More than Shyness: Selective Mutism and its Link to Sensory Processing Disorder

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Abstract

Selective mutism (SM) is a childhood anxiety disorder. Since anxiety is related to Sensory Processing Disorder (SPD) the purpose of this study was to find out if sensory processing difficulties are present in children with SM. Clinical information was collected online from 147 caregivers and the data were complete for 122 subjects (ages 3-18). Short Sensory Profile (SSP) assessment was used to measure sensory reactivity in a group of children with SM. According to SSP definite sensory impairments were detected in 64 % of the children with SM, whereas probable sensory impairments were present in 24 % of the SM group. The highest rates of SPD were reported in three sections of SSP: taste/smell sensitivity, visual/auditory sensitivity and auditory filtering. Moreover, SPD was present at a higher rate in children with SM compared to a group of typically developing children. The above findings suggest that a vast percentage of children with SM may be affected by SPD, regardless of other co-occurring diagnoses. This pioneering result has an implication for combining the existing SM therapy methods with Sensory Integration training (SI) and/or neuro-sensori-motor reflex integration techniques.

Key Words:
selective mutism, sensory processing

"Anxiety can just as well express itself by muteness as by a scream"

Søren Kierkegaard (1813- 1855)

A second grade girl with selective mutism reaches the front of a lunch line. She is asked what she would like to have for lunch. She does not answer. Her body freezes and she looks down at the floor. The line is building behind her. "You are holding the line! Have you lost your tongue?" shouts the lunch monitor. She does not respond and goes away. When asked a question in the classroom her voice gets stuck again. She wiggles on her chair, her heart is pounding and panic is rising in her chest. Again, she does not give any answer. "She never talks"- her peers claim. This upsetting scenario is just an example of what a child with selective mutism might go through.

Selective mutism is a type of anxiety disorder portrayed by a child's consistent lack of speech in various social settings such as at school, whereas speaking at home with close family members comes easily (DSM-5, American Psychiatric Association, 2013). Children with selective mutism (SM) usually struggle to complete normal everyday tasks like asking a question in class, informing about an injury or participating in a play (Johnson & Wintgens, 2015; Kotrba, 2015). Avoiding speech in public settings may have negative consequences on social interactions, academic performance and overall well-being of children with SM. They may miss out on social relations with peers and get hardly any chance to train social skills (Bergman, Gonzales, Piacentini, & Keller, 2013).

SM is more common in females than males and it affects bilingual children more often (Garcia, 2004; Kumpulainen, 2002). Bilingual children have higher rates of SM and the prevalence of SM among immigrant families is 2.2 % (Elizur & Perednik, 2003). Nevertheless, it is important to have in mind that being bilingual is not a direct cause for selective mutism. Children prone to anxiety will develop SM because of the promoting factors such as being uncomfortable using a new unfamiliar language (Kotrba, 2015).

Taking into consideration the fact that SM can be gauged on an anxiety scale, it is worth to mention that elevated anxiety levels correlate with sensory processing dysfunction (Engel-Yeger & Dunn, 2001; Heller, 2003; Johnson, 1975; Royeen et al., 1991). According to Kranowitz (1998) feelings of anxiety may be triggered by sensory processing dysfunction, causing withdrawal and muteness. Interestingly, recent findings indicate that approximately 75% of children with SM have difficulties in sensory processing, specifically in auditory area which can have a negative impact on their ability to talk (Muchnik et al., 2013). Furthermore, the sense of smell, called olfactory sensory perception was also studied in relation to anxiety mechanisms. Results showed a relationship between hypersensitivity to unpleasant odors and raised anxiety levels (Krusemark & Li, 2012). Sensory processing difficulties and its connection to anxiety have been mostly examined in children with Autism Spectrum Disorder (ASD; Kirby, Dickie & Baranek, 2015; Tomchek & Dunn, 2007) and Attention Deficit Hyperactivity Disorder (ADHD; Reynolds & Lane, 2009).

According to current findings there is very little evidence whether dysfunction in sensory processing is related to SM. With respect to those missing pieces of evidence, I investigated in the present study the relationship between SM and Sensory Processing Disorder (SPD). Confirming the existence of sensory processing impairments in children with SM would give a significant implication for revising and possibly complementing current SM therapy methods. At present, a combination of behavioral techniques, family therapy, play therapy, audio/video self modelling and in certain cases pharmacotherapy are among the most common approaches for treating children with SM (Bergman, et al., 2013; Oerbeck, Stein, Wentzel-Larsen, Langsrud & Kristensen, 2014). SM therapies are usually slow and it may take many months or years until the child starts talking in different social settings. However, a new multimodal therapy called Social Communication Anxiety Treatment (S-CAT) has recently been tested showing very promising results in a short time of application (Klein, Armstrong, Skira, Gordon, 2016). Treatment for

SM is recommended to be administered in environments where symptoms are present, such as in schools. The pedagogical efforts and support from teachers seem to be a crucial factor for the successful therapy (Oerbeck, et al., 2014).

SM is present on the social anxiety spectrum and it may co-exist with diagnoses like obsessive compulsive disorder, depression, speech impairments or autism spectrum disorders (Wong, 2010). Black and Uhde (1995) proposed that SM is as a variant of social phobia which manifests itself in excessive social anxiety symptoms. Currently this idea is being scientifically tested and mixed results have been obtained so far. Most of the children with SM enjoy social interplay as long as a verbal response is not expected. In contrast, children with social phobia tend to avoid all types of social contacts, both verbal and nonverbal (Yeganeh, Beidel, Turner, Pina, & Silverman, 2003). Like other psychiatric disorders SM symptoms can vary from mild to severe. The Selective Mutism Information and Research Association (SMIRA) proposes that children with SM can be divided into "high profile SM sufferers" and "low profile SM sufferers". High profile sufferers do not communicate verbally in school settings, though they are sometimes able to talk to selected peers. Low profile sufferers, on the other hand might sometimes answer in a low voice to selected teachers and peers but their anxiety sustains, making them too anxious to initiate verbal contact. Children with low SM profile can be mistakenly perceived as extremely shy, which in turn lowers their chances to receive professional help. The earlier the intervention is made the bigger the chances are for successful treatment (Bergman, et al., 2013).

The link between anxiety and sensory processing was also proposed by Ayres (1972). Ayres (1972) presented a theory of Sensory Integration (SI), which became a pillar upon which later theories were developed. SI is both a theory and a treatment method for sensory dysfunction used by occupational therapists around the world.   SI theory assumes that human brain organizes all sensory impressions from various senses like sight, hearing, touch, smell, taste, vestibular (balance) and

proprioceptive (muscle and joints). When sensory impressions are well coordinated the brain creates meaningful perceptions, thus enabling learning and behavior. A neurological dysfunction called Sensory Processing Disorder (SPD) may impair the brains ability to receive and react to information from various senses (Dunn, 2001; Miller, Anzalone, Lane, Cermak, & Osten, 2007). According to Ayres (1972) a dysfunction in modulation of sensory impressions may in turn lead to anxiety and distractibility. Ayres compared SPD to neurological "traffic jam" that can affect one sense at a time or it may affect multiple senses simultaneously (Ayres, 1983).

Research suggest that as many as one in every sixth child could be affected by sensory problems, which in turn have a negative impact on everyday life functions (Ben-Sasson, Carter, Briggs-Gowan, 2009). Principally, SPD affects children's self-esteem but it can also affect their social participation, movement and learning abilities (Cosbey, Johnston & Dunn, 2010). Children with SPD may be very intelligent and appear fine at first, but observations over time reveal that they can also be withdrawn, aggressive, clumsy and fearful. Individuals affected with SPD may benefit from Sensory Integration Therapy (SIT), where they are exposed to rich sensory stimuli during therapy sessions. Apart from vision and hearing SIT also regulates tactile, vestibular and proprioceptive senses. SIT uses sensory techniques in order to stimulate the nervous system to create new synaptic connections. Eventually, improvements in the nervous system may reduce problem behaviors and ease the learning process (Baranek, 2002; Kranowitz, 1998). A longitudinal study indicated that children with learning difficulties who received sensory integration therapy over a period of two years showed significant improvement in both neurophysiological development and learning capacity (Reynolds & Reynolds, 2010).

According to Dunn's model (1997) of sensory processing, sensory profiles are strictly connected to the neurological thresholds (high and low) and strategies of self-regulation (active or passive). Individuals with low thresholds notice the input quickly, while individuals with high thresholds need much stronger sensory input to notice a change (Dunn, 1997). A low sensory threshold is common in hypersensitivity and a high sensory threshold is characteristic of hyposensitivity (Caminha & Lampreia, 2012). Sensory Modulation Disorder (SMD) as a common category of SPD includes three different types of sensory profiles: "hypersensitive/over-responsive, hyposensitive/under-responsive and sensory craving" (Miller et al., 2007; Perez-Robles, Doval, Jane, Caldeira da Silva, Papoilla, Virella, 2012). Whereas some persons with SPD over-respond to stimulation like touch, sound, light or food, others may under-respond showing hardly any reaction to stimulation, even if it is extreme (Dunn, 2009). Previous studies show that people with hypersensitivity to tactile stimuli display raised levels of anxiety (Ayres, 1983; Royeen & Lane, 1991; Wilbarger, 1995). Moreover, it has been emphasized that hypersensitiveness could trigger stress and anxiety reactions even in emotionally stable environments (Heller, 2003). Sensory Based Motor Disorder (SBMD) is the other important category of SPD that may involve poor balance, low muscle tone, clumsiness and difficulty using both sides of the body at the same time. In addition, those affected with SBMD show deficits in gross, fine and oral-motor skills which make daily activities like dressing or washing difficult and imprecise. Those motor deficits could be applied, apart from SIT by sensorimotor therapy (SMT; Niklasson, 2013) that showed to be effective with specific sensory and motor issues. SMT concentrates on integrating the inhibited postnatal developmental reflexes known as primitive reflexes. Ayres (1973) concluded that maturity of the nervous system depends to some extend on primitive reflexes integration. Another promising therapy that balances sensory motor dysfunction is a neurosensorimotor reflex integration program (MNRI; Masgutova, Akhmatova, Sadowska, Shackleford & Akhmatov, 2016).

As mentioned above, dysfunctional sensory responsiveness, especially in the auditory area has been linked to numerous mental health disorders; and anxiety is one of them. Additionally, research suggested that a part

of the auditory system in children with SM does not function in the usual way, making the person overstimulated by its own voice, thus causing withdrawal from social interactions (Arie et al., 2007; Muchnik et al., 2013). SPD and its relation to anxiety has previously mostly been studied in children with ASD and ADHD (Adamson, O'Hare & Graham, 2006; Caminha & Lampreia, 2012; Tomchek and Dunn, 2007; Shulamite & Ben-Sasson, 2010). The aim of this study is to find out whether children with SM are affected by SPD. Within the present study, three hypotheses are addressed: 1. Sensory Processing Disorder (SPD) is present in children with Selective Mutism. 2. SPD prevalence in children with SM can be related to the existence of other comorbid diagnoses. 3. The more dysfunction in sensory processing the more severe the SM symptoms are.

Method

Participants

Data were collected online from 147 caregivers to children with SM. The inclusion criteria for the study were to have children and teenagers officially diagnosed with SM at minimum age of three years. The SM group consisted of 70% (n = 85) girls and 30% (n = 37) boys, mean age 6.65. Participating families came from the United States (n = 45), Australia (n = 24), England (n = 38), and other countries (n = 15). Among all the children in the SM sample 33% were reported to have comorbid diagnoses, including ASD. Twenty five out of 147 surveys were excluded from statistical analysis. Twelve children did not fulfill the inclusion criteria and 13 surveys were not completed in all SSP sections, thus 122 surveys were analyzed. The difference in sensory responding between children with SM and neurologically typical children was analyzed with help of a sample presenting a group of typically developing children (n = 221), mean age 4.29, taken from a study on sensory processing in autistic children (Tomchek & Dunn, 2007).

Measure

The survey consisted of an online questionnaire divided in 2 sections. The first section included 9 questions about demographics, the severity of SM symptoms, co-existing diagnoses and the therapy length (Appendix). Severity of SM was measured on a Likert scale from 1 to 4 (1 = mild symptoms, 4 = severe symptoms). Each level of SM severity was defined by a description of how verbal the child was in different environments such as at home, school and public places. The second section included a Short Sensory Profile (SSP) clinical assessment tool. The SSP is a standardized caregiver questionnaire report that identifies the possible presence of sensory difficulties. It was created from a longer version, called Sensory Profile (SP). According to Tomchek and Dunn (2007) the discriminate validity of the SSP is approximately 95 % in identifying children with and without difficulties in sensory processing. SSP items are scored on a 1 to 5 point Likert scale and caregivers report the percentage of time their children are engaged in certain behaviors. Items (e.g. "my child reacts emotionally or aggressively to touch", "withdraws from splashing water" or "holds hands over ears to protect from sound") have five possible response options: always - 100% of a time, frequently - 75% of the time, occasionally - 50 % of the time, seldom - 25 % of the time or never - 0% of a time. SSP has a high screening value and it takes approximately 10 minutes to fill in. The SSP caregiver report is divided in 7 measure sections: Tactile Sensitivity (7 items), Taste/Smell Sensitivity (4 items), Movement Sensitivity (3 items), Underresponsive/ Seeks Sensation (7 items), Auditory Filtering (6 items), Low Energy/Weak (6 items), and Visual/Auditory Sensitivity (5 items). The seven measure sections of SSP assessment tool were treated in this study as separate index variables after averaging the ratings of the respective items in each section. Cronbach's alpha coefficients for all seven index variables ranged between .84 and .95. A total SPD index variable was created averaging difficulties in all sensory areas.

Procedure

The survey was created in Qualtrics online survey software (Qualtrics Software Solutions). A link to the survey together with an invitation letter was published in three closed social media groups with approximately 8500 members from different parts of the world. Members in those social media groups were mostly parents and caregivers to children with SM. The link to the survey was active for a period of three weeks. After gathering data the survey was closed and all data was exported to IBM SPSS Statistics Data Editor Version 24 for Windows.

Results

To test whether sensory processing impairments are present in children with SM, performance rates on each SSP section were counted according to the key score. SSP classification for sensory problems calculates the scores falling more than 1 standard deviation from the mean as a probable sensory dysfunction, whereas scores greater than 2 standard deviations from the mean indicate definite deficits in sensory processing (Tomchek & Dunn, 2007). The results showed that 64 % (n = 78) of the studied children with SM were definitely affected by SPD in comparison with 3 % (n = 7) of the children from a typically developing group (Tomchek & Dunn, 2007). Probable sensory dysfunction was detected in 16 % (n = 44) of the children with SM and in 14 % (n = 31) of the typically developing children. Summing up definite and probable sensory dysfunction gave an indication of SPD presence in 80 % (n = 89) of the children from the studied SM sample (Table 1). As shown in Table 1 the highest rates of SPD were reported for taste/smell sensitivity (61%, n = 74), visual/ auditory sensitivity (62%, n = 76) and auditory filtering (68%, n = 83).

A Chi-square goodness of fit test was performed to compare the proportion of SPD presence in a SM sample with the proportion of SPD in a typical group of children without any diagnoses obtained from a previous study (Tomchek & Dunn, 2007). Figure 1 presents the group comparison, which showed that there was a significant difference in the proportion of SPD prevalence in the current SM sample (80%) compared with 17% that was obtained in a typical group from a previous study, χ^2 (1, N = 122) = 346.75, p < .05.

To test whether SPD prevalence in children with SM is related to other co-occurring diagnoses, an independent samples t-test was conducted on the SM group with and without co-occurring diagnosis. The result showed no significant difference in SPD rates between children with SM only (M = 2.55, SD = .70) and those who had other diagnoses in addition to SM (M = 2.69, SD = .84; t (120) = 1.034, p = .303. The magnitude of the differences between the means was small (eta-squared = .008).

To test the third hypothesis that there is a relationship between the severity of SM and the intensity of sensory processing difficulties a Spearman Rank Order Correlation test was used. A non-parametric correlation test was chosen because both variables were measured on a Likert scale. Spearman Rank Order Correlation test indicated no significant relationship between the severity of SM ranked 1- 4 and the presence of SPD symptoms ranked 1-5, (rs = .073).
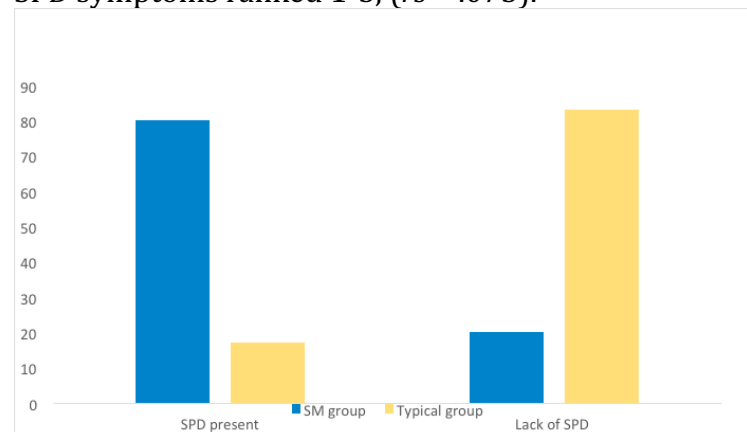

Figure 1. Presence of SPD in percent – comparison between SM group and a typical group (Tomchek & Dunn, 2007).

Table 1.

Presence of SPD (definite and probable) as a percentage of the studied children with SM compared to a typical sample of children based on SSP scores.

	SPD presence %	
Section	Children with SM (*n* = 122)	Typically developing children (*n* = 221)
Tactile Sensitivity	53	24
Taste/Smell Sensitivity	61	15
Movement Sensitivity	40	28
Underresponsive/Seeks sensation	32	25
Auditory Filtering	68	12
Low Energy/Weak	40	13
Visual Auditory Sensitivity	62	23
Total SSP	80	17

Note: SPD = Sensory Processing Disorder; SSP = Sort Sensory Profile; SM = Selective Mutism; Typically developing children = a sample taken from an existing study.

Discussion

The results of the present study confirm that children with SM display a wide range of sensory processing impairments according to the SSP assessment scores. The fact that SM is understood as an anxiety disorder makes it possible to draw parallels to previous research presenting relationships between SPD and anxiety disorders. The link between SPD and SM was not unexpected since the sensory processing difficulties, especially hypersensitiveness has been linked to anxiety in the past (Ayres, 1972). Furthermore, previous research has confirmed a relationship between SPD and anxiety disorders (Engel-Yeger & Dunn, 2001; Heller, 2003). Some researchers have even suggested a causal relationship, where certain sensory reactivity patterns may lead to anxiety symptoms (Levit-Binnun, Szepsemwol, Stern- Ellran, & Engel-Yeger, 2014).

When analyzing different areas of sensory processing in the SM sample, a certain pattern emerged showing that processing difficulties were mostly observed in the area of auditory filtering, visual/auditory sensitivity and taste/smell perception. The results showed that children in the SM sample suffered mostly from auditory impairments including auditory filtering. Participating children were disturbed by background noises and appeared not to respond to their names even though their hearing was normal. Previous studies among children with SM suggest that auditory processing dysfunction may affect the ability to communicate verbally in selected situations, and that they may try to resolve their auditory deficits by avoiding verbalization (Muchnik, 2013). According to Ross-Swain (2007) therapeutic interventions for treating auditory processing difficulties are limited to a few alternative treatments including Tomatis method of sound stimulation. Tomatis sensory-neural integration training has also been shown to be ~~also~~ effective in lowering anxiety symptoms (Du Plessis, du Toit, Wynand & Kirsten, 2011). Another interesting result in the current study was that children with SM presented dysfunctions in taste and smell perception. Children were described as picky eaters, avoiding certain smells and food types. These findings support previous research presenting the linkage between anxiety and taste/smell hypersensitivity (Krusemark & Li, 2012).

Another research question concerned whether the SM sample differed significantly on SPD prevalence from a group of children without any diagnoses. The difference in the proportion showed that more sensory problems were present in the SM group compared to a typical group taken from a previous study (Tomchek & Dunn, 2007), i.e. further supporting the first hypothesis. When analyzing the results of the SSP

caregiver report both definite and probable sensory problems were interpreted as an indication of some degree of SPD. Comparing those two mentioned groups only in relation to definite sensory problems also gives support to the first hypothesis since SPD definitely existed in 64% of children with SM compared with only 3% in a typical group.

Several children in the SM group had even other co-existing diagnoses, e.g., ASD. As mentioned earlier, SPD and its relation to anxiety have been mostly studied in children with ASD and ADHD (Adamson, O'Hare & Graham, 2006; Caminha & Lampreia, 2012; Tomchek and Dunn, 2007; Shulamite & Ben- Sasson, 2010). With regard to those findings, I investigated if SPD prevalence in the studied group could be related to the existence of other comorbid diagnoses. The results showed that SPD was present in children with SM despite other comorbid diagnoses including autism spectrum disorders, which in turn additionally strengthens the link between SM and sensory processing dysfunction.

The current study results did not find a relationship between severity of SPD and the intensity of SM symptoms. The lack of support for the third assumption could partly depend on the method chosen for measuring the severity of SM symptoms. In order to measure the severity of SM I created four definitions of SM severity levels using a Likert scale from Mild (1) to Severe (4). Instead, another standardized tool could be used e.g. Selective Mutism Questionnaire (SMQ; Bergman et al., 2008) to identify SM severity groups. SMQ measures the frequency of child's speaking and social interactions in different settings including home, school and public places, hence creating objective rates of SM symptom severity. Using a validated assessment tool such as a SMQ questionnaire could be a more adequate choice for measuring SM severity. Addressing this in a replication study could possibly lead to results that favor the third hypothesis.

The above findings suggest that sensory processing difficulties should be thoroughly examined in children diagnosed with SM. There is a need to consider the sensory impairments when planning therapy interventions for children with SM, as it might target an underlying cause and not only the symptoms of this disorder. Abernethy (2010) pointed out that the existence of extreme sensory processing difficulties may block or slow down the effects of treatment interventions for mental health disorders. In case sensory impairments are present in patients with SM, therapists should consider implementing complementary therapy interventions including sensory integration treatments, primary reflex integration therapies or Tomatis auditory integration (Ayres, 1983; Niklasson, 2013; Du Plessis et al., 2011; Masgutova et al., 2016; Reynolds & Reynolds, 2010; Ross-Swain, 2007). Intervention methods should be applied depending on the sensory problem area. However, it cannot be overlooked that anxiety might be both a cause and a result of sensory processing difficulties (Ayres, 1972). In this case, anxiety may be understood either as an over-responsive reaction to sensory stimuli or as a response reaction to stress hormones that in turn may lead to sensory overload. Since the causal relation between anxiety and SPD has not yet been established, a thorough examination of each individual sensory profile is of great importance.

The etiology of SM is still unknown and therapies are difficult and time consuming. The length of SM therapy is very individual but it usually takes at least a couple of months for a child with SM to make progress from a non-verbal to verbal communication at school. Then the speech needs to be gradually generalized to new people and situations, which demands a lot of engagement and support both from parents and school personnel. Sadly, not all the children with SM get an adequate help and many parents complain that searching for professional guidance becomes a personal battle (Johnson & Wintgens, 2015). Further investigation should be made to ease the situation of individuals affected with this peculiar childhood disorder. To generalize the findings more research should be conducted using a combination of different assessment tools complementing the use of SSP. Evaluating the sensory disorders should even include testing for unintegrated primary reflexes.

Limitations

When it comes to study limitations it should be mentioned that my choice of the assessments tools and psychological test batteries was restricted. Short Sensory Profile (SSP) measurement tool, though recommended for children up to 14 years old seemed to be the best possible option, concerning the accuracy of sensory processing measure. Another limitation of this study was the usage of a convenient sample consisting of a typically developing group of children from a previous study. Since I did not have access to raw data of the typically developing group, matching the participants for gender and the chronological age was not possible. Furthermore, data were collected indirectly through a caregiver questionnaire. Gathering data from the caregivers, though a common practice in studies of children may have a negative effect on the study's internal validity.

Conclusion

In conclusion, the current study presents a pioneering statement that children with SM may suffer from sensory processing impairments apart from other co-existing symptoms. The linkage between SM and SPD adds a new dimension to our understanding of SM. The above statement brings about the idea for testing the sensory profiles of children with SM, thus planning the best possible therapy interventions. Summing up, the relationship between sensory processing difficulties and selective mutism should receive attention among psychologists and speech therapists that work with SM daily. Viewing the current therapy trends, it can be proposed that collaboration between SM specialists and occupational therapists working with sensory integration therapies should be established. SI therapies could be complemented by techniques that integrate primary reflexes e.g. Masgutova Neurosensorimotor and Reflex Integration (MNRI).

Acknowledgments

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