Eteplirsen Treatment for Duchenne Muscular Dystrophy: A Qualitative Patient Experience Study

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Supplementary Material 1. Verbatim quotes describing the patient experience of DMD prior to eteplirsen treatment in individuals amenable to exon 51 skipping[a]

Concept	Caregivers of children who were ambulatory at interview (*n* = 9)	Caregivers of children who were early non-ambulatory at interview (*n* = 6)
Physical functioning: Upper limb		
Difficulty lifting objects	– *"Holding heavy things, like for example a full gallon of milk, he can't lift it very well."*	– *"Like, let's say, for example, if he want a drink of water, so he holds with one hand, and then he makes the other arm held them to lift it and to drink a little bit water back."*
Difficulty with fine motor movements	– *"Like, opening things, he couldn't even open a bag of chips [laughs]."*	– *"He writes a little bit and then he got tired so he stopped, then his muscle would get weaker in his hands and his, err, fingers."*
Difficulty carrying objects	– *"I would say anything that was […] bigger than what would fit in his hand, it could be difficult. Yeah, but if it just fit in his hand, it would be – he could handle it."*	Not reported by caregivers of early non-ambulatory children
Difficulty with arm weakness	– *"The weakness in his arms, that he can't hold heavy things and such."*	– *"He has lost some more movement of his arms. Um, you know, he used to be able to raise them above his head on his own. Or even, you know, putting on his glasses or getting something out of his eye, you know, now he has us hold his arm up for him to do those things."*
Difficulty reaching above head	Not reported by caregivers of ambulatory children	– *"He won't try to lift his arms up, like, up over his head […] if his hair's long enough, he'll pull his hair to get his arm up."*
Physical functioning: Lower limb		
Difficulty using stairs	– *"Stairs were an issue, he had to pull – kind of, pull himself up. He would go one at a time. He would step up with his right leg and push himself up and do that with every single step."*	Caregiver of early non-ambulatory children were not asked about some aspects of lower limb functioning, to avoid upset
Difficulty running	– *"He could kind of run, um, but it was definitely not a normal run, and he couldn't run for very long."*	
Difficulty walking	– *"[…] getting very fatigued when he walked, starting to walk badly, like loading his weight more to one side than to the other one."*	
Difficulty transferring in/out of car or bath	– *"In and out of the car is still a struggle, […] I have to help him get out of the bath, um, and I give him my arm and he climbs out."*	
Difficulty transferring on/off toilet or from bed to wheelchair	Not reported by caregivers of ambulatory children	– *"He's not able to move from his bed to his wheelchair."*
Physical functioning: Core		
Difficulty getting up from the floor	– *"He just was not able to get up, and that was the biggest sign, and that's why we took him to the doctor in the first place, because he was doing what you call Gower sign, which is the beginning, um, sign of muscular dystrophy."*	– *"He would have a little bit of trouble getting off the ground, like, he would get up weird."*
Difficulty bending down	– *"When it comes to picking up his toys, because they're so low to the ground, he won't do it."*	Not reported by caregivers of early non-ambulatory children

Concept	Caregivers of children who were ambulatory at interview (*n* = 9)	Caregivers of children who were early non-ambulatory at interview (*n* = 6)
Risk of falling	– *"I would say he was falling more […] He's a toe walker, so he's also got that going […] those were the biggest things we, we would see, was just, like, more falling."*	– *"And then the sudden falling down was happening, like, all this time, and he would just collapse, like, out of nowhere."*
Poor balance	– *"He doesn't really have that much balance […] before I found out that he had this or anything […] he wasn't very balanced, but he rode a bike, and then, now, he just – he doesn't ride a bike at all, 'cause he has no balance."*	Not reported by caregivers of early non-ambulatory children
Difficulty getting out of bed	– *"I guess, even maybe climbing in and out of bed could […] it's – takes just a little bit more, um, a little bit more of a try, I guess, for him."*	Not reported by caregivers of early non-ambulatory children
Difficulty sitting upright	– *"I would say being able to sit still. It was hard for him […] I say that because I think it was hard for him to sit in a, in a hard chair"*	Not reported by caregivers of early non-ambulatory children
ADLs		
Impacts on sports/ leisure or play involving lower limbs	– *"He had played some T-ball before that time, and so just him not being able to run like he could, and do the things with the other kids, I think that was probably like a, a hard moment for him."*	– *"We really didn't do a lot of activities […] Like, he could put the legs of the wheelchair, like, to the side and he will kick the ball, but he will get tired, um, really fast."*
Difficulty getting dressed	– *"Shoes is the biggest thing that he can't do. But, like, putting on a shirt, pants, um, he can't have anything with, like, buckles […] He can't, he can't button pants, so we usually get, like, um, joggers or, you know, something that he can pull on and off."*	– *"[…] just mainly, err, putting on pants."*
Difficulty washing and bathing	– *"[Child] has always needed assistance with, err, getting dressed and bathing, um, but he's still able to get in the tub himself, stand up, um, but […] I have to wash him."*	– *"He still cannot take a shower on his own, um, so, he's still not able to do those things."*
Impacts on sports/ leisure or play involving upper limbs	– *"Like, they have a basketball team. He couldn't, you know, push it up to the goal like most kids can."*	– *"He was getting tired, like, err, playing videogames or err, holding a ball."*
Difficulty writing	– *"Writing, he had a big difficulty with. He's doing better now, but […] he had a, err, big difficulty with trying to figure out what hand he uses to write."*	– *"He can't write a lot […] he writes a little bit and then he got tired so he stopped, then his muscle would get weaker in his hands and his, err, fingers."*
Difficulty completing household chores	– *"He has a big issue with trying to clean his bedroom."*	– *"The only thing I did notice was it took him a very long time, if I told him to, um, make his bed, to put his sheet on […] I didn't understand why it was so hard for him to put his sheet on his bed."*
Difficulty keeping up with peers	– *"He does have a couple here in the neighborhood, um, that he runs around with, and obviously he has trouble keeping up with them. He's still very ambulatory but, um, does have trouble keeping up with them."*	– *"If the other kids wanted to play tag or something, he couldn't, you know, keep up with them, so it made it harder for him to play."*

Concept	Caregivers of children who were ambulatory at interview (*n* = 9)	Caregivers of children who were early non-ambulatory at interview (*n* = 6)
Difficulty using utensils	– *"He'll grab the spoon, um, not how we – you and I normally would to eat, he'd grab it from, from the top of the, the handle, and that's how he does it."*	– *"If he got, like, a meat or whatever, we have to cut it […] he can't cut the meat, he can't, we cut it for him, and then he eat it all."*
Difficulty toileting	– *"We do have a bidet that he uses, um, so he does, I guess, have difficulty in cleaning himself after going to the bathroom."*	– *"He was able to go in the bathroom, like, with somebody's help. He had an aide at the school […] who goes to the school and take him to the bathroom and stuff like that."*
Difficulty shopping	– *"It would be really hard if I had to go to the store […] he wasn't able to keep up with me or, um, he would get so frustrated."*	Not reported by caregivers of early non-ambulatory children
Difficulty socializing with others	– *"[…] socializing with other people, not so much. Um, he usually got made fun of because of the way he ran […]. I don't know if he understands how to make friends, and I've tried to help him with that, but he's always thinking that they're against him."*	– *"There were just certain things, like, um, like, if we went on a field trip […] he couldn't adapt how to them […] So just certain things like that would be difficult for him."*
ADLs: School		
Difficulty participating in physical education	– *"Probably the only time he really has an issue at school […] is during physical education, gym class […] not being able to do the whole class or just, um, struggling to keep up with his friends during the class, depending on what they're doing."*	– *"He was fine with school, just […] like, PE-related and things like that were difficult, a lot were difficult, because […] he couldn't, like, run and stuff like that."*
Difficulty interacting with other children	– *"[…] Other students, he, um, argues and, kind of, just is bossy […] sometimes kids didn't want to help him, and he, kind of, had this idea that people should just, like, automatically do those things for him, so that didn't really mesh with his peers very well."*	Not reported by caregivers of early non-ambulatory children
Signs and symptoms		
Fatigue	– *"Right around one and two o'clock is when he would get tired, and I think that's because of the MD […] after lunch, he would just get really tired and the teachers would have to call me sometimes, that [Child]'s falling asleep."*	– *"He […] really didn't have much energy. Um, I would say he will have, he will have, like, maybe 85% of energy. […] we will move him from the bed to the wheelchair, or the wheelchair to the toilet, or the toilet to the wheelchair, he will get a little bit fatigued. "*
Pain	– *"Um, in his legs […] if he'd walked too far, err, he would start saying, 'Oh, my, my legs are sore, my legs really hurt.'"*	– *"[…] A lot of back pain, I was told because of the way that […] he walked because of his muscle weakness was, like, grating the bone in his back, so that's why his back would hurt."*
Other aspects of HRQoL: Sleep impacts		
Disrupted sleep	– *"He has no trouble falling asleep, it's staying asleep through the night […] he'll wake up in the middle of the night around – I would say about three, four in the morning, and be ready to go for the day."*	– *"Yeah, um, he will wake up, like, three or four times at night."*

Concept	Caregivers of children who were ambulatory at interview (*n* = 9)	Caregivers of children who were early non-ambulatory at interview (*n* = 6)
Sleep apnea	– *"They also found out with the DMD, he had, um, severe sleep apnea […] he would stop breathing in his sleep."*	– *"Well, he actually has sleep apnea now […] I didn't know that it was as bad as it was. Um, he, he stops breathing for ten times an hour at night."*
Difficulty falling asleep	– *"He has difficulty going to sleep."*	Not reported by caregivers of early-non ambulatory children
Other aspects of HRQoL: Cognitive-behavioral functioning		
Difficulty concentrating	– *"He is very impulsive, and, um, yeah, again, struggles to sit still and concentrate and focus."*	– *"He did have some difficulty with concentrating sometimes […] let's say he had a, a test, um, and he would get impatient."*
Reduced learning ability	– *"There's some cognitive pieces to it, um, in that he is low academically, cognitively."*	Not reported by caregivers of early non-ambulatory children
Speech/communication delays	– *"He's completely non-verbal and he'll echo a word every now and then."*	Not reported by caregivers of early non-ambulatory children
Difficulty reading	– *"He still is reading at kindergarten level, technically doesn't read […] if you try to get him to sound out some words […] it's really hard for him."*	– *"He does have an IEP for reading. Um, he does need a little bit of help with reading."*
Social/emotional delays	– *"But also, um, just with some cognitive and […] social-emotional delays, um, and struggles that way."*	Not reported by caregivers of early non-ambulatory children
Other aspects of HRQoL: Emotional well-being		
Upset	– *"[Child] has always been very emotional […] he can get really withdrawn, err, and internalize things."*	– *"Sometimes he's sad because he remembers when he used to walk and he starts thinking about it and he gets teary-eyed and stuff, um, but that doesn't happen very often."*
Anger	– *"He can, um, be pretty quick, err, tempered, um, and has struggled with, um, getting super angry."*	– *"He would get very, very emotional during some things […] if he gets mad, he cries."*
Frustration	– *"I would say probably frustration […] he gets frustrated a lot, and then I think – but then he did go through a lot of problems where he would be very, very happy. So, he'd go from very happy to very frustrated very quickly."*	– *"Um, and just I would say mostly frustration and anger […] because just not being able to do the things. Like, say, 'cause he has an older brother who is perfectly healthy, so his brother can go climb a tree, and he can't do that. So, um, things like that were very upsetting to him because he can't do what his brother can do."*
Anxiety	– *"There are also some anxieties […] just some different anxiety. He could be really clingy."*	– *We did have him talk to somebody last year […] just help him work through anger and fear."*

ADLs activities of daily living; *HRQoL* health-related quality of life.

[a]Caregiver IDs are not provided in order to preserve anonymity; efforts have been made to include quotes from each of the caregivers interviewed.

Supplementary Material 2. Verbatim quotes describing the patient experience of eteplirsen treatment in individuals amenable to exon 51 skipping[a]

Concept	Some improvement perceived	No change: Level of impact maintained	Continued decline perceived
Physical functioning: Upper limb			
Difficulty with fine motor movements	– *"He's able to use his hands a little bit more […] he fixes a lot of the phones and […] electrical stuff in the house. Well, let's say somebody have a radio that is not working, he can fix that […] he can do repetitive movement with his hand, because he don't get tired, like, like he used to."*	– *"He still has strength in his hands […]."*	– *"Writing's a little bit harder […] doing little things for his siblings that he might have been able to do in the past, you know, taking a lid off, or, you know, this or that."*
Difficulty lifting objects	– *"He can hold a book without any issues, he doesn't get tired."*	– *"This one we can say it's stayed the same. It is the same, basically."*	No caregivers reported a continued decline
Arm weakness	– *"I think I see an increase in strength because it's little things now that I'm thinking about it. Like, hitting a, hitting a ball […] now, he's swinging through all the way around, so, I mean, there's obviously a strength increase there."*	– *"He is now non-ambulatory […] But his arms still function, and his hands still function pretty well."*	– *"Actually, arm one I think, I think has changed, it gets a little bit weaker."*
Poor hand grip	– *"His grip is perfectly fine. Um, I think it's really good […] Probably gotten a little bit stronger actually."*	No caregivers reported 'no change'	– *"Yes […] in his hand, he got a little bit, err, weaker."*
Difficulty reaching above head	No caregivers reported an improvement perceived	No caregivers reported 'no change'	– *"Lifting his arms above his head, like in that sense that he has to put his arms up and, you know, his arms get tired really quickly."*
Physical functioning: Lower limb			
Difficulty walking	– *"He can walk and he lasts longer, longer walking. I don't see him so agitated as before, that with a really short distance he was very agitated, it seemed that his breathing was going to go out because he couldn't keep walking."*	– *"I'd say yes and no. He's still able, you know, he can still walk. Um, I try to make sure every day that he does that. But there are days that he doesn't want to move. He just – he says he, he hurts."* *I: […] would you say that stayed the same since the treatment?* *"Yes."*	No caregivers reported a continued decline
Difficulty running	– *"When he starts, like, running and stuff, initially, before the, kind of, down trend in, in stamina […] I think he is moving quicker, faster, um, than he was before […] Like, he's able to do it longer."*	– *"Like, he can't – he couldn't full out sprint before the treatment […] yeah, and he can't do it after either."*	No caregivers reported a continued decline

Concept	Some improvement perceived	No change: Level of impact maintained	Continued decline perceived
Difficulty using stairs	– *"The stairs, it seems that little by little, he is recovering a bit of strength, at least to have enough strength to climb up and down stairs. It's enough, for me, that's enough already."*	No caregivers reported 'no change'	– *"His ability to go up the stairs has slowed down […] there was a slight, um, difference in his strength when he was trying to go up the steps."*
Difficulty transferring	– *"I didn't think about this before, but, um, getting in and out of vehicles […] I used to have to, like, lift up his legs and his whole body, and, like, lift him into the vehicle, and lift him out and stand him up, and, recently, […] it doesn't take as much energy to get him in, it's a little easier."*	– *"We have to help him in and out, so I'd say it's the same."*	No caregivers reported a continued decline
Difficulty jumping	– *"About the first […] six to eight weeks of treatment […] he could jump, and that was probably the most noticeable thing […] not jumping off of something but, like, literally from the ground, jumping up and jumping down."*	No caregivers reported 'no change'	No caregivers reported a continued decline
Activities of daily living (ADLs)			
Impacts on sports/leisure or play involving upper limbs	– *"He started trying to throw a ball around, um, much that really made me happy. Um, so, then after that, it just kept happening."*	– *"It's stayed the same, but, like, well, what I said before, that his ha, his hand a little bit weaker, so he can't stay more long with the remote to play."*	No caregivers reported a continued decline
Impacts on sports/leisure or play involving lower limbs	– *"He's doing a lot more, um, which is a blessing anyway, because he's not, um, just like homebound or bedbound like he was. He actually tries to go outside and play […] and he's riding his scooter again."*	– *"It's, it's the same, but he, he take it."*	No caregivers reported a continued decline
Difficulty getting dressed	– *"He is able to do – um, he's able to pull his shirt on and wash his teeth and brush his hair without any issue."*	– *"He can dress himself, with help sometimes. Sometimes he can't very well, but it's not much. And he hasn't changed, he still, and it's not much help he needs."*	– *"He's not really able to, to get dressed now, he can help a little bit, but it's, it's hard for him. He gets tired, he'll get tired easily."*
Difficulty washing or bathing	– *"He's, um, more upbeat and he's able to stay in the shower […] completely unattended now."*	– *"No, that's pretty much the same."*	– *"We do it all now and that's more […] he doesn't want to bend forward and stuff."*
Difficulty completing household chores	– *"He actually has certain chores that he does, and we just found in the one, he learned how to vacuum […] That's something new."*	No caregivers reported 'no change'	No caregivers reported a continued decline

Concept	Some improvement perceived	No change: Level of impact maintained	Continued decline perceived
Difficulty writing	– *"He was having a hard time with the writing before, now […] he's able to complete words when he, when he writes, and he feels good about himself."*	– *"He writes slower, you know, and he's always been really slow with his writing."*	– *"Writing's a little bit harder."*
Difficulty using utensils	– *"He was very unwilling before, and, and now he's more willing to use his, his utensils."*	– *"Yeah, no, he don't use a knife […] He can't. Yeah, stayed the same."*	No caregivers reported a continued decline
Difficulty toileting	No caregivers reported an improvement perceived	– *"The wiping has stayed the same, um, but that's because…"*	No caregivers reported a continued decline
Signs and symptoms			
Fatigue	– *"It's a lot better. Um, I haven't experienced him getting fatigued anymore."*	– *"No, I think that's pretty much the same."*	– *"He gets tired more quickly."*
Muscle weakness	– *"The physical therapist who we worked with, you know, same person for a long time, said he just has so much more overall tone, um, muscle tone than he's had before."*	– *"What I'm seeing is they say they're going to keep him maintained, like, he's going to keep it the same level this was […] he's not going to get, err, weaker and weaker and weaker."*	– *"I still have noticed that there is, there is some weakness, a little bit more weakness."*
Pain	– *"He doesn't complain, um, of his legs getting sore, um, like he used to."*	– *"No, it's stayed about the same."*	– *I: What you noticed, in order for you to notice this change for the worse?* *"Um, not climbing stairs and saying that his thighs hurt."*
Other aspects of HRQoL: Cognitive-behavioral functioning			
Difficulty concentrating	– *"I would say even his ability to concentrate [laughs] has improved."*	– *"I would say that probably stayed the same. I don't think that had – really had any effect on that area."*	No caregivers reported a continued decline
Reading difficulties	– *"He is definitely a better reader and he is way more into reading, which has helped him understand material at school, he's been more confident, gets good grades, and is really able to focus on it."*	– *"No […] he can read, you know. I make sure. I'm, like, 'No, read this.'"*	No caregivers reported a continued decline
Learning difficulties	– *"He's doing really good. Um, he came up, like, 65% on his, um, math […] to now, he's moved up a lot, um, so that's a good thing."*	No caregivers reported 'no change'	– *"There's some cognitive pieces to it, um, in that he is low academically, cognitively […] it's probably gotten worse."*
Delays in social and emotional functioning	No caregivers reported an improvement perceived	No caregivers reported 'no change'	– *"Behavior, um, is a challenge, um, to say the least. Um, so that inhibits his overall success a lot at school […] it's probably gotten worse."*
Other aspects of HRQoL: Emotional well-being			
Overall emotional well-being	– *"And then he just seems alive […] overall, he seems a lot calmer, his mentality does."*	No caregivers reported 'no change'	No caregivers reported a continued decline

Concept	Some improvement perceived	No change: Level of impact maintained	Continued decline perceived
Feeling upset	– *"And I've noticed […] recently, that he doesn't get as up-upset as easily, um, and if he does get upset, it doesn't take as long or as much effort to, kind of, um, bring him back to level."*	– *"[Child] has always been very emotional and, like I said, he can get really withdrawn, err, and internalize things […] I don't know if there's really been a change since starting, starting Exondys on that. Honestly, I think, um, it's probably the same."*	No caregivers reported a continued decline
Feeling angry	No caregivers reported an improvement perceived	– *"It is the same. The same. But thanks God, they don't, they don't get worse, so it's same, the emotion."*	No caregivers reported a continued decline
Feeling frustrated	– *"And now I see that he walks a longer distance, and he is not so agitated."*	– *"He still gets frustrated, he still – he can be very happy one moment and, um, he'll, kind of, get over on, um, the next moment, so I'm not sure that's changed."*	No caregivers reported a continued decline
Low confidence	– *"Yes, it definitely gives him confidence, and, um, you know, kind of, makes him feel proud of himself and not needing so much."*	No caregivers reported 'no change'	No caregivers reported a continued decline

ADLs activities of daily living; *HRQoL* health-related quality of life; *I*, interviewer.

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