

# There is insufficient evidence (level 4) to support or refute the use of therapy balls as an alternate form of seating for improving classroom behaviour of children with autistic/behavioural disorders.

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## **CLINICAL SCENARIO:**

There is currently increasing emphasis on the evaluation of sensory integration therapy by occupational therapists, for children with autistic and concomitant behavioural disorders. Children with autistic and behavioural disorders frequently exhibit difficulty with engagement, attention and appropriate behaviours for productive performance in the classroom. Therapists aim to provide these children with an opportunity to modulate sensory input, while maintaining appropriate levels of behaviour during school time. Anecdotal reports suggest that therapy balls as an alternate form of seating may provide a child with autistic and/or behavioural disorders with an opportunity to maintain appropriate classroom behaviours. How effective is such a treatment approach in changing the classroom behaviours of children with autistic/ behavioural disorders?

## **FOCUSSED CLINICAL QUESTION:**

Are therapy balls an effective form of alternate seating compared to typical classroom chairs in improving in class behaviour and attention of children with autistic/behavioural disorders?

## **SUMMARY of Search, 'Best' Evidence' appraised, and Key Findings:**

- Three citations were located that met the inclusion criteria - 2 studies involving single case series (level 4 evidence) and 1 descriptive/expert opinion (level 5 evidence) article.
- One study using single subject design was appraised (Schilling & Schwartz, 2004). This study evaluated the frequency of specific behaviours (attention and engagement), of four children with autism (ASD) before, during and after the use of therapy balls as alternate classroom seating.
- The study found that all four students displayed marked improvement in their in-seat behaviour and engagement during the use of therapy balls for alternate classroom seating. However, due to the study methods and potential biases, the results have limited generalisability and validity. This study does not provide conclusive evidence for the use of therapy balls as a form of alternate seating for children with autism.

## **CLINICAL BOTTOM LINE:**

For children with autism, therapy balls used for up to 10 minutes a day, for three weeks as an alternate form of classroom seating may improve in-seat behaviour and attention to class activities by as little as 25% or as much as 80%.

**Limitation of this CAT:** This critically appraised paper has been individually prepared as part of a university subject, reviewed and marked by a lecturer, but has not been externally peer-reviewed.

**SEARCH STRATEGY:**

Using the levels of evidence as defined by the Oxford Centre for Evidence-based Medicine (Phillips, Ball, Sackett, et al., 2001), the search strategy aimed to locate the following study designs:

- Systematic reviews and meta-analyses of randomised controlled trials (level 1a);
- Systematic reviews and meta-analyses of randomised and non-randomised controlled trials (level 2a);
- Randomised controlled trials (level 1b or 2b);
- Controlled trials, cohort (level 2b)
- Case-control studies (level 3b);
- Case series (level 4); or
- Expert opinion including literature/narrative reviews, consensus statements, descriptive studies and individual case studies (level 5).
- A search was also conducted for clinical practice guidelines.

**Terms used to guide Search Strategy:**

- **P**atient/Client: children, autism, autistic disorder, autism spectrum disorder, attention deficit disorder, pervasive developmental disorder
- **I**ntervention: therapy balls, alternate seating, dynamic seating, school intervention, therapy
- **C**omparison: typical classroom seating/ no treatment
- **O**utcome(s): behavioural and attention changes in the classroom

Databases and sites searched	Search Terms	Limits used
- New Zealand Guidelines group - UK guidelines	Alternate seating AND classroom behaviour AND autism OR ADHD OR attention deficit hyperactive disorder	N/A
Cochrane Library	Autism AND seating	NIL
OTseeker	Alternative seating OR therapy balls AND autism OR ADHD	NIL
PEDro	Autism, ADHD	NIL
Cinahl & Pubmed	Autism OR ADHD AND seating AND classroom AND behavio*	NIL
Eric	Alternative seating AND autism AND classroom	NIL
PsychINFO	Alternat* seating AND autism AND behavio*	NIL
Medline	Autism OR ADHD AND seating OR "therapy balls" AND behaviour AND classroom	NIL
Google Scholar	"Alternative seating" OR "therapy balls" AND autism or ADHD	NIL

## INCLUSION and EXCLUSION CRITERIA

### Inclusion Criteria:

- Studies including children aged 3 to 12 years
- Studies including children diagnosed with behavioural disorders (autism/ADHD)
- Studies investigating the use of therapy balls or alternative seating
- Attention to task or engagement in school activities measured as an outcome
- Studies focussing on behavioural changes as an outcome
- Studies published in English

### Exclusion Criteria:

- Adults
- Behavioural interventions not concerned with classroom seating

## RESULTS OF SEARCH

Three relevant studies were located and categorised as shown in Table 1 (Levels of Evidence, Centre for Evidence Based Medicine, 1998):

**Table 1:** Summary of Study Designs of Articles retrieved

Level of Evidence	Study Design/ Methodology of Articles Retrieved	Number Located	Source(s)
N/A	Clinical Guidelines	0	
Level 1a/ 2a	Systematic Reviews	0	
Level 1b/ 2b	Randomised Control Trials	0	
Level 3	Cohort Studies	0	
Level 4	Case series, single-subject (Schilling & Schwartz, 2004) (Schilling, Washington, Billingsley & Geitz, 2003)	2	Cinahl, Pubmed, PsychINFO, Google Scholar
Level 5	Descriptive, expert opinion (Mulligan, 2001)	1	Pubmed, Google Scholar

## BEST EVIDENCE

The article by Schilling and Schwartz (2004) was identified as the 'best' evidence and selected for critical appraisal. The reasons for selecting this paper were:

- The article met all inclusion/exclusion criteria, and addressed the focused clinical question
- Although the same level of evidence as the study conducted by Schilling and colleagues (2003), the study by Schilling and Schwartz (2004) had more participants (4 vs 3).
- Both studies used the same intervention and have a similar applicability to practice. However, the outcomes measured in Schilling and Schwartz (2004) were most specific to the clinical question. Schilling and colleagues (2003) also focused on in-seat behaviour but their alternate outcome was legible word productivity and was considered less appropriate to the clinical question.
- The study by Schilling and Schwartz implemented the intervention across varied ability levels, a variety of settings (compared to 1 classroom in Schilling et al, (2003) and during varied activities.

## SUMMARY OF BEST EVIDENCE

**Table 2:** Description and appraisal of a study using single subject withdrawal design (Schilling & Schwartz, 2004).

### ***Aim of the Study***

To examine the effects of therapy balls, as alternate seating, on the engagement and in seat behaviour of children diagnosed with autism spectrum disorder (ASD) within a school setting.

### ***Intervention Investigated***

The intervention involved the implementation of therapy balls at school in classroom settings that were individualised for each participant. The intervention was implemented during different classroom activities for each child based on a teacher interview that identified the activity and time of day that they deemed most difficult for the child (in areas of behaviour and engagement). Participant schedules and curriculum activities were not altered to accommodate the intervention process.

The duration of each intervention and outcome measure sessions varied from 5 minutes to a maximum of 10 minutes in length. Each phase was implemented for a minimum of two weeks with participants being observed at the same time each day. Three data collection sessions were scheduled each week. Subject absences and the unavailability of students due to changes in the school schedule, altered the amount of session per week. Children in this study sat on the therapy balls for a maximum of 10 minutes a day, for a period of three weeks.

The only change between baseline/withdrawal phases and the intervention phase was the implementation of the therapy ball for classroom seating.

### ***Outcome Measures (Primary and Secondary)***

The two primary outcomes of interest were improved seat behaviour and increased levels of classroom engagement.

#### Primary Outcomes

**In-seat behaviour** was measured as either “in-seat” or “out-of-seat”, based on whether the participants’ buttocks were in contact with the seat proportion of the chair, and the four legs of the chair were in contact with the floor (typical classroom chair). For the participant seated on the floor, in-seat behaviour was measured by the child being in an upright position with any proportion of his buttocks on the floor. On-ball behaviour was measured by any portion of the participants’ buttocks in contact with the ball, the ball being in contact with the floor and one foot in contact with the floor.

**Engagement** was measured as ‘engaged’ when the student was orientated towards appropriate classroom activities. ‘Non-engaged’ was when the student was not oriented towards appropriate activities, such as staring at people or an object unrelated to instruction.

#### Secondary Outcomes

**Social validity** was determined by means of a questionnaire completed by the teacher and teaching assistant of each child. Responses positively focussed on the therapy ball over the traditional classroom seating.

**Oppositional behaviour** to routine and request was a major issue for 1 out of the 4 participants therefore the frequency of oppositional behaviour was measured. This was a secondary measure to in seat behaviour and engagement. Oppositional behaviour was classified as the refusal to follow routine. Data for this variable were collected using a frequency count across the entire phase.

No standardised outcome measure was used. All measures were subjective and based on opinion.

**Data Collection**

Data collection occurred via real time sampling, where the recorders wore wireless headsets to hear a pre-programmed 10 minute tape that announced 'record' and the interval every 10 seconds

The authors of the study evaluated inter observer agreement or interrater reliability comparing the two raters a minimum of once per phase for each of the participants (the exact amount is not given). Interrater reliability for in-seat behaviour ranged from 95% to 100% ( $X = 98\%$ ) and for engagement ranged from 82% to 100% ( $X = 90\%$ ).

**Table 2: Results**

NB: All measures are approximations taken from Figures 1 to 4, in Schilling and Schwartz (2004).

**SUBJECT 1 – BENCH vs BALL**

<b>OUTCOME</b>	<b>Baseline (A) Mean &amp; Range</b>	<b>Intervention (B) Mean &amp; Range</b>	<b>Mean Difference</b>	<b>Withdrawal (A) Mean &amp; Range</b>	<b>Intervention B Mean &amp; Range</b>	<b>Mean difference</b>
Engagement (% of time engaged)	27 21 to 30	77 50 to 92	50	40 30 to 47	85 79 to 95	45
In seat (behaviours) (% of time in seat)	10 0 to 18	83.5 70 to 93	73.5	12.5 37 to 0	79 57 to 90	77.5

**SUBJECT 2 – CHAIR vs BALL**

<b>OUTCOME</b>	<b>Baseline (A) Mean &amp; Range</b>	<b>Intervention (B) Mean &amp; Range</b>	<b>Mean difference</b>	<b>Withdrawal (A) Mean &amp; Range</b>	<b>Intervention B Mean &amp; Range</b>	<b>Mean difference</b>
Engagement (% of time engaged)	39.9 30 to 50	75 50 to 80	35.1	64.1 70 to 49	88.7 82 to 97	24.6
In seat (behaviours) (% of time in seat)	16.2 0 to 39	83.3 70 to 95	67.1	9.6 40 to 0	89.2 82 to 100	79.6

**SUBJECT 3 – FLOOR vs BALL**

<b>OUTCOME</b>	<b>Baseline (A) Mean &amp; Range</b>	<b>Intervention (B) Mean &amp; Range</b>	<b>Mean difference</b>	<b>Withdrawal (A) Mean &amp; Range</b>	<b>Intervention (B) Mean &amp; Range</b>	<b>Mean difference</b>
Engagement (% of time engaged)	22.7 10 to 55	57.3 60 to 89	34.6	30 39 to 9	85.2 79 to 91	55.2
In seat (behaviours) (% of time in seat)	57.1 39 to 95	87.6 79 to 100	30.5	62.8 77 to 49	93.7 89 to 98	30.9

**SUBJECT 4- BALL vs CHAIR**

<b>OUTCOME</b>	<b>Intervention (B) Mean &amp; Range</b>	<b>Withdrawal (A) Mean &amp; Range</b>	<b>Intervention (B) Mean &amp; Range</b>	<b>Mean Difference</b>
Engagement (% of time engaged)	72.1 60 to 91	31.3 40 to 20	70.2 65 to 80	39.9
In seat (behaviours) (% of time in seat)	98.3 90 to 100	90.8 100 to 78	98.7 95 to 100	7.7
Oppositional Behaviour (Number of applied warnings)	0	212	0	212

**Original Authors' Conclusions**

"Findings of this study indicate substantial improvements in in-seat behaviour and engagement across all four participants when seated on therapy balls. This study demonstrated that the intervention was effective across varied ability levels, across a variety of classroom settings and activities. Although the results of this study provide one of the first empirically validated uses of sensory based treatment for children with ASD in a classroom setting, one must be cautious not to over generalise the findings" (Schilling & Schwartz, 2004).

**Critical Appraisal:****Validity** (*Methodology, rigour, selection, bias*)

- Due to the study method (single subject design, four subjects) the external validity and generalisability (across a wider population) of the study's findings are weak
- The study design permits individual differences and allows the child to serve as his or her own control. The study can be easily replicated with more than one client. It is difficult, however, to conclude whether the differences observed were due to the intervention alone, as other factors uninvolved with treatment may change over time (eg medication).
- There was no control group, therefore, no random allocation to groups. No comparisons were made between subjects receiving the intervention and subjects receiving no intervention. This reduces the certainty that the observed changes are due to the intervention.
- The small sample size (n=4) reduced the power of the study, with no power calculations reported. This study could act as a pilot to assist in providing calculations for future studies.
- The outcome measures used were non-standardised, subjective measures with obvious lack of validity and reliability. This lack of standardised measurement reduces the validity of the study's findings.
- The assessors were unidentified which could lead to measurement bias, and would be likely to favour the findings of improvement and change. To control measurement bias, the two assessors collected data using momentary time sampling where each recorder wore a wireless headset to hear a pre programmed tape that announced 'record' and the interval every 10 seconds so that each recorder did not chose when to write down results

- All results were estimated by the writer (KH) from the graphs within text (original authors contacted to request raw data, but not provided for inclusion). Clinical significance was estimated from the graphs; no estimates were available from the authors. Statistical significance was also not reported in the original study. All approximate findings are likely to contain bias, as they are personal approximations.
- The researchers report that baselines were stable before the intervention was initiated. However, visual inspection of graphs and results estimated suggest that the subjects did not show a stable baseline before the intervention was implemented. Up to 10 data points per phase would have been beneficial to show a stable baseline. Therefore, a change between baseline and treatment phases cannot confidently be attributed to the treatment applied. Variable baselines make interpretation of the results complex.
- Ethical approval/ parental consent was gained from the participant's parents before implementing intervention.
- There were insufficient data points collected per phase to enable accurate result interpretation. Only basic statistics and simple description of results could be developed.
- Recall bias from teachers in the form of a questionnaire could be evident; as it is more likely the teachers will recall positive responses rather than negative and this can favour the results of positive intervention.
- Timing of intervention was over short periods, a maximum 10 minutes per day with participants using therapy balls as alternate seating over a total of 3 weeks. These short periods may not represent the true behaviours or noticeable effect over a longer period of time or a typical school day or lesson

**Results** (*Favourable or unfavourable, specific outcomes of interest, size of treatment effect, statistical and clinical significance; minimal clinically important difference*)

- The results favour the use of therapy balls as a form of alternate seating for children. However, visual analysis of the graphs was required as no raw data or statistical analysis were provided. Means, standard deviations and statistical significance of individual change were not reported. On estimation of each participant results it was calculated that all participants displayed marked improvement in behaviour.
- It is proposed a change of 10% over time, between means across study phases is a clinical important change. Using this estimation, all 4 participants showed a clinically important change for both in-seat behaviour and engagement to classroom tasks. Participants had a minimum of 25%, and a maximum of 79.6% change, between baseline/withdrawal and intervention phases. There is the possibility that had a larger sample size been used, and the clinical significance been interpreted over a total population, the results could present differently.
- Assessment of the trends and levels between the phases were visually analysed and interpreted. There was an accelerated and variable trend when participants were assigned to the therapy ball. In the withdrawal phase, it was identified that a decelerating, variable trend was identified. This helps to specify that the behavioural direction for each participant varies from negative to positive (intervention) and from positive to negative (withdrawal). This indicates that there were distinct differences with in-seat behaviour and engagement to tasks for each participant during the intervention phase.

- Outcome measures used were non-standardised objective measures that limit clinical and functional significance of change however. However the inter observer reliability and agreement was high stating that the improvement during intervention was identified similarly across the board.
- No power calculations provided (therefore, interpretation of data from line graphs could be inaccurate)
- No information on costs or cost effectiveness was provided

## **IMPLICATIONS FOR PRACTICE / APPLICABILITY**

### **Clinical Implications**

- This study provides therapists with alternate classroom seating strategies for children with autism.
- Therapy balls have already been introduced to classrooms in Switzerland and Florida. Although the methodology of the appraised study limits the validity of results, the study found a clinically important difference in behaviour when children were seated on therapy balls (Schilling & Schwartz, 2004).
- Therapy balls cost less than \$40 (i.e they are relatively low cost), easily transportable and represent a simple intervention which therapists can replicate in schools.
- Outcome measures (the amount of time out of seat, the amount of time not attending to task, the amount of warnings required to behave) should ideally be taken before and after the intervention, in order to determine the treatment effect once intervention is ceased. If therapists and parents are seeking an intervention which might improve children's behaviour in the classroom, therapy balls could be introduced, using some of these suggested measures, before and after.
- The study methodology has limited generalisability and external validity, therefore it is suggested that therapists do not base their interventions solely on this study. However, in the absence of higher level of evidence, when therapists are making clinical decisions (on alternate seating as a form of sensory integration to improve in class behaviour) they should acknowledge their awareness to this study as it is the most current and highest level of evidence to date.
- Another study conducted by Schilling and colleagues (2003) suggested similar results for the same intervention, and thus has similar applicability to practice. It is suggested that therapists also use this study to inform their practice.
- Therapists may wish to use an outcome measure such as the Engagement Check (Parsons et al, 1989) that is standardised and quantifies behaviour, along side the observational method. It is recommended that information regarding validity and reliability is sought before the outcome measure is considered for practice.
- Schilling and Schwartz allowed up to 10 minutes per day over a 3-week period for the child to be seated on the therapy balls. Therapists must be cautious if implementing this intervention into practice, as there was no suggested accountability period for 'novelty' effects. However, in the study conducted by Schilling et al (2003), students used the balls for 1 week prior to data being collected, thus accounting for novelty effect and still resulting in overall positive outcomes.

- When fitting a child for a therapy ball, it is important that the diameter of the ball allows the child can sit comfortably with his/her feet flat on the floor, with knees and hips flexed at 90 degrees. It is recommended that therapists contact the manufacturers of the therapy balls to ensure correct individual measurements.
- A further consideration for the use of therapy balls as alternate seating for children within the classroom is the reported improvement in arousal level whilst maintaining a healthy, safe and productive posture. It is suggested that therapists obtain a copy of the following studies (Schroder, 1997; Lear & Pomeroy, 1994; Witt & Talbot, 1998) for appraisal.

### Research Implications

- The appraised study (Schilling & Schwartz, 2004) represents a major contribution to research and practice, in the absence of other higher level evidence on alternate classroom seating for children with autism. The study adds to findings previously published by Schilling et al (2003).
- The study provides a stepping-stone for a larger study to be conducted in the future. The improvements reported for in-seat behaviour and engagement support the need for further study and replication. Children with autism, ADHD and other behavioural disorders could be randomly selected and assigned to a treatment or control group over a longer intervention period; random allocation and use of a control group would provide more rigorous and reliable findings. School-based therapists need to continue to study the use of therapy balls within the classroom in order to help the students in need to succeed

### REFERENCES

Phillips, B., Ball, C., Sackett, D., Badenoch, D., Straus, S., Haynes, B. & Dawes, M. (1998). Levels of evidence and grades of recommendations. [http://www.cebm.net/levels\\_of\\_evidence.asp](http://www.cebm.net/levels_of_evidence.asp) accessed May, 2005.

#### Article critically appraised:

Schilling, L.D. & Schwartz, I.S. (2004). Alternative seating for young children with autism spectrum disorder: Affects on classroom behaviour. *Journal of Autism and Developmental Disorders*, 34(4), 423-432.

#### Related Articles (not individually appraised)

##### Level 4 Evidence

Schilling, D.L., Washington, K., Billingsley, F.F. & Deitz, J. (2003). Classroom seating for children with attention deficit hyperactivity disorder: Therapy balls versus chairs. *The American Journal of Occupational Therapy*, 57(5), 534-541

##### Level 5 Evidence

Mulligan, S. (2001). Classroom strategies used by teachers of students with attention deficit hyperactivity disorder. *Physical & Occupational Therapy in Paediatrics*, 20(4), 25-44