on the autism spectrum there are many other clinical features that can be present. These include several intellectual impairments ranging from mild to very severe, higher risk of epilepsy, anxiety, hyperactivity, eating disorders and symptoms of irritable bowel **[1]**.

The likely pathophysiology, of autism is that it is due to defective function of a gene or genes **[2]**. These genes are necessary to regulate the wiring of the brain particularly the frontal lobes. Autism is one of a group of neurodevelopmental disorders that include Prader-Willi syndrome (due to genes focused on the wiring of the base of the brain) and cerebral palsy (due to genes focused on the wiring of the motor cortex). The presence of bowel symptoms is due to the fact that the gut has its own nervous system. It is not easy to coordinate the function of a hollow tube in such a way that it moves the contents along in a coordinated way. This suggests that some of the genes that control the connectivity in the frontal cortex may also be involved in the proper wiring of the gut.

There is evidence that the prevalence of autism is rising, some of this is no doubt due to more awareness of the condition and to improved diagnostic criteria. However, a true increase in the prevalence may also be contributing **[3]**. The recent dramatic increase in the prevalence of autism suggests that there may be some factors in the environment that are altering gene expression through epigenetic mechanisms **[4]**.

Can individuals who are on the autism spectrum be helped in their life journey? It is worth asking this question because of the existence of the biological mechanism by which the brain changes itself by the production of new nerve cells and new nerve connections, a process that has been called neuroplasticity. It used to be thought that neuroplasticity only occurred in childhood but there is evidence that it can also occur in more mature brains **[5]**. What is the best way to induce brain changes? Surprisingly much of the research on neuroplasticity has used music as the tool **[6]**. There is evidence of the power of music playing to increase neuronal connections. Firstly, it has been shown that there are differences in the brain structures between musicians and non-musicians **[7]**. When playing the violin, the violinist uses the fingers of her left hand, giving those fingers a lot of exercise. This has been shown to cause anatomical change **[8]**.

Can music change the life course of a child on the autism

spectrum? This case report discusses one such child in whom music has had a dramatic impact on his life.

Case Report

Master J was a slowly developing child who at the age of 4 had no speech, no awareness of the outside World and very poor motor skills. He loved staring at lines and would often flap his hands. His parents took him to an appropriate health professional and were given a diagnosis of autism. They then organised a series of therapies including speech therapy, play therapy and occupational therapy. Prior to starting school, they took him to the Royal Children's Hospital in Melbourne for cognitive testing. He was diagnosed as being in the bottom 5% of his age group meaning that he would struggle to finish school. Because of this result, he was enrolled in a school for children with special needs.

When he was aged 7, he started learning the piano with a piano teacher who had been trained as a music therapist and who had a unique way of teaching. She had developed the Theraplay approach which focuses on the strengths of the children. After the first week, his tightly curled hands uncurled and he started playing notes with individual fingers. After the first year he could play competently with two hands. As his confidence improved, his parents transferred him to a regular school where he surprised them by coping well. In the school he became known as "The Piano Player". At high school he also took up the Trombone which allowed him to be a member of school bands. The students and teachers of the music department at the school were very supportive of him. In year 10 of school, he did the grade 7 piano exam and got an A. In the senior years of secondary school, he developed a love of music theory. He completed VCE (Victorian secondary school certificate) and enrolled in a Science degree at University.

As a young adult he now has regular full-time work and music is still very important to his social life. He often purchases music CD's on line. He joined a Folk Music Group that meets to practice weekly and which performs monthly. In January of every year, he attends the Koroit Lake School of Irish Celtic Song and Dance and has recently been appointed as Ticket Manager. He is a regular attender at Folk Festivals where he always takes his keyboard and often finds opportunities to play it with the other attendees. In Melbourne he is a regular attender of Concerts, especially of the Brandenburg Orchestra.

Discussion

This case report demonstrates the benefits of learning to play a musical instrument when there are neurodevelopmental problems. Music has a powerful effect to encourage neuroplasticity in the brain. This is likely due to the fact that it encourages repetitive movements of fingers and arms. As demonstrated in the homunculus **(figure 1)**, which represents the relative size of the different parts of the body in the brain. The hands have a very large representation in the motor cortex probably to allow fine and delicate movements of the fingers. There is no other human activity where there are long hours of repetitive movements as there are when a child is learning to play a musical instrument. There is evidence that new neural pathways depend on moving the limbs. Listening to music alone does not have this beneficial impact. While playing any musical instrument will have benefits, piano playing is probably the best instrument because it requires coordination of both hands.

Figure 1. Humunculus (from Wikipaedia)

Conclusion

All special schools must have a music program because it is the only activity that can improve neural connections and therefore anatomically improve neurodevelopmental problems.

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