King's Research Portal

DOI:

[10.1111/scd.12434](https://doi.org/10.1111/scd.12434)

Document Version

Peer reviewed version

[Link to publication record in King's Research Portal](#)

Citation for published version (APA):

Mac Giolla Phadraig, C., Asimakopoulou, K., Daly, B., Fleischmann, I., & Nunn, J. (2020). Nonpharmacological techniques to support patients with intellectual developmental disorders to receive dental treatment: A systematic review of Behaviour Change Techniques. *SPECIAL CARE IN DENTISTRY*, 40(1), 10-25.
<https://doi.org/10.1111/scd.12434>

Citing this paper

Please note that where the full-text provided on King's Research Portal is the Author Accepted Manuscript or Post-Print version this may differ from the final Published version. If citing, it is advised that you check and use the publisher's definitive version for pagination, volume/issue, and date of publication details. And where the final published version is provided on the Research Portal, if citing you are again advised to check the publisher's website for any subsequent corrections.

General rights

Copyright and moral rights for the publications made accessible in the Research Portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognize and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the Research Portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the Research Portal

Take down policy

If you believe that this document breaches copyright please contact librarypure@kcl.ac.uk providing details, and we will remove access to the work immediately and investigate your claim.

Non-pharmacological techniques to support patients with intellectual developmental disorders to receive dental treatment: A systematic review of Behaviour Change Techniques.

Abstract

Aims: To identify the non-pharmacological patient-support-techniques(nPSTs) reported, used or recommended for people with Intellectual-Developmental-Disorders(IDD) to receive dental treatment; to identify their active ingredients and evaluate their effectiveness by adopting an existing taxonomy of behaviour-change-techniques(BCTs).

Methods and results: Following a protocol, a search strategy was undertaken using Medline, Embase, Cochrane Library, Scopus, Cinahl and Psycinfo(EBSCO). Selection criteria were applied, with review and extraction in duplicate. A comprehensive list of nPSTs were identified and coded by their constituent Behaviour-Change-Techniques(BCTs), where *BCT-taxonomy-Version-1*. criteria were satisfied. Quality assessment was undertaken and effectiveness of BCTs reported. From 915-screened articles, 23 were included. In 207 instances nPSTs were identified, representing 46 distinct nPST techniques, such as positive-reinforcement(n=18) and tell-show-do(n=9). Of the 207 nPST codes, 135 were coded as BCTs(65.2%). The most commonly coded BCT was *Demonstration of the Behaviour*(BCT6.1; n=25). Considering studies of interventions(n=11), all were at moderate to critical risk of bias. No interventions or outcome measures were comparable across studies.

Conclusion: This is the first review to bring together techniques dentists use in practice and theory-driven BCTs. A significant overlap between nPSTs and BCTs was evident supporting the use of BCT taxonomy to code dental interventions. No strong evidence supporting any intervention was identified.

Clinical Significance: This review identifies a need for consensus on key elements of design and reporting of nPST studies. BCT taxonomy should be applied to describe and develop interventions that work.

Key words: Behaviour management; Dental treatment; Intellectual disability; Behaviour Change Technique

Funding: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Introduction

Intellectual developmental disorder (IDD) describes a group of developmental conditions characterized by significant impairment of cognitive functions, which are associated with limitations of learning, adaptive behaviour and skills [1]. The term IDD refers to approximately one per cent of western populations. People with IDD have poor oral health outcomes [2, 3].

In order to provide professional dental care that is safe, effective and acceptable, dental teams offer a range of supports to patients who have IDD. Together, these techniques are often referred to as behaviour management or behaviour support techniques. In this review, we refer to them as *Patient Support Techniques* (PSTs), emphasising the person-centred focus that ought to underlie their application. PSTs are often differentiated as either pharmacological (pPSTs) or non-pharmacological (nPSTs). Pharmacological techniques are well defined and include a range of sedation techniques and general anaesthesia. Whereas Non-pharmacological techniques are less clearly defined and vary from tell-show-do and positive reinforcement to physical interventions such as clinical holding.

The successful use of nPSTs opens a door for patient access to comprehensive oral care in a traditional setting, for a lifetime [4]. Many nPSTs are preferable to sedation or general anaesthesia for several reasons. Firstly, they enable treatment that is least restrictive of the patient's rights and freedom of action by reducing reliance on restrictive pharmacological and physical supports, while promoting a positive experience of dentistry. Secondly, nPSTs provide an opportunity for the learning of coping skills for professional and home-based oral care. Thirdly, they impact downwards the costs and risks of dental care [5, 6]. Finally, whilst effective use of nPSTs can ensure access to care, a lack of skills and training in nPSTs presents a serious barrier to the provision of this care [7, 8]. While nPSTs should be applied based on sound clinical principles [9], dentists may need to be supported in their understanding and use of nPSTs. [10] [11]. For example, by increasing awareness of the rationale behind using any nPST [12][13] so that such use is grounded in the evidence-base and is applied with the rigour expected in all other areas of dental science. This would ensure that people with IDD are supported appropriately.

The lack of evidence supporting the use of nPSTs for people with IDD is well documented [5, 6, 14, 15]. A fundamental issue is the lack of a common language describing what it is that dentists actually do to support their patients with IDD. Whilst commonly used pPSTs can be clearly and distinctly described according to composition, dosage, route and protocol, the same is not true about nPSTs. The lack of clear exposition of such techniques makes them difficult to identify or differentiate [16].

This creates a lack of clarity and overlap in the terms used within this field. This happens by labelling the same technique differently and conversely by labelling different techniques similarly. Terms that may exemplify such indistinction include ‘acclimatisation’, ‘desensitisation’ and ‘familiarisation’.

Such problems are not unique to dentistry. For example, behavioural scientists, having faced similar difficulties with enhancing understanding, theory and practice of techniques supporting effective behaviour change, have developed a unified, valid and robust taxonomy with which to describe behaviour change interventions across disciplines [17]. The Behaviour Change Technique Taxonomy (BCTtV1) is a taxonomy of 93 hierarchically clustered techniques that identifies the “active ingredients” of behavioural interventions across disciplines [18].

To date, the overlap between patient behaviour support in dental care and behaviour change more generally remains unexplored. Behaviour change techniques (BCTs) are actions taken by oneself or by another that include the performance of wanted behaviours and/or inhibition of unwanted behaviours whereas nPSTs, from a behavioural perspective, are interventions applied in a dental context to enable the behaviours necessary for successful dental treatment. Whilst it might be reasonable to assume an overlap between BCTs and nPSTs, there is no valid or reliable means of categorizing all nPSTs so as to understand the ‘active ingredients’ of commonly used nPSTs. Similarly, dental nPST research may help inform and shape BCT research by, for example, expanding its scope and focus. If the BCTtV1 accurately describes the active ingredients at work in nPSTs this would allow for valid, reliable labelling within this discipline, promoting description, planning, evaluation, improvement and replication of evidence based nPSTs.

This systematic review reports on non-pharmacological patient support techniques that are reported, used or recommended specifically for people with IDD in order to receive dental treatment and assesses the fit and effectiveness of these techniques in an existing taxonomy of behaviour change techniques (BCTs).

Methods

Design

A systematic review following a pre-defined protocol (Prospero ID CRD42017057146). Research questions:

1. What non-pharmacological patient support techniques (nPSTs) are used, reported or recommended to use with people with Intellectual Developmental Disorder (IDD) to receive dental treatment?

2. What active ingredients or Behaviour Change Techniques (BCTs) are present within nPSTs?
3. What evidence exists for the effectiveness of BCTs for use with people with IDD to receive dental treatment?

Search strategy

Searches were undertaken in Medline, PubMed, Embase, Cochrane Library, Scopus, Cinahl and Psychinfo (EBSCO). The search string used in Medline (Ovid) is listed below ([Supplemental Table 1](#)) and was adapted for other databases. Articles were also identified through citation searching, authors' bibliographic database and consultation with experts. Searches were re-run just before final analyses and further studies retrieved.

[Link Supplemental Table 1 to be included in text above](#)

Study selection

The eligibility criteria for this review are listed in Table 1. Regarding the population, only studies involving people with IDD or conditions typically characterized by IDD were included. Studies that specifically excluded people with IDD or where the population was defined by another condition such as dementia or autism were excluded. For studies evaluating effectiveness, comparisons included normal care, placebo or other technique. Outcomes included scales and indices of behaviour, cooperation and anxiety; measures of behaviour across frequency, intensity, duration and magnitude; the need for and use of restraint and sedation; physiological measures such as galvanic skin conductance and heart rate. Regarding design, experimental and pre-experimental studies of interventions were included as were cross-sectional surveys of the acceptability of PSTs and robust narrative reviews (that met a minimum quality assessment score)[19]. Opinion articles, qualitative studies and case reports were excluded.

Instructions were developed, piloted, refined and applied for the screening process. Pairs of authors screened titles and abstracts independently. Full texts were retrieved and independently assessed for eligibility by pairs of authors. Disagreement was resolved through discussion and consensus reached.

Table 1 about here.

Data extraction

Utilising standardised, pre-piloted forms, data were extracted for assessment of study quality and synthesis, in duplicate. All authors extracted data independently. Differences were agreed through discussion. Pairs of authors extracted all nPSTs and BCTs independently and tables were produced to

include general features such as characteristics, design, sample details, outcome measures, follow-up and outcome, where appropriate. Missing data were requested from study authors, when indicated [12, 20].

Analysis

To develop the list of nPST terms, pairs of authors independently extracted all sections of text that described techniques to support patients, into an Excel spreadsheet. These were then labeled independently, with agreement through discussion. nPST labels were developed on the actual terms used and/or their description rather than behavioural science theory. When a nPST was described but not named, a label was assigned by two authors, reflecting the terminology commonly associated with the technique in other studies or in dental practice. Similar labels were then aggregated. An attempt was made to aggregate codes conceptually where nPSTs shared similar features. However, given the complete lack of clarity in both the description of PSTs and their underpinning theoretical basis, this empirical exercise did not aim to support the development of a robust nPST terminology.

Where there was adequate description to meet the criteria necessary to specify a BCT according to BCTtV1 all coded nPSTs were broken down in constituent BCTs, coded as either + (BCT present in all probability but evidence not clear) or ++ (BCT present beyond all reasonable doubt, clear evidence available). Pairs of authors applied the BCT taxonomy independently, with agreement by discussion where necessary. All authors undertook training in the use of the taxonomy.

We report the list and frequencies of identified PSTs and BCTs found in all studies. Meta-analysis was not possible due to heterogeneity of design, sample, intervention and outcome.

Quality assessment

Pairs of authors independently assessed the risk of bias for all studies. Disagreements were resolved by discussion. Standard criteria were used for the assessment of risk of bias from Cross-over RCTs (ROB) [21], Non-randomised studies of interventions (ROBINS-I) [22] and Cross-sectional surveys (NIH-QAT) [23]. Narrative reviews were not assessed for risk of bias due to their inherent bias, however, only higher quality reviews were included [19].

Results

Figure 1 demonstrates flow at each stage of the review. Twenty-three studies were included: eleven pre-/ experimental, seven cross-sectional and five narrative reviews. Summary tables are included in Table 2.

Figure 1 about here

Table 2 about here

Frequency of Patient Support Techniques (nPSTs) and Behaviour Change Techniques (BCTs)

Number of reported nPSTs per paper ranged from 1- 35. In total, 207 nPST codes were extracted, representing 45 distinct non-pharmacological techniques (Table 3). Of the 207 nPST codes, 123 were reportedly used, 45 were tested for effectiveness and 39 tested for acceptability. In 128 instances nPSTs were recommended, 61 were presented neutrally and in 18 instances, PSTs were positively not recommended, mainly for ethical reasons; for example, Hand over mouth +/- airway restriction. Regarding evidence to support the associated recommendation / non-recommendation: Primary evidence supporting the paper's associated recommendation/non-recommendation of a nPST was presented for 62 nPST codes, whilst secondary evidence (referencing other articles such as AAPD guidelines) was present for 101 nPST codes. There was no evidence offered for 44 nPST codes. By way of summary, all nPST codes were loosely gathered into seven overarching groups: Reinforcement (n=50); Modelling (n=16); Desensitisation (n=24); Distraction / Relaxation (n=20); Other communication strategies (n=40); Adaptation of clinical environment (n=17) and Physical intervention (n=38).

Table 3 about here.

From 207 coded nPSTs, 135 were coded as BCTs (65.2%). Of the identified BCTs, 37% were identified with high certainty (n= 52) and 63.0% were of low certainty (n=83). In total, the literature was found to include 31 distinct BCTs from a list of 93 (33.3%) potential techniques (Table 4). The most commonly recorded BCTs were Demonstration of the Behaviour (BCT6.1; n=25); Exposure (BCT7.7; n=17); Material Reward (Behaviour) (BCT10.2 n=15); Social Reward (BCT10.4 n=12); Instruction on how to perform a behaviour (BCT4.1 n=10) and Distraction (BCT12.4 n=10).

Table 4 about here.

Effectiveness of BCTs

BCT effectiveness was assessed by examining all experimental / pre-experimental studies of interventions (n=11). These were two nRCTs[12] [24], two *pre-post design (no control)* [25] [26], two *multiple baselines design*[27] [28], two *controlled, post-test only designs*[29] [20], two *one-shot case studies*[30] [31]and one *Cross-over randomised trial* [32].

In total, 268 participants were included. Sample size ranged from n=3 to n=63. All participants had IDD plus or minus other features, some included adults (n= 67), children (n=64), adults and children (n=74) and 63 were unclearly assigned.

Studies evaluated behaviours among participants who were engaged in a variety of dental tasks that included: entering the dental office without sedation (n= 1) [25]; attending for a dental visit (n=4) [20, 28, 29, 31] ; undertaking dental prophylaxis (n=3) [30] [26] [32]; mocking up a dental procedure to the point of placing an activated drill in mouth (n=1) [12] and scaling (n= 2) [27] [24]. Outcome measures were also varied and included six different Likert scales of cooperation, behaviour and/or anxiety[32] [29] [30] [20] [25] [27] four task analyses (ranging from five to 34 steps) [24, 26, 28, 31]; eight measures of frequency / magnitude / duration / presence of specific behaviours [12, 20, 24, 25, 27, 30-32]; five physiological measures including heart rate monitoring and galvanic skin conductance [20, 30, 32]; two counts of use of sedation [24, 25] and two of the use of restraint by the dental team as proxy measures of PST success/failure[12, 24]. The clinical significance of tasks and outcomes were unclear.

Interventions were poorly described in most studies, though there were exceptions [12]. In ten of the 11 studies, interventions contained codable BCTs: The exception involved the prior receipt of information by a dentist regarding prospective patients. [29] Only one study compared BCTs to other BCTs, while other controlled studies compared outcomes to waiting list control or routine care. Table 2 demonstrates that no interventions or outcome measures were comparable across studies. The 'active ingredients' in each study are listed in Table 2. Studies often lacked control groups or repeated measures; sample sizes were generally small. With reference to [Supplemental Table 2](#), the one Cross-over RCT identified was at high risk of bias. Applying ROBINS-I criteria, eight studies were at critical risk, one at serious risk and one at moderate risk of bias, meaning that nine studies had some important problems or were problematic or too problematic to provide any useful evidence for synthesis. Quality assessment domains most at risk of bias related to possible confounding, selection bias, and bias in measurement of outcomes.

[Link to Supplemental Table 2 in-text above.](#)

Notwithstanding this serious risk of bias, some BCTs were associated with improvements in outcomes; Restructuring the physical environment 12.1[32]; Material reward (behaviour) 10.2 with Reward approximation 14.4 and Reduce prompts/cues 7.3 [12]; Restructuring the social environment 12.2, [25] ; Exposure 7.7th, Demonstration of the Behavior 6.1, Reward approximation 14.4, Body changes 12.6, Non-specific Reward 10.3[24]; Instruction on how to perform the behaviour & Demonstration of the Behaviour 4.1&6.1 and Exposure 7.7 and Material Reward (Behaviour) 10.2 and Social reward 10.4

and Reward approximation 14.4 and Adding objects to the environment 12.5 and Non-specific Reward 10.3 [27]; Social reward 10.4 & Material Reward (Behaviour) 10.2 and Adding objects to the environment 12.5 [26]; Exposure 7.7 with Incentive (outcome) 10.8, Prompts/cues 7.1, Reduce Prompts/cues 7.3, Biofeedback 2.6(+), Body changes 12.6, Mental rehearsal of successful performance 15.2 and Demonstration of the Behaviour 6.1 [31]. In the only head-to-head study, Exposure 7.7 with Social reward 10.4 and Reward alternative behaviour 14.8 were identified as maybe being more effective than Demonstration of the Behaviour 6.1[28]. There was no evidence supporting the effectiveness of BCTs such as Body changes 12.6, Distraction 12.4 and Demonstration of the behaviour 6.1 with Material Reward (Behaviour) 10.2[20]. While not currently considered a BCT, receiving prior information may not be effective [32].

Taken together, there is limited evidence, mostly at high, serious or critical risk of bias, for the effectiveness of any BCT present in nPSTs to support people with IDD to undertake very basic dental treatment.

Discussion

This is the first review to attempt to bring together techniques dentists use in practice and theory-driven BCTs. This process identified 45 distinct ways in which dental teams support patients with IDD to receive dental care (nPSTs). Whilst it may be easy to consider them broadly under seven headings (reinforcement; modelling; desensitisation; distraction / relaxation; other communication techniques; adapting clinical environment and physical intervention), the difficulty with such a grouping exercise implies a theoretical underpinning and reliable and valid use of language that was not present in the work reviewed. Whilst not presented quantitatively, coding nPSTs in this study was hampered by inherent problems in the language, design and reporting of the included studies. Therefore, although used here for summary purposes, we warn against the use of these overarching terms, as such use is likely to perpetuate the mislabelling of interventions that confounds this field. Knowing this, our comprehensive collection of PSTs might form the basis upon which future work can explore their active ingredients.

Given that dentists are not usually formally trained in Behaviour Change and that psychologists behind the BCT taxonomy did not develop it for dentistry *per se*, it was encouraging to note that there was some overlap between nPSTs and BCTs. This process demonstrated that about a third of recognised BCT techniques might explain about two thirds of what dentists do to support people with IDD. When focusing on intervention studies, where more detail is available, this taxonomy performed even better, with only one intervention not codable by its BCT. Meanwhile, many of the nPST techniques

did not match any BCT, such as those involving physical intervention, giving control (surprisingly) and voice control. So, some of what dentists do is outside of the realm of BCT, as it is currently defined. This has implications for the concept of a BCT taxonomy, which is being refined within and across disciplines[33].

Across included studies, heterogeneity was high regarding design, sample selection, experimental conditions, interventions, outcome measures, and reporting. Indeed 'dental treatment' meant different things across studies. Many studies focused on elementary tasks such as examinations or prophylaxis, which are probably far easier to cope with than other essential dental procedures such as local anaesthetic injections and fillings, making generalisability across dental procedures unlikely. Apart from one study, all were at high, serious or critical risk of bias. Bias was most likely in domains such as selection and confounding biases. Bias was also critical regarding outcome measurement, which is often inherently subjective in this area of research. Blinding of participants and operators was also challenging. Adopting the BCT framework, as in this review, it was clear that there is very weak evidence supporting the effectiveness of any active ingredient identified.

Limitations of our process

A limitation of this study was the difficulty in coding nPSTs. The lack of standardised valid and reliable taxonomy limited data extraction from a literature that exacerbated these issues. In comparison, BCTtV1 had clear descriptors of what to code and training in how to code. Nevertheless, the authors did find it difficult to wield this tool too. Previous research has highlighted difficulties in training coders in its application [34].

Implications

The lack of a common language, framed with rigour, to describe how dental teams do and should support their patients with IDD has restricted the development of how these skills are learned, practiced and researched. This has fostered a tendency for dentists to apply what is effective in their hands rather than based on evidence. This review offers a first step in the process to develop evidence-based practice in this field.

The lack of common language encourages disparities in how we learn and teach these skills. This has led to an apprenticeship model, whereby dentists learn and teach techniques that may be unrepeatable across practitioners and incomparable to each other and to the broader field. This study offers a bridge to emerging frameworks for teaching behaviour change, that can be applied interdisciplinarily, as well as across dental curricula from behaviour support to smoking cessation to oral hygiene support.

This review informs both research reporting and design. The lack of a common language has meant that interventions that aim to support patients with IDD can be difficult to interpret, understand what works, repeat and improve. Retrospectively applying such taxonomies can be fraught and open to interpretation and error. We call for all researchers working in this field to code their interventions according to agreed taxonomies. At this point, the BCTtV1 can be recommended for this purpose, although it could also be improved. There is a need for consensus in how this is to be applied within the dental profession. Regarding design, future research can address confounding and selection bias through appropriate design, particularly through well-randomised controlled trials. Consensus regarding index procedures and a core-set of outcome measures that include validated and objective measures would reduce heterogeneity, enable comparison and reduce risk of measurement bias.

Conclusions.

This is the first review to attempt to bring together techniques dentists use in practice and theory-driven BCTs. It was encouraging that there was overlap between PST and BCTs. Now we have greater insight into what dentists use and what may or may not be effective, and we know what part of this is theory-mapped. The next step is to seek consensus on key elements of design and reporting. Then research can focus on key nPSTs that overlap with BCTs and develop intervention that work, train dental teams to adopt these, and move away from untested, a-theoretical attempts at behaviour support.

References

- [1] L.S. Carulla, G.M. Reed, L.M. Vaez-Azizi, S.-A. Cooper, R.M. Leal, M. Bertelli, C. Adnams, S. Cooray, S. Deb, L.A. Dirani, S.C. Girimaji, G. Katz, H. Kwok, R. Luckasson, R. Simeonsson, C. Walsh, K. Munir, S. Saxena, Intellectual developmental disorders: towards a new name, definition and framework for “mental retardation/intellectual disability” in ICD-11, *World Psychiatry* 10(3) (2011) 175-180.
- [2] L.M. Ward, S.A. Cooper, L. Hughes-McCormack, L. Macpherson, D. Kinnear, Oral health of adults with intellectual disabilities: a systematic review, *Journal of Intellectual Disability Research* 0(0).
- [3] N.J. Wilson, Z. Lin, A. Villarosa, A. George, Oral health status and reported oral health problems in people with intellectual disability: A literature review, *Journal of Intellectual & Developmental Disability* 44(3) (2019) 292-304.
- [4] R.A. Lyons, Understanding basic behavioral support techniques as an alternative to sedation and anesthesia, *Special Care in Dentistry* 29(1) (2009) 39-50.
- [5] J.T. Newton, Restrictive behaviour management procedures with people with intellectual disabilities who require dental treatment, *Journal of Applied Research in Intellectual Disabilities* 22(2) (2009) 118-125.
- [6] F. Kemp, Alternatives: A review of non-pharmacologic approaches to increasing the cooperation of patients with special needs to inherently unpleasant dental procedures, *The Behavior Analyst Today* 6(2) (2005) 88.

- [7] G. Smith, S. Rooney, J. Nunn, Provision of dental care for special care patients: the view of Irish dentists in the Republic of Ireland, *Journal of the Irish Dental Association* 56(2) (2010) 80-84.
- [8] P.S. Casamassimo, N.S. Seale, K. Ruehs, General dentists' perceptions of educational and treatment issues affecting access to care for children with special health care needs, *Journal of Dental Education* 68(1) (2004) 23-8.
- [9] D. Faulks, L. Freedman, S. Thompson, D. Sagheri, A. Dougall, The value of education in special care dentistry as a means of reducing inequalities in oral health, *European Journal of Dental Education*. 16(4) (2012) 195-201.
- [10] H.M. Kawia, H.S. Mbawalla, F.K. Kahabuka, Application of Behavior Management Techniques for Paediatric Dental Patients by Tanzanian Dental Practitioners, *The Open Dentistry Journal* 9 (2015) 455-461.
- [11] M. Humza Bin Saeed, B. Daly, J.T. Newton, Knowledge and practice of behavioral management principles among dentists treating adults with learning disabilities, *Special Care in Dentistry* 32(5) (2012) 190-5.
- [12] R. Kohlenberg, D. Greenberg, L. Reymore, G. Hass, Behavior modification and the management of mentally retarded dental patients, *ASDC Journal of Dentistry for Children* 39(1) (1972) 61-7.
- [13] L. Marks, N. Adler, H. Blom-Reukers, J.H. Elhorst, A. Kraaijenhagen-Oostinga, J. Vanobbergen, Ethics on the dental treatment of patients with mental disability: results of a Netherlands - Belgium survey, *Journal of Forensic Odontostomatology* 30 Suppl 1 (2012) 21-8.
- [14] B. Peltier, Psychological treatment of fearful and phobic special needs patients, *Special Care in Dentistry* 29(1) (2009) 51-7.
- [15] J.E. Nathan, Behavioral management strategies for young pediatric dental patients with disabilities, *ASDC Journal of Dentistry for Children* 68(2) (2001) 89-101.
- [16] C. Mac Giolla Phadraig, C. Griffiths, P. McCallion, M. McCarron, J. Nunn, Communication-based behaviour support for adults with intellectual disabilities receiving dental care: A focus group study exploring dentists' decision-making and communication, *Journal of Intellectual Disabilities* 1744629517738404.
- [17] C. Abraham, S. Michie, A taxonomy of behavior change techniques used in interventions, *Health Psychology* 27(3) (2008) 379.
- [18] S. Michie, M. Richardson, M. Johnston, C. Abraham, J. Francis, W. Hardeman, M.P. Eccles, J. Cane, C.E. Wood, The behavior change technique taxonomy (v1) of 93 hierarchically clustered techniques: building an international consensus for the reporting of behavior change interventions, *Annals of Behavioral Medicine* 46(1) (2013) 81-95.
- [19] G. La Torre, I. Backhaus, A. Mannocci, Rating for narrative reviews: concept and development of the International Narrative Systematic Assessment tool, *Senses and Sciences* 2 (2015) 31-5.
- [20] J. Boj, J. Davila, A study of behavior modification for developmentally disabled children, *ASDC Journal of Dentistry for Children* 56(6) (1989) 452-457.
- [21] J.P. Higgins, S. Green, *Cochrane handbook for systematic reviews of interventions*, John Wiley & Sons, 2011.
- [22] J.A. Sterne, M.A. Hernán, B.C. Reeves, J. Savović, N.D. Berkman, M. Viswanathan, D. Henry, D.G. Altman, M.T. Ansari, I. Boutron, ROBINS-I: a tool for assessing risk of bias in non-randomised studies of interventions, *BMJ* 355 (2016) i4919.
- [23] Natioal Institute of Health, Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies., 2014. <https://www.nhlbi.nih.gov/health-pro/guidelines/in-develop/cardiovascular-risk-reduction/tools/cohort>. (Accessed 21/07/2019).
- [24] S.C. Altabet, Decreasing dental resistance among individuals with severe and profound mental retardation, *Journal of Developmental and Physical Disabilities* 14(3) (2002) 297-305.
- [25] C.M. Cajares, C.M. Rutledge, T.S. Haney, Animal assisted therapy in a special needs dental practice: An interprofessional model for anxiety reduction, *Journal of Intellectual Disability-Diagnosis and Treatment* 4(1) (2016) 25-28.

- [26] S. Yilmaz, Y. Ozlü, G. Ekuklu, The effect of dental training on the reactions of mentally handicapped children's behavior in the dental office, *ASDC Journal of Dentistry for Children* 66(3) (1999) 188-91, 154-5.
- [27] K.B. Maguire, B. Lange, M. Scherling, R. Grow, The use of rehearsal and positive reinforcement in the dental treatment of uncooperative patients with mental retardation, *Journal of Developmental and Physical Disabilities* 8(2) (1996) 167-177.
- [28] C. Conyers, R.G. Miltenberger, B. Peterson, A. Gubin, M. Jurgens, A. Selders, J. Dickinson, R. Barenz, An evaluation of in vivo desensitization and video modeling to increase compliance with dental procedures in persons with mental retardation, *Journal of Applied Behavior Analysis* 37(2) (2004) 233-238.
- [29] D. Meurs, M. Rutten, A. De Jongh, Does information about patients who are intellectually disabled translate into better cooperation during dental visits?, *Special Care in Dentistry* 30(5) (2010) 200-205.
- [30] J.M. Davila, J. Menendez, Relaxing effects of music in dentistry for mentally handicapped patients, *Special Care in Dentistry* 6(1) (1986) 18-21.
- [31] J. Neumann, S.C. Altabet, R. Fleming, Behavioral medicine interventions for individuals with severe/profound mental retardation, *Mental Health Aspects of Developmental Disabilities* 3(3) (2000) 98-104.
- [32] M. Shapiro, R.N. Melmed, H.D. Sgan-Cohen, S. Parush, Effect of sensory adaptation on anxiety of children with developmental disabilities: a new approach, *Pediatric dentistry* 31(3) (2009) 222-228.
- [33] J. Presseau, N.M. Ivers, J.J. Newham, K. Knittle, K.J. Danko, J.M. Grimshaw, Using a behaviour change techniques taxonomy to identify active ingredients within trials of implementation interventions for diabetes care, *Implementation Science* 10(1) (2015) 55.
- [34] C.E. Wood, M. Richardson, M. Johnston, C. Abraham, J. Francis, W. Hardeman, S. Michie, Applying the behaviour change technique (BCT) taxonomy v1: a study of coder training, *Translational behavioral medicine* 5(2) (2015) 134-148.
- [35] C. Connick, M. Palat, S. Pugliese, The appropriate use of physical restraint: considerations, *ASDC journal of dentistry for children* 67(4) (2000) 256-62, 231.
- [36] M. Romer, Consent, restraint, and people with special needs: a review, *Special care in Dentistry* 29(1) (2009) 58-66.
- [37] A.M. de Castro, F.S. de Oliveira, M.S. de Paiva Novaes, D.C. Araújo Ferreira, Behavior guidance techniques in Pediatric Dentistry: attitudes of parents of children with disabilities and without disabilities, *Special Care in Dentistry* 33(5) (2013) 213-217.
- [38] I. Elango, D. Baweja, P. Shivaprakash, Parental acceptance of pediatric behavior management techniques: a comparative study, *Journal of Indian Society of Pedodontics and Preventive Dentistry* 30(3) (2012) 195.
- [39] J.T. Newton, P. Sturmey, Students' perceptions of the acceptability of behaviour management techniques, *European Journal of Dental Education* 7(3) (2003) 97-102.
- [40] P. Sturmey, M. Thomsett, G. Sundaram, J.T. Newton, The effects of method of behaviour management, client characteristics, and outcome on public perceptions of intervention acceptability in paediatric dentistry, *Behavioural and Cognitive Psychotherapy* 31(2) (2003) 169-176.
- [41] A.C.B. Oliveira, S.M. Paiva, I.A. Pordeus, Parental acceptance of restraint methods used for children with intellectual disabilities during dental care, *Special Care in Dentistry* 27(6) (2007) 222-226.

Table 1. Inclusion and exclusion criteria

	Inclusion	Exclusion
Population	Adults or children with ID, or terms likely to include this population ^a	General population without disabilities; Conditions, specifically identified as not ID e.g. autism, dementia, etc.
Intervention	Study reports, uses, or recommends non-pharmacological patient support techniques: Specific focus on dental clinical environment.	Study does not report, use or recommend non-patient support techniques; Not specifically focused on dental clinical environment
Comparison (For experimental/quasi-experimental designs only)	No comparison, usual treatment, waiting list control, alternative intervention	
Date	No date restriction	
Types of study to be included	Studies of interventions Clinical Guidelines Reviews Surveys and cohort studies	Case reports, case series Opinion and editorials Qualitative studies
Language	No language restriction	

^a Including Special Healthcare Needs, Special, Disabled etc.

Table 2a: Summary table of studies of interventions.

Study details	Intervention, PST & BCT	Measures	Results	Conclusion
Shapiro, 2009 (Israel) [32]. Cross-over randomised trial Prophylactic procedures Sample size: n=16 procedures	Sensory Adapted Environment: v. Routine care (n=16) BST: <i>Restructuring the sensory environment</i> (6.2) with <i>Immobilisation by a restrictive device</i> (7.3) BCT: Restructuring the physical environment 12.1(++) with NA	Anxiety and Cooperation Scale (5 Point Likert); Negative dental behaviours checklist (5 point Likert); Electrodermal activity	Outcomes (I v II): Likert - Mean 3.34 v 1.94 (p<0.01). Duration of anxious behaviours: M 9.0 v 23.4 mins (p<0.01); Number of anxious behaviours Mean 4.1 v 4.6 (p>0.05); Magnitude of anxious behaviours 8.5 v 15.5 (p<0.05) Mean EDA 1,230kohms v 446kohms (p<0.001) e.g. lower state of arousal; Relaxation: Mean EDA 2014 v 763 (p<0.01)	As applied in this study, Restructuring the physical environment 12.1(++) may improve cooperation among children with IDD for dental prophylaxis. However, this is uncertain because this study adopted a small sample. While references for power calculation are provided, details of calculation unclear. No blinding undertaken.
Meurs, 2010 (Netherlands) [29] Randomised controlled, post-test comparison First dental visit Sample: n=57	Dentist received information about the patient prior to dental visit (n = 29) v. Routine care n=28) (BST: Receiving information about patient (4.5); BCT: NA)	Behavior Rating Scale (5-point Likert)	Outcomes (I v II): Likert - Cooperation Scale scores - Information Group: n=23, M=2.2(SD=1.4) v No information group: n= 21, M= 2.0(SD= 7.2). NS	As applied in this study, receiving information about the patient prior to the dental visit (not a BCT) may not lead to behavior change for adults and children with IDD at first dental visit.

Davila, 1986 (USA) [30] One-Shot Case Study Exam; prophylaxis; operative stimuli. Sample size: n=24	Vocal music v. Instrumental music v. Routine care (n=24) BST: Providing music for relaxation (3.3.1) with Familiarisation (1.6) BCT: Body changes 12.6(+)& Distraction 12.4(++)	Visual assessment and anxiety rating scale (5-point Likert); Three pen polygraph; Electrodermal activity	Outcomes (I v II): Likert - Unclear 3. Visual assessment rating scale omitted due to lack of validity. Validity reported to be in the range of .25-.48. Reporting unclear. 2. GSR no statistically significant difference reported using ANOVA (Mean GSR scale score of .91 (No music); .75 (Vocal Music) and .38 (Instrumental Music). Bivariate analyses between conditions reported to show difference between no music and instrumental music conditions. No descriptive statistics presented ($p < 0.05$)	Body changes 12.6(+) & Distraction 12.4(++), as applied in this study, did not show association with improved outcomes for adults with IDD undergoing dental stimuli.
Boj, 1989 (USA) [20] Non-randomised, controlled post-test comparison First dental visit	Video Modeling v. Routine care BST: <i>Video Modeling</i> (1.4.2) with <i>Positive Reinforcement</i> (1.2.1) BCT: Demonstration of the behavior 6.1(++) with Material Reward (Behaviour) 10.2(+)	Heart rate, Cooperation scale (5-point Likert)	Outcomes (I v II): Likert - NS Data not presented. Presentation of p values indicate that no difference between intervention and control for Melamed BPRS and Cooperation Scale.	Demonstration of the behavior 6.1(++) with Material Reward (Behaviour) 10.2(+) as applied in this study, may not be effective for 3-4 year olds with IDD in attending the dentist for the first time.

Sample: n=28			Difference noted ($p<0.05$) in heart rate at Step 1 (positioning), Step 2 (Oral exam) and 6 (end of appointment) in favour of control group (No video modelling)	
Kohlenberg, 1972 (USA) [12] non-Randomised controlled trial Sit back; pay attention; open mouth with drill on Sample size: n=17	Behaviour modification (n=9) v. routine care (n=8) BST: <i>Positive reinforcement</i> with <i>Shaping</i> and <i>Fading</i> (1.2.1 & 1.1.1 & 1,1,4) BCT: Material reward (behaviour) 10.2 (++) with Reward approximation 14.4(++) and Reduce prompts/cues 7.3(++)	Counts: Seconds mouth open; number of restraining behaviours by the dental team	Mouth open: Intervention group: from approx. 52% to 70% (18% difference) of time with mouth open v Control group: from approx. 45.5% to 44% (difference 1.5%) of time mouth open. Difference at post-test between groups ($p<0.02$). Mean number of restraining movements: Intervention group: from 1.3 restraints pre-test to 0.5 restraints post-test v. Control Group: mean pretest restraints = 1.2 and mean post-test = 1.2 restraints. At post-test, difference in mean number of restraints used between control and intervention noted ($p<0.005$), having been similar at pre-test.	Material reward (behaviour) 10.2 (++) with Reward approximation 14.4(++) and Reduce prompts/cues 7.3(++) as applied in this study may be effective for children with IDD to open their mouths with a drill on. Measures are reliable and the intervention was applied with fidelity. However, this is uncertain because the study lacks generalizability, as it is non-randomised, underpowered, and likely to be at risk of Type 2 error.

Cajares, 2016 (USA) [25] Pre-test- post-test comparison Enter dental surgery for sedation without coaxing or premedication Sample size: n=30	Pre-exposure to Animal Assisted Therapy v. Post-exposure (n=30). BST: <i>Animal assisted therapy</i> (6.3.2) BCT: Restructuring the social environment 12.2 (++)	ADAMs Anxiety (5-point Likert); Count of behaviours; Use of sedation	Outcomes: (I v II): Mean = 4.3 (SD 0.8) v 2.9 (SD=0.9) (p<0.05) % exhibiting agitation: 83.3% v 20%; % exhibiting combative behaviours 33.3% v 20%; % needing coaxing or sedation to enter surgery 83%(based on chart comparison) v 16.7% post-AAT.	Restructuring the social environment 12.2 (++) , as applied in this study, may be associated with reduced anxiety and improved behavior among adults attending for dental sedation. However, this is uncertain because the design does not allow assumption of causation due to lack of control group and validity of data collection. Statistical methods for continuous data not clear. Pretest data (for comparison) for two of three variables taken from chart at previous visit. Power calculation not reported.
Altabet, 2002 (USA) [24] Non-randomised controlled trial Dental cleaning	Systematic Desensitisation (n=35) v WL control (n=28) BST: <i>Systematic desensitisation</i> (1.5.1) with <i>Modeling</i> (1.4), <i>Relaxation</i> (3.3), <i>Reinforcement</i> (1.2) and <i>Shaping</i> (1.1.1) BCT: Exposure 7.7 (++) , Demonstration of the Behavior 6.1 (+), Reward	Number of steps in hierarchy	Outcomes: (I v II) Qualitative improvement in at least one area of observation noted among 63% of Intervention Group v 39% of control group (non-significant).	Exposure 7.7 (++) , Demonstration of the Behavior 6.1 (+), Reward approximation 14.4(+), Body changes 12.6 (+), Non-specific Reward 10.3 (+) as applied in this study may be effective for people with IDD to undergo dental cleaning, although this effect is so

Sample size: n=63.	approximation 14.4(+), Body changes 12.6 (+), Non-specific Reward 10.3 (+)		Intervention group: 19/35 (54%) demonstrated an increase in number of steps completed v Control Group: 6/28 (21%) demonstrated an increase at second observation compared to pre-test ($p < 0.05$). Intervention group: Mean increase of 1 step following intervention (7.5 – 8.5 steps) v. Control Group: Mean decline of 0.2 (9.2 – 9.0 steps) at post-test ($p < 0.01$). No difference in % of participant use of sedation (graphic presentation) between groups. No difference in % of participant use of restraint (graphic presentation) between groups.	small it may not be clinically relevant. However, transferability of intervention unclear as the desensitization process was intensive: twice a week for 8 weeks minimum. Inclusion of group (n=12) who partially completed process indicates shorter intervention may be similarly effective. Validity uncertain because small sample suggests that power was inadequate; Unequal outcome measures at baseline (mean 7.5 v 9.2 steps) suggests non-random selection may have influenced study. Possible ceiling effect.
Maguire, 1996 (USA) [27] Multiple baseline	Pre-multi-component intervention v. Post-intervention (n=4). BST: Multi-component behavioural intervention including: Tell-Show-Do (4.4) and Familiarisation (1.6) and Manageable	<i>Cooperation Index</i> (4-point Likert) converted; Count of	Outcomes: (I v II): Mean resistance score from pretest to post-test: 15.3 v 0.9.	A multicomponent intervention consisting of Instruction on how to perform the behavior & Demonstration of the Behavior 4.1&6.1(++) and Exposure 7.7(++)

Sit calmly in chair, be quiet, hands in laps, mouth open, tolerate procedure. Sample size: n=4	Discomfort (4.7) and Give control (4.1) and Positive Reinforcement (1.2.1) and Providing fidgets and comforters (6.1.1) and Reinforcement (1.2). BCT: Instruction on how to perform the behavior & Demonstration of the Behavior 4.1&6.1(++) and Exposure 7.7(++) and Material Reward (Behaviour) 10.2(++) and Social reward 10.4(++) and Reward approximation 14.4(++) and Adding objects to the environment 12.5(++) and Non-specific Reward 10.3(++)	cooperative / resistant behaviours.	All subjects: Mean resistance score from pretest to post-test 15.3 v 0.9. Hypothesis test not presented All subjects significantly decreased their resistance as the intervention was implemented.	and Material Reward (Behaviour) 10.2(++) and Social reward 10.4(++) and Reward approximation 14.4(++) and Adding objects to the environment 12.5(++) and Non-specific Reward 10.3(++) as applied in this study may be effective at reducing in-chair resistance to dental treatment for adults with IDD. The magnitude of effect is potentially clinically significant, but needs further testing in more challenging situations. Study design limits external validity.
Yilmaz, 1999 (Turkey) [26] Pre-test- post-test comparison Dental prophylaxis (5-step) Sample size: n=20	Pre-Reinforcement v. Post-intervention (n=30) BST: <i>Reinforcement</i> (1.2) and <i>Providing fidgets and comforters</i> (6.1.1) BCT: Social reward 10.4 (+) & Material Reward (Behaviour) 10.2 (+) and Adding objects to the environment 12.5 (+)	Number of steps in hierarchy	Outcomes: (I v II) At baseline 4/18 (22.2%) participants completed all steps v 17/20 (85%) at post-test.	A multicomponent intervention involving Social reward 10.4 (+) & Material Reward (Behaviour) 10.2 (+) and Adding objects to the environment 12.5 (+) could be effective for children with IDD to receive dental prophylaxis. The magnitude of effect is potentially clinically significant. However,

				design lacks control group. Therefore, caution in attributing causation.
Neumann, 2000 (USA) [31] One-Shot Case Study Dental visit (34-step) including scaling for two participants. Sample: n=3	Systematic Desensitisation with reinforcement BST: <i>Systematic desensitization</i> (1.5.1) with <i>Positive reinforcement</i> (1.2.1), <i>Prompting</i> (1.1.3), <i>Fading</i> (1.1.4), <i>Biofeedback</i> (1.2.6), <i>Relaxation</i> (3.3), <i>Visualisation</i> (3.1.1) and <i>Modeling</i> (video and in vivo) (1.4&1.4.1&1.4.2), BCT: Exposure 7.7(++) with Incentive (outcome) 10.8(++), Prompts/cues 7.1(++), Reduce Prompts/cues 7.3(++), Biofeedback 2.6(+), Body changes 12.6(++), Mental rehearsal of successful performance 15.2(+) and Demonstration of the Behavior 6.1(++).	Heart Rate, Number of steps in hierarchy; Count restraint; Count sedation	Outcomes: (I v II) Described descriptively. One participant was able to tolerate full scaling after 5 simulated scaling; One was able to tolerate partial scaling after four sessions. One, whose behaviour was most severe at the onset, allowed exam and fluoride application at the end of therapy. Heart Rate not reported.	A multicomponent intervention involving Exposure 7.7(++) with Incentive (outcome) 10.8(++), Prompts/cues 7.1(++), Reduce Prompts/cues 7.3(++), Biofeedback 2.6(+), Body changes 12.6(++), Mental rehearsal of successful performance 15.2(+) and Demonstration of the Behavior 6.1(++). as applied individually in this study may improve dental behaviours in adults with IDD allowing scaling. However, the design does not allow for inference of causation; the intervention was applied differently across participants who varied greatly in their need for intervention and outcome. Reporting does not follow conventional format.

Conyers, 2004 (USA) [28] Multiple baseline Dental examination (18-step) Sample size: n=6	I. Systematic Desensitization (n=3 +2) v. Video modeling (n=3-2) BST: <i>Systematic desensitisation</i> (1.5.1) with <i>Reinforcement</i> (1.2) and <i>Partial Reinforcement</i> (1.2.3). V BST: Video modeling (1.4.2) BCT: Exposure 7.7 (++) with Social reward 10.4 (++) and Reward alternative behavior 14.8 (++) . V BCT: Demonstration of the Behavior 6.1 (++)	Number of steps in hierarchy	Outcomes: (I v II) Data presented Graphically: Approximate description as follows: Desensitisation effective for 5/5 (100%), presented graphically as 4=18/18 and 1=13/18 giving a mean of 17/18 steps completed, range 13-18) and video modelling effective for 1/3 who started with a score of 13/18, and not effective for two (66%).	Exposure 7.7 (++) with Social reward 10.4 (++) and Reward alternative behavior 14.8 (++) may be more effective than Demonstration of the Behavior 6.1 (++) for completing tasks involved in dental examination in adults with IDD, as both are applied in this study. However certainty unclear due to design, possible confound of learning effect and small sample, mean that generalization is impossible.

PST=Patient Support Technique, BCT= Behaviour Change Technique

Table 2b: Summary table of narrative reviews

Study details	Findings	PSTs (BCTs)
Connick, 2000 [35] Aim: Offer guidance on need for and appropriate use of restraint for people with profound ID	Data collection: Selection strategy clear: Focused review of relevant law and literature. Connick offers an extensive and authoritative discussion on the use of physical intervention for dental care, and	Clinical Holding (NA); Mechanical Restraint (NA); Desensitisation (7.7 (+))

Reference population: Adults and children with profound ID who require support in specific conditions	related issues. Article endorsed by National Association of Protection and Advocacy Systems (NAPAS).	
Kemp, 2005 [6] Aim: Review of general and specifically behavioural approaches that appear in the dental literature Reference population: Adults and children with special needs	Data collection: Selection strategy clear: Expansive in-depth discussion on “representative and selective (not exhaustive)” literature. Findings: Broad review considering behavioural approaches to decrease resistance and increase cooperation with appraisal of individual studies. Common characteristics of effective treatments are outlined and their limitations discussed. Strong psychological perspective with practical suggestions.	Reinforcement (14.2&10.3(+)); Escape extinction (NA); Modeling (6.1(++)); Desensitisation (7.7(++)); Familiarisation (8.1(+)); CBT (3.1(++)); Distraction (12.4(++)); Relaxation (12.6(+)); Hypnotherapy (NA); Give control (NA); Tell-Show-Do (4.1 &6.1(+)); Communication (NA); Nonverbal communication (NA); Restructuring the social environment (NA); Scheduling treatment length / timing / flexibility / postponement (NA); Clinical Holding (NA); Mechanical Restraint (NA); Hand over mouth +/- airway restriction (NA); Positive reinforcement (10.4(+)); (10.2 + 10.4(++)); (10.8 & 10.4 & 10.2(++)); (10.2+10.4 + 3.1(+)); Differential reinforcement (14.6(+)); Information (4.1(++)), Reprimand (14.2(+)); Requests (NA); Voice control (NA); Providing fidgets and comforters (12.1(+)) and Animal assisted therapy/companion animal (12.2(+))
Lyons, 2009 [4] Aim: Offer expert guidance on the principles of basic behavioural support.	Data collection: Selection strategy unclear: Strategies identified from AAPD guidance; Clear outline of search strategy in some sections and not in others. [4]	Shaping (8.1(++)); Positive reinforcement (10.2&10.4(++)); Contingent escape (14.10(++)); Escape extinction (NA); Modeling (6.1(++)); Desensitisation (7.7(++)); Repetitive tasking (8.1(++)); Noncontingent escape (7.5(++)); Tell-Show-Do

Reference population: Adults and children with special care needs	Findings: Extended discussion on range of non-invasive, non-pharmacologic behavioural techniques, applied to adults with developmental disabilities.	(4.1&6.1(++));Non-verbal communication (NA); Distraction (12.4(++)); Hypnosis (NA); Restructuring the physical environment (12.1(++)); Flexibility (NA); Consistency (NA).
Newton, 2009 [5] Aim: To review literature on non-restrictive supports. Reference population: Adults with ID and challenging behaviours	Data collection: Selection strategy unclear: Mainly studies of dental behaviour management in individuals with ID Findings: Newton emphasises the unacceptable nature of restrictive physical supports. Newton's review highlights that there is a need for research into non-restrictive behaviour management of individuals with intellectual disabilities who require dental treatment.	Voice control (NA); Tell-show-do (4.1&6.1(+));Positive reinforcement (10.3(+)); Distraction(12.4(+)); Non-verbal communication(NA); Desensitization (7.7(++)); Modeling (6.1(+)); Non-contingent escape (3.1(++)); Differential reinforcement (10.2&12.4(++)); Contingent escape (14.10(+)); Mechanical restraint (NA); Hand over mouth +/- airway restriction (NA)
Romer, 2009 [36] Aim: Expert guidance on physical intervention with people with ID; To review of the literature and applicable laws pertaining to consent issues. Reference population:	Data collection: Selection strategy clear: systematic approach taken to summarise legislation, case law, and literature. Findings: Romer briefly lists alternatives to physical intervention after a comprehensive review on clinical holding and related issues with list of alternative techniques from paediatric literature. This article covers many aspects of restrictive practice relevant to dentists in the field of Special Care Dentistry.	Modeling (6.1(+)); Distraction (12.4(+)); Desensitisation (7.7 (+)); Reinforcement (NA); Clinical holding (NA)

Adults and children with special needs.		

PST=Patient Support Technique, BCT= Behaviour Change Technique

Table 2c. Summary table of cross-sectional surveys

Study details	Findings	PSTs (BCTs)
de Castro, 2013 [37] Aim: To compare acceptance of Behaviour Guidance Techniques (BGTs) between parents of children with and without IDD. Sample: Eighty parents of children between 4-8yrs of age shown techniques and asked to score acceptability.	Data: Acceptability of BGTs using a Likert scale. Findings: de Castro <i>et al.</i> test the acceptability of a comprehensive menu of techniques (source=AAPD). Basic techniques showed higher rates of acceptance than advanced techniques.	Voice control (NA); Non-verbal Communication (NA); Tell-Show-Do (4.1 +6.1(+)); Positive reinforcement (10.2(+)); Distraction (12.4(+)); Parental presence / Absence (3.3(+)); Physical restraint (NA); Mechanical restraint (NA); Hand over mouth (NA)
Elango, 2012 [38] Aim: To compare acceptance of BGTs between parents of children with and without SHCN Sample: Parents of children with and without Special healthcare needs; n=102 divided in three groups.	Data: Acceptability of BGTs using a visual analogue scale Findings: Elango <i>et al.</i> test the acceptability of a comprehensive list of behaviour management techniques. Hand Over Mouth should be used with caution.	Tell Show Do (4.1 + 6.1(+)); Positive Reinforcement(10.2&10.4(+)); Modeling (6.1(+)); Contingent escape (14.10(+)); Mouth Prop (NA); Voice control (NA); Physical restraint (NA); Hand over mouth (NA)

Humza bin Saeed, 2012 [11] Aim: To measure dentists' knowledge and practice BGTs for adults with ID. Sample: Dentists throughout UK: n=53; 37 specialists and 16 non-specialists	Data: Acceptability of BGTs using a Likert scale and knowledge of BGTs. Findings: Humza bin Saeed <i>et al.</i> test the acceptability of 15 BGTs. These included 10 behavioral management techniques and five other techniques (pharmacological and physical interventions) derived from the literature. All dentists were confident in applying PSTs while knowledge was very low.	Tell-Show-Do (4.1 & 6.1 (+)); Voice Control (NA); HOM+/-AR (NA); CBT (13.2(+)); Negative Reinforcement (14.10(+)); Desensitisation (7.7(+)); Video modeling (6.1(+)); Distraction (12.4(+)); Nonverbal communication (NA); Positive Reinforcement (10.3(+)); Non-contingent escape (7.5(+)).
Marks, 2012. [13] Aim: to evaluate ethical considerations expressed by dentists in the Benelux towards the use of physical restraint for people with ID Sample: Dentists attending specialist SCD organisations / meetings in Holland and Flanders: Response rate 66 %; (n = 172) in the Netherlands and 95 % (n = 44) in Belgium. N= 216	Data: Attitudes towards a number of PSTs including nitrous oxide sedation and restraint by carers and dental staff. Outcomes: Marks <i>et al.</i> largely focus on ethical dilemma of use of restraint. Many dentists report concern about the use of physical intervention, with manual fixation perhaps most acceptable.	Hypnotherapy (NA); Clinical Holding (NA); Mechanical restraint (NA)
Newton, 2003 [39] Aim: To compare acceptability of BGTs among dental students Sample: Dental Students in London; n=131 dental students	Data: Standardized measure of the acceptability of behavioural treatments using vignettes in educational setting: Treatment Evaluation Inventory, (TEI) as reported by Kazdin, French and Sherick, 1981. Outcome: Newton <i>et al.</i> found that dental students' acceptability of techniques varied depending on outcome and presence of disability. List of techniques sourced from AAPD guidelines.	Clinical Holding (NA); Mouth prop (NA); Voice Control (NA); Tell-Show-Do (4.1 & 6.1(+)); Relaxation; Positive Reinforcement (12.6 & 10.2(+)); Mechanical restraint (NA); HOM+/-AR (NA).

Sturmey, 2003 [40] Aim: To evaluate the acceptability of a restrictive procedure used in dentistry: the hand over mouth technique Sample: n=218 members of general public. Equal males and females.	Data: Modified measure of the acceptability of behavioural treatments using vignettes in educational setting: Treatment Evaluation Inventory, (TEI) as reported by Kazdin, French and Sherick, 1981. Outcomes: Sturmey <i>et al.</i> found that members of the public rated effective methods of intervention as highly acceptable irrespective of child characteristics and independent of intervention method used. There was a marginally significant effect whereby the hand over mouth method of behaviour management during dental procedures was perceived as somewhat less acceptable than relaxation training and reinforcement; however, the effect was of modest size.	HOM+/-AR (NA); Mechanical restraint (NA); Voice Control (NA); Clinical Holding (NA); Reinforcement (10.1(+)); Relaxation (12.6(+)); Give control (NA); Tell-Show-Do (4.1 and 6.1(+)); Mouth prop (NA); Parental inclusion (3.3(+)); Provide toys and fidgets 12.5(+)
Oliveira, 2007 [41] Aim: To analyze parental acceptance regarding physical and chemical restraint on patients with intellectual disabilities. Comparison between with and without disabilities. Sample: 209 ex 227 invited parents/legal guardians of children with intellectual disabilities	Data: Two examiners judged and validated the data collection instruments (questionnaire and diagram). Findings: Oliveira <i>et al.</i> found that parents considered active restraint (50.7%), passive restraint (55.9%) and sedation (58.9%) more acceptable than GA (22.9%)	Clinical Holding (NA)

PST=Patient Support Technique, BCT= Behaviour Change Technique; BGT = Behaviour Guidance Technique; SHCN = Special Healthcare Needs;

HOM +/- AR = Hand over Mouth +/- Airway restriction.

Table 3. Patient support techniques reported, used or recommended in the literature.

Patient Support Technique	Number of studies
Shaping	4
Cueing	1
Prompting	1
Fading	3
Extinction	2
Reinforcement	9
Positive reinforcement	18
Negative reinforcement (including contingent escape).	6
Differential reinforcement	2
Thinning / Partial Reinforcement	1
Biofeedback	1
Escape extinction	2
Modeling	8
Video modeling	8
Desensitisation	9
Systematic Desensitisation	7
Familiarisation (including stepwise introduction / acclimatisation / repetitive tasking / practice / training)	8

CBT	2
Distraction	9
Guided imagery / Visualisation	1
Relaxation	8
Providing music for relaxation	2
Hypnotherapy	3
Give control	4
Non-contingent escape	3
Tell-Show-Do	9
Information	3
Consistency	1
Manageable discomfort	1
Communication	1
Reprimand	1
Requests	1
Voice control	8
Nonverbal communication	5
Restructuring the physical environmental	1
Restructuring the sensory environment	2
Providing fidgets and comforters	4

Restructuring the social environment	2
Parental /Carer presence/absence	3
Animal assisted therapy/companion animal	2
Scheduling appointments: length / timing / flexibility / postponement	3
Clinical Holding (including physical restraint, holding and manual fixation)	11
Mechanical Restraint (including immobilisation by a restrictive device)	11
Mouth prop	5
Hand over mouth +/- airway restriction	11

Table 4. Behaviour Change Techniques identified in PSTs reported, used or recommended.

BCT code	BCT	Number of times reported
Group 2.	Feedback and Monitoring	N=1
2.6	Monitoring of behavior by others without feedback	1
Group 3.	Social Support	N=7
3.1	Social support (unspecified)	4
3.3	Social support (emotional)	3
Group 4.	Shaping knowledge	N=10
4.1	Instruction on how to perform the behaviour	10
Group 6.	Comparison of the behaviour	N=25
6.1	Demonstration of the behaviour	25
Group 7.	Associations	N=24
7.1	Prompts / cues	1
7.3	Reduce prompts / cues	3
7.4	Remove access to the reward	1
7.5	Remove aversive stimulus	2
7.7	Exposure	17
Group 8.	Repetition and substitution	N=4
8.1	Behavioural practice/rehearsal	3
8.7	Graded tasks	1
Group 10.	Reward and threat	N=39
10.1	Material incentive (behavior)	1

10.2	Material reward (behavior)	15
10.3	Non-specific reward	8
10.4	Social reward	12
10.8	Incentive (outcome)	3
Group 12.	Antecedents	N=30
12.1	Restructuring the physical environment	4
12.2	Restructuring the social environment	2
12.4	Distraction	10
12.5	Adding objects to the environment	4
12.6	Body changes	10
Group 13.	Identity	N=1
13.2	Framing / reframing	1
Group 14.	Scheduled consequences	N=17
14.2	Punishment	2
14.3	Remove reward	2
14.4	Reward approximation	6
14.6	Situation-specific reward	1
14.8	Reward alternative behavior	1
14.9	Reduce reward frequency	1
14.10	Remove punishment	4
Group 15.	Self-belief	N=1
15.2	Mental rehearsal of successful performance	1

Figure 1. **PRISMA 2009 Flow Diagram**