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Management of Impulsivity, Inattention, Hyperactivity Induced by Digital Surplus (Simulating ADHD) in Children and Adolescents

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Introduction

Physicians need to be cautious in prescribing methylphenidate to digitally over stimulated kids who simulate ADHD. This monograph attempts to

1. Explore causes of ADHD
2. Emphasise the causative effects of digital overstimulation in ADHD
3. Provide rational understanding of the cause and effect of the ADHD process on the brain
4. Offer rationale for and proposed Empathic Learning Therapy before trying drugs
5. Discourage children from being labelled and branded as ADHD when the issue is only a matter of varied symptoms

Working Hypothesis

Digital addiction works just like other addictive conditions. Salience, initiation, navigation, conclusion – mediated via optimal dopamine response (not too high, not too low) are dysregulated because of continued dopamine drive. Satiety mediated via optimal serotonin producing reward motive has been dysregulated with serotonin spiking to achieve satiety competing with the dopamine drive. In this scenario inattention, impulsivity and hyperactivity are only symptoms of underlying dysregulation of motivational systems. (1) Why this simulates ADHD is because executive empathic pathways commencing in the dorsolateral prefrontal cortex (dlPFC) have been overwritten by the repetitive, reflexive, reactive, cyclical stress survival pathways of the ventero medial prefrontal cortex (vmPFC) responding to subcortical input from amygdala, hippocampus and hypothalamus. (2)

In this framework, digital addiction causes a cycle of decreased function of brain reward systems and recruitment of anti-reward systems that progressively worsen, resulting in the compulsive use of more digital games etc. Counter-adaptive processes, such as opponent process, that are part of the normal homeostatic limitation of reward function fail to return within the normal homeostatic range and repeatedly drive the allostatic state. Excessive digital gaming and cartoons thus results in the short-term amelioration of the reward deficit. However, in the long term, there is worsening of the underlying neurochemical dysregulations that ultimately form an allostatic state (decreased dopamine and opioid peptide function, increased corticotropin-releasing factor activity). This allostatic state is reflected in a chronic deviation of reward set point that is fuelled not only by dysregulation of reward circuits but also by recruitment of brain and hormonal stress responses. (3), (4)

D1 receptors of dopamine are overcharged by pixel (digital) stimulation causing poor working memory. D1 receptors function best in a limited middle range of Dopamine concentration. Too low there is apathy; too high there is impulsivity. Excessive stimulation causes delay-related firing of the neurons' non-preferred directions with brain having increased background "noise". Increased dopamine, noradrenaline and cortisol in these children brains inhibit executive empathic functions of the prefrontal cortex producing the

impulsivity, inattention and hyperactivity of ADHD. Heavy users of smart phones are likely to develop the left side of their brains, leaving the right side untapped or underdeveloped, The right side of the brain is linked with concentration and its failure to develop will affect attention and memory span, which could in as many as 15% of cases lead to the early onset of dementia.

Triad of Symptoms

It is important to distinguish between which one of the triad of symptoms of ADHD (inattention, impulsivity, hyperactivity) is predominant in a child and decide if drugs will help. A rule of thumb is - if impulsivity is predominant, child will deteriorate with drugs. Of the two schools of thought I subscribe to ADHD being a behavioural problem rather than a sensory process problem. This is controversial. In my work I have avoided labelling children as ADHD because the labelling involves far too many normal children with slightly variant behaviour. It is more logical to deal with the triad of impulsivity, inattention and hyperactivity as possible in different proportions - having their onset in diverse sociological and environmental factors – the most important being alteration of brain tracts, neuronal orientation and brain's neurochemical balance by digital surplus.

The confusion in understanding the pathogenesis of ADHD comes from the medical profession's insistence that genetically induced neurobiological causes rather than sociological and environmental factors are the mainstay in the pathogenesis of ADHD. The biological genetic modus attempts to downplay the greater importance of sociological human factors. It is thought that familial prevalence of ADHD is not due to genetic factors but because the same sociological factors that causes ADHD like behaviour in one family member cause the same in others. But this too is controversial. Digital surplus significantly contributes to pharmaco-pathogenesis of ADHD like behaviour.

Dr Manfred Spitzer, a German neuroscientist, published a book titled "Digital Dementia" in 2012 that warned parents and teachers of the dangers of allowing children to spend too much time on a laptop, mobile phone or other electronic devices. Dr Spitzer warned that the deficits in brain development are irreversible and called for digital media to be banned from German classrooms before children become "addicted." (5)

Analogy - Seven Steps for Executive Control

1. Child learns initiation and hears approval – if not he applies to nothing
2. Child plans the crawl or steps – mentally marking progress plan.
3. Child considers others – empathy as he continues. (if not no regard to other's discomfort or damage)
4. Child avoids risks or distractions (if not takes risks)
5. Child continues with attention (if not gives up easily)

6. Child completes task – learns end goal (if not does nothing to completion)
7. Child receives joyful reward – hug, kiss, cookie etc. – learns legitimate joy, wait until time. (if not busts life early – sex, money, gamble).

Digital stimulant effect has 5 components (6)

1. Time length of exposure to LED screen
2. Pixel per inch (PPI) of smart phone
3. Rate of pixel change in cartoon frame
4. Intensity and variability of sound and colour
5. Time of exposure effect is more after 6 pm

Proprioception, Spatial Attuning and 3D Effect

LED screen takes child away from 3D sense, sight, touch that wires brain space sense for future brilliance. Spatial tracts of the brain lay an infrastructure for other tracts to build up. Frictional effort of colouring with pastel, pencil or brush improves hand- eye- spatial coordination and should not be substituted with easy digital colouring. Such manual effort improves handwriting which feeds speech. Proprioception = spatial sense is a strong brain wirer. Child has an internal speech when he uses manual toys (speaking to dolls) which is lost when passively following a digital screen. This is why moulding and take aim games are used in the Empathic Learning Centre.

Salience and Satiety

Executive or Emotional – problem of digital overplus - Under conditions of digital abuse and stress the amygdala activates stress pathways in the hypothalamus and brainstem, which evokes high levels of noradrenaline (NA) and dopamine (DA) release. This impairs PFC (prefrontal cortex) regulation but strengthens amygdala function, thus setting up a 'vicious cycle'. (6) For example, high levels of catecholamines, such as occur during digital games and violent cartoons, strengthens fear conditioning mediated by the amygdala. By contrast, stress of digital games and violent cartoons impairs higher-order PFC abilities such as working memory and attention regulation. Thus, attention regulation switches from thoughtful 'top-down' control by the PFC that is based on what is most relevant to the task at hand to 'bottom-up' control by the sensory cortices, whereby the salience of the stimulus (for example, whether it is brightly coloured, loud or moving) captures kid's attention. The amygdala also biases towards habitual motor responding (jitters) rather than flexible, spatial navigation. (1) Thus, during stress of digital games and violent cartoons, orchestration of the brain's response patterns switches from slow, thoughtful PFC regulation to the reflexive and rapid emotional responses of the amygdala and related subcortical structures.

Sleep

Children and adults must be off the pixel screen two hours prior to sleep, for naturally designed deep sleep "software" to work in the brain and for neurones to reset for a fresh start the next morning. Higher percentage of blue light in LED screen works against neuronal safety and delays getting back to default mode network of brain waves. Children digitally stimulated will be disturbed and restless in sleep – they will be jittery. They will wake up irritated and will feel as if they didn't sleep well. Even adults will feel so. Late into night digital games and under the blanket smart phone activity for parents not to see affect memory and retinal health. (7) Researchers establish that anything causing loss of REM sleep (which is 15% of normal sleep) causes memory loss – as happens with sleep apnoea or playing digital games into the night. Read more in "Parenting in a Digital Age"

Melatonin

Pineal Gland in the brain secretes melatonin as darkness sets in – sunset. LED screen, pixels, higher % of blue light in smart gadgets and disturbed sleep patterns suppress melatonin secretion. Smart phones and digital games after 9 pm are unhealthy. Melatonin is helpful for neuronal recovery, retinal health and for health of reproductive organs. Depression of melatonin secretion is related to cancer of reproductive organs and AMD of Retina. Excess blue light in all LED bulbs have an effect too. Children's cartoon zone should be prior to 6 pm.

It is during well coordinated sleep that the glymphatic system activates and removes neurochemical debris and optimises neurones for next day. (8)

Learning and Sports

Sports make brain tracts lay down well by spatial orientation. Hand – eye – mouth coordination while eating is the brainiest zaniest enterprise child can do at age 3. Spatial sense (proprioception) provides neuronal infrastructure for other brain activities. Digital meddling ruins all this. Swimming is a brain smart equilibrium activity – without any competitive goal.

Speech

Researchers have proven that digital exposure before 2 years is the prime reason for speech defects. Digital screen takes away from the child 3D natural interplay - we touch and see all things 3D by nature. Kids 3D play with toys drastically reduce when exposed to digital activity. Finger movement in 3D touch facilitates special senses and hand writing. Handwriting suffers with TV and digital activity of child less than 4 years.

Speech is best absorbed in the first 3 years by hearing natural voice with empathy and engagement – loving people and doing what child hears – especially by focussing on meal time – hand eye mouth coordination of feeding himself with help. TV pours out voice and sight irrelevant and unintelligible to child. Addiction to flipping digital screens limits

special movement of finger, eye and hand. American Paediatric Association recommends that digital screen should not be given to children under 2 years. (9)

Attention Span

Digital abuse acts to shorten and make shallow attention span. They say, "I know" without studying or grasping. They think like cartoons on screens learning can be fast forwarded. A child at 3 years can get used to managing form initiation to successful conclusion in a stretch of 15 minutes. Before that a child must be engaged in – buildings block, dolls, cooking – at least in a time stretch of 10 min. At 5 years every child has to be ready for 30 minutes in a school period and by 12 years child needs to manage 40 minutes in a productive time stretch even at home. TV and digital gadgets remove from a child their ability to give attention, concentration and focus.

Causative factors for ADHD

Children affected from foetal life manifest the classic triad of symptoms of ADHD from 4 to 6 months, mainly as feeding and sleeping difficulties. Thirty percent are affected during the antenatal period by different influences on the foetal brain that affect PgE2 levels in different brain areas viz. – drugs in pregnancy, smallest doses of alcohol, smoking, even daily administered "safe" drugs like paracetamol, skin or nail applications, mother's digital life, violent or excessive music or movies mother is exposed to, family strife as mother copes filtering through to foetal brain and anything that adds up to "Maternal Deprivation Syndrome". (10) If not clinically indicated avoid all drugs during pregnancy.

Other 70 % are affected after birth. The two main contributions are social and digital. Maternal inattention (lack of bonding), paternal disconnection or abuse, hostile home environment are some of the social factors. These are often substituted by the digital nanny – overexposure and too early exposure to digital screen, cartoons and games. Digital surplus is coupled with lack of outdoor and spatial attuning activity.

Most neurones should be spatially attuned or committed uni-directionally (preferred direction) in the early development of brain tracts. Early digital exposure scrambles the spatial alignment of neurones, so that neurones respond to inputs from many directions and also fire multi-directionally in non-preferred directions. This is the basic pathology of neuronal arrangements in the brain of the child showing inattention, impulsivity and hyperactivity to varying degrees. Multi directional neuronal arrangements make the child over sensitive to sound and colour inputs – distracted and can only be corrected by reducing the digital input. Child gives up dorsolateral PFC driven top down executive empathic planning and instead turns to bottom up amygdala driven responses as in stress – over responding to subcortical impulses. (1)

ADHD and Vaccines

Did mercury in vaccines act like lead to mimic Ca2+ and potently activate PKC signalling causing deficits in PFC (Prefrontal Cortex) attentional regulation that mimic the symptoms of attention-deficit hyper-activity disorder (ADHD). (11) It also confirmed in a previous study that found an upward trend in ADHD among births toward the later part of the year, peaking in November". – Columbia University Dept of Medicine Study – Is the reason organophosphates (during summer) or other chemicals in the first 4 months of pregnancy crossing into fetal brain before fetal blood brain barrier develops.

Parenting

All that happens to children by parental neglect, digital surplus and market force of entertainment, drugs, allergies, junk food – alienate them from parents and distance them from reality. There is a real need to educate the younger professionals and all work force – corporate and public, that children's digital health is important – especially focussing on 0 – 12 years. The cause for speech defect could be lack of parental speech interaction. Children best pick up phonemes in the first three years of life and in the first year they can pick up any language.

Environmental factors

Several environmental factors have been identified as recognized risk factors for ADHD. *In utero* events such as maternal stress during pregnancy , prenatal exposure to tobacco, alcohol and other drugs/environmental toxins , pregnancy and birth complications, as well as intrauterine growth retardation and low birth weight/prematurity have been associated with ADHD. Early postnatal environmental influences related to ADHD or core ADHD symptoms include neonatal anoxia, seizures, brain injury, exposure to lead, and polychlorinated biphenyls . Psychosocial adversity and high levels of family conflict were also associated with ADHD. Recent findings have related ADHD to more specific familial issues such as inconsistent parenting after controlling for parental ADHD, marital, and children's negative appraisal of family conflict. Children having suffered early institutional deprivation for a duration of 6 months or above show high levels of ADHD-like symptoms, but in this population, inattention/hyperactivity was also strongly linked to attachment disorders. (12)

Food

Serotonin is a chemo-transmitter in the brain that regulates hunger and satiety – "feeling full". Digitally "toxic" kids have variable serotonin responses that makes them eat at odd times (snacking) – never coming to satiety at a given time.

Risk

Impulsive, hyperactive behaviour promoted by digital surplus makes children and even youth take risk, seek thrills and push limits. One day they will find themselves on the wrong side of the law. Digital over stimulation by war games, thrill games over wire the risk pathway of PFC making children or youth risk prone – including gambling and drug abuse. Digital surplus wired them for bottom up regulation – start sudden, no planned navigation, thrills on the way rather than wait patiently for end pleasure and reward. Quick results – attitude spills over to food, money and sex. (1)

Eyesight

It is reported that in some parts of China, 90 percent of high school graduates have near-sightedness. Though rates are lower it is increasing in Europe and the Middle East. Intense levels of schooling and little time spent outdoors may have contributed to the epidemic rise of near-sightedness in China. This means kids who spent more time outside were 23 percent less likely to develop near-sightedness. Needless say digital overuse prevents outdoor exposure of children. (13)

Brain Wiring and Memory

Developing Human Connectome Project - For instance, it is now known that babies start to learn and explore the world long before they have taken their first breath. Using different techniques to measure a foetus's real-time neural activity, scientists have found that their brains seem to react to flashes of bright light or loud noises, for instance. In the last trimester foetuses also seem to have learnt to recognise the calming sound of the maternal voice and the theme tune of her favourite TV show. They may even taste her latest meals: flavours such as garlic might be able to pass into the amniotic fluid, meaning that weaning babies tend to be drawn to the smells of foods their mother ate during pregnancy. (12)

The capacity to learn increases after birth. In the first few days, a baby is already listening to the sounds of speech and beginning to work out the structure of their parents' proud cooing, laying down the foundations for grammar. At around the same time, the brain is constantly tending those thickets of new neural connections, both growing and then pruning the spreading axons to build the most efficient networks possible as it expands its skills and intelligence.

Cartoons and digital games over-wire and chemicalise the kinaesthetic, music and visual tracts (formerly called Right Brain activism) – overtaking language, mathematical, logical and relational tracts of the brain (formerly called Left brain activism). You get a child who is always in the realm of the fantastic and is bored with the normal. Present day spooky cartoons introduce even the paranormal resulting in fear, disturbed sleep and depression. Children should not be exposed to daily cartoons or daily digital games because anything done daily becomes an addictive feeder habit. Therefore make it every other day. Over 30

min of anything wires a tract memory. So limit to less than 30 mins.

With adults too, too much digital information processing in one hour will result in a multitasking milkshake brain which is unable to concentrate and this will impair memory.

Table 1: Pharmacological Summary of Pathogenesis (6)

Delicious cycle of normal living	**Vicious cycle of adult or digital stress**
Creative new empathic executive thinking from Prefrontal cortex	Repetitive reactive stress survival thought patterns where memory of amygdala drives along with hypothalamus and hippocampus
Top down regulation moving from one job to the next – linear logical	Bottom up control with old feelings governing your present cyclical behaviour
Driven by what child (or adult) decides to do. Dopamine says go and levels off. Serotonin says – satiety. Balance of dopamine and serotonin working at optimal concentration	Driven by sensory cortices, salience of the stimulus (E.g., whether it is brightly coloured, loud or moving) captures kid's attention. No successful conclusion sought
Spatial navigation encouraged by swimming, take aim games, rhythmic well timed dance is foundational (Included in Empathic Learning Therapy)	During stress of digital games and violent cartoons, orchestration of the brain's response patterns switches from slow, thoughtful PFC regulation to the reflexive and rapid emotional responses of amygdala and subcortical structures.
Homeostasis – proper dopamine serotonin balance	Allostatic state – stress response with corticotrophin adrenaline cycle recruited.
Working memory normal	Working memory diminished
Slow, thoughtful PFC regulation	Reflexive and rapid emotional responses of amygdala and subcortical structures.
Desired Effect – Alert Non Stressed Waking optimize working memory by engaging post synaptic α2a = Also block α1 or β = D1 optimal engage.	**Undesirable effect of digital addiction and over stimulation – impaired working memory, short attention span, distraction.** 1. High levels of Noradrenaline during stress stimulate low affinity of Dopamine at α1 and β1 2. Depletion of NA or α2a blockade This is equal to D1 blockade or D1 excess
Dopamine at optimal levels improve working memory, attention and executive action initiated from PFC	Too little dopamine or too much results in the U response for dopamine. That is when dopamine is too low or too high dopamine provokes bottom up regulation to take over

	when neurones in kinaesthetic, musical/audio and visual/spatial brain tracts fire in a non directional manner provoking the "ADHD" behaviour – impulsivity, inattention and hyperactivity. They respond to too many stimuli and are over aroused.
whereas D1 receptor stimulation sculpts neuronal firing by decreasing firing to non-preferred inputs (that is, it decreases 'noise')	α_{2A}-receptor stimulation enhances network firing for shared inputs (that is, it increases the 'signal'
	excessive D2 receptor stimulation impairs PFC working memory function in animalsand humans and is associated with increased response-related firing in monkeys and increased response-related blood oxygen level-dependent signals in human imaging studies

Empathic Learning Therapy

Digital surplus (TV, Cartoons, Games, LED screen) increases adrenalin, noradrenaline, cortisol – making children to be on continual fright, fight, flight. Dopamine and Serotonin also increase - in the brain tracts. Dopamine says - Start and Serotonin says – slow down. Latter two have much to do with sleep and awake, appetite, working memory, initiation, pleasure, salience (minding one thing at a time and being spatially and directionally attuned), satiety ("I have had enough, I feel fulfilled"), thrills, sexual appetite.

My working theory is that it is the neuronal firing order - with certain brain tracts over committed and others inhibited that is chaotic in ADHD which causes the neurochemical imbalances of catecholamines, dopamine and serotonin. Therefore receptor active drugs will only provide temporary relief or none at all and anyway receptor down-regulation leading to less effect will make practitioners prescribe higher doses producing more side effects. More drugs are prescribed for side effects without omitting the aggressor. Empathic learning therapy remodels brain tracts and commits neurones to preferred directional firing.

Empathic learning therapies (ELT) effectively retrains neuronal directionality while improving the child's attention span, working memory, recall, connection and collation. Retraining of mildly affected children may take 4 to 6 weeks of ELT with parent being trained to implement remedies at home while attending sessions at Empathic Learning Centre (ELC) once or twice a week.

Early learning for children must be with empathy engaging the heart brain of 40000 neurones alongside the big brain. Mother's bonding and empathy is recommended more than other teachers. Smart techniques early - away from the mother, do not contribute to better learning. In actual fact they retard learning and delay speech.

Empathic learning therapy concentrates on the seven functional tracts of the Brain. At the Empathic Learning Center (ELC) uses what children are currently proficient in, to make them do what they would not like to and then aim to develop those brain tracts that are underdeveloped. (14), (15)

Table 2: Functional Brain Tracts

Functional Brain Tract	**Dysfunction**	**Brain Area**	**Therapy**
Intrapersonal	Assumes others personages – usually imitating cartoons, Poor initiation, easily distracted	Prefrontal cortex – initiation, executive decisions. Healthy thoughts of oneself	Take aim games, arts crafts, planning, sand board.
Interpersonal	Dyspathy, selfish	Frontal cortex - empathy	Small group activities
Linguistics	Speech defects, poor handwriting and language skills	Speech Language	Poetry, elocution, reading, drama composition
Mathematical Logical	poor math, life skills management poor	Motor, frontal cortex, temporal lobe	Riddles, take aim games, puzzles
Kinaesthetic	Jittery, needs to expend kinaesthesia	Motor, temporal lobe	Swimming, classical dance, table tennis, sports, cooking
Music, Sound	High sensitivity to sound, addicted	Auditory lobe, temporal lobe	Classical music, guitar any musical instrument
Visual	Colour distracted	Visual cortex	Purposeful art
Colour and Sound - For example, high levels of noradrenaline acting at α_1- and β-receptors enhance memory consolidation processes in the hippo-campus (4) and increase the signal/noise ratio in primary sensory cortices. This explains why ADHD children are very sensitive to visual and auditory input.			
Spatial - proprioception	Balance and special assessment low, can't catch ball	Pyramidal tracts	Eye hand mouth and other coordination archery, swimming, moulding

Pharmacological therapy

Millions of children are growing up with drug-intoxicated brains. They are given no hope that they can learn to control their own behavior and grow up to be effective adults—goals they will never achieve with medication-drenched brains. Many drug-treated children will suffer from irreversible brain changes that hamper their mental life. In the case of stimulants, many will have their growth stunted and become prone to cocaine addiction in young adulthood. As a result of antipsychotics such as olanzapine, risperidone and aripiprazole many will suffer from development delays and from tardive dyskinesia with its irreversible abnormal movements that impair and stigmatize.

Dr. Angell cites the case of Dr. Joseph L. Biederman, professor of psychiatry at Harvard Medical School and chief of paediatric psychopharmacology at Harvard's Massachusetts General Hospital. She explains: *"Thanks largely to him, children as young as two years old are now being diagnosed with bipolar disorder and treated with a cocktail of powerful drugs, many of which were not approved by the Food and Drug Administration (FDA) for that purpose, and none of which were approved for children below ten years of age." (16)*

Biederman's own studies of the drugs he advocates to treat childhood bipolar disorder were, as *The New York Times* summarized the opinions of its expert sources, *"so small and loosely designed that they were largely inconclusive." (16)*

20% of children with inattention and moderate hyperactivity will respond to a morning dose of methylphenidate during school hours. A higher dose frequency will down regulate the receptors leading to an increased dose of methylphenidate resulting in undesirable side effects. A drug holiday is recommended. Prescribe the minimum dose required while avoiding daily dosage and withhold drug during weekends. The benefit of methylphenidate is optimum at this prescribed amount as its mode of action is via stimulation of postsynaptic α2a in the over aroused reticular formation. Minimal dose of methylphenidate acts on α2a but with increasing dose, the receptor specificity is lost while side effects increase.

Summary

Digital surplus/overstimulation should be considered in the presentation of children with impulsivity, inattention and hyperactivity, simulating ADHD. There are many correlations for ADHD. Methyl phenidate has a limited place in treatment and judicious prescription is warranted. Empathic Learning Therapy should be used in the first line of treatment.

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