University of Hertfordshire UH

Life and Medical Sciences
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NHS Hertfordshire Community NHS Trust

Study to investigate the effectiveness of using a humanoid robot (Kaspar) to improve the social skills of children with an Autism Spectrum Disorder: a randomised controlled feasibility trial

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Introduction

Early intervention leads to the best outcomes for children with a diagnosis of ASD.[1]

There is growing interest in using robots in autism– one such robot is Kaspar.[2]

A child plays games with a therapist using Kaspar as a mediator. All games contain elements of joint attention, turn-taking and imitation i.e. building blocks for social success.

Feasibility Aim

To test the practicality of running a definitive RCT within NHS settings on the effectiveness of robot mediated interaction for social skills development.

Method

Design/Setting

A mixed design, single blind feasibility RCT with two parallel groups. Participants were recruited from one NHS Trust (HCT) over an 11-month period. Children were randomised to receive an intervention with Kaspar and a therapist (KG), or the same intervention but with a therapist only (TOG).

Participants

42 children recruited from Communication Difficulties Assessment Clinic at HCT in Watford, UK.

Eligibility criteria

Children aged 5-10 years, diagnosed within the past year. Able to speak and/or understand English. With an IQ>=70. The Parent/carer to be able to understand written English. The child not receiving any social communication intervention not usual NHS care.

Procedure

Children randomly allocated into one of two groups:

Kaspar group

Therapist only group *(Offered Kaspar sessions once their involvement in the study finished)*

Intervention

2 familiarisation sessions followed by six therapy sessions of 20 minutes each.

Outcome measures

Completed at Baseline, 10 weeks after baseline and 12 weeks later:

Social Skills Improvement System.[3]

Social Communication Questionnaire.[4]

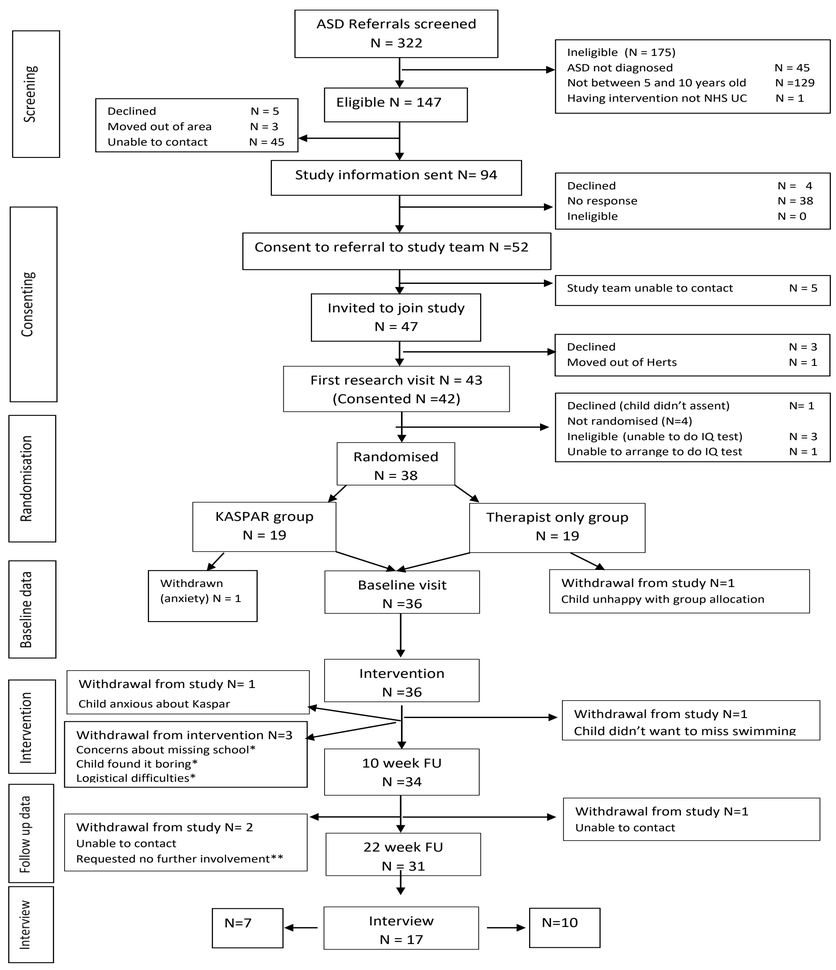
Parenting Stress Index – 4.[5]

Child Health Utility 9D.[6]

Child and Adolescent Service Use Schedule (amended version). [7]

Qualitative Analysis

Semi-structured interview with 50% of families.



- Agreed to complete study measures, ** had previously dropped out of intervention

Figure 1. CONSORT diagram

Results

Table 1. Feasibility results

Feasibility Criteria/data required	Outcome
More than 40% recruitment rate. Recruitment target – N=40 .	Feasibility criterion met: 45% of those who were sent details of the study were randomized. 40.4% gave consent. Recruitment target met: 42 families were consented.
Rate of attrition in each arm of the study less than 35% .	Feasibility criterion met: 18% of participants withdrew from intervention (26% in KG and 10% in TOG).
Completion of at least 80% of the questionnaires .	Feasibility criterion met: 96% of questionnaires completed.
Good acceptability of the intervention among clinicians, patients and their families.	Clinicians reported it would be a beneficial intervention for children with autism. Parents/carers were happy with the intervention. Both clinicians and families reported the intervention to be less engaging for older, more able children. Older children provided feedback to make the games more suited to them e.g. not nursery rhymes.
Positive feedback from clinical staff about scheduling clinics .	Interviews with clinicians indicated that it could be delivered in an NHS setting. Interviews with parents supported the provision of this therapy within the NHS.
The 80% confidence interval of the effect size between groups excludes zero in one of the possible outcome measures.	The 80% CI for SSIS problem behaviours did not include zero at 22 weeks.
Estimation of completion rates and identification of big cost drivers.	100% response rate for both measures.
Any issues with study design can be addressed.	The issues that arose were technology-related and can be addressed.

Table 2: The mean treatment effect (Therapy Only vs Kaspar) of the SSIS

		Therapy Only			Kaspar		
Timepoint	Total	N	Mean	SD	N	Mean	SD
Social Skills Improvement System (Social Skills)							
Baseline	36	18	64.83	15.14	18	72.33	18.43
10 Weeks	34	17	67.41	13.31	17	73.76	19.10
22 Weeks	31	16	69.63	12.94	15	76.53	24.55
Social Skills Improvement System (Problem Behaviour)							
Baseline	36	18	44.83	8.21	18	40.06	12.41
10 Weeks	34	17	41.00	9.51	17	41.65	15.17
22 Weeks	31	16	44.50	9.94	15	34.13	12.02

	Difference between study arms					
		Confidence interval			Confidence interval	
Timepoint	**Diff**	**Lower**	**Upper**	**d'**	**Lower**	**Upper**
Social Skills Improvement System (Social Skills)						
Baseline						
10 Weeks	-6.35	-17.86	5.15	-0.39	-0.68	0.05
22 Weeks	-6.91	-21.19	7.37	-0.36	-0.67	0.09
Social Skills Improvement System (Problem Behaviour)						
Baseline						
10 Weeks	-0.65	-9.49	8.20	-0.05	-0.40	0.32
22 Weeks	10.37	2.29	18.45	0.94	0.37	1.17

Conclusions

- ✓ All feasibility criteria were met.
- ✓ Some issues with the technology – these can be addressed.
- ✓ Possible to make games more complex, so engaging for older and more able children.
- ✓ Effect sizes indicate that the children showed improvements in their behaviour.
- ✓ Possible to run a definitive study to investigate whether using Kaspar in this way will improve children's social skills.

References

[1]Dawson G. Early intensive behavioral intervention appears beneficial for young children with autism spectrum disorders. Journal of Pediatrics 2013;162(5):1080-81. [2]Robins B, Dickerson P, Stribling P, et al. Robot-mediated joint attention in children with autism: A case study in robot-human interaction. Interaction studies 2004;5(2):161-98. [3] Gresham FM, Elliott SN. Social Skills Improvement System—Rating Scales. Minneapolis, MN: Pearson Assessments 2008. [4] Rutter M, Bailey A, Lord C. The Social Communication Questionnaire. Los Angeles: Western Psychological Services 2003. [5]Abidin RR. Parenting stress index. 4th ed. Lutz, FL: PAR 2012. [6]Stevens K. Valuation of the Child Health Utility 9D Index. Pharmacoeconomics 2012;30:729-47. [7]Byford S, Cary M, Barrett B, et al. Cost-effectiveness analysis of a communication-focused therapy for pre-school children with autism: results from a randomised controlled trial. BMC psychiatry, 2015;15(316):1.

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