Appendix:

Devices to Manage Tremors in Parkinson's Disease and Essential Tremor

Appendix A. Search Strategies

Set #	Strategy	Search Yield
PubMed		
28-Aug-2023, Limits: English language, Publication date 01/01/2018 onwards		
#15	#12 AND #13 AND #14	1,418
#14	English [Language]	31,306,268
#13	("2018/01/01"[Date - Publication]: "2024"[Date - Publication])	8,110,688
#12	#10 NOT #11	2,903
#11	("infant"[mesh] OR "child"[mesh] OR "adolescent"[mesh]) NOT ("adult"[mesh])	2,146,948
#10	#8 NOT #9	2,908
#9	(("Animals"[MESH] OR "Animal Experimentation"[MESH] OR "Models, Animal"[MESH] OR "Vertebrates"[MESH]) NOT ("Humans"[MESH] OR "Human experimentation"[MESH]))	5,150,859
#8	#3 AND #7	3,041
#7	#4 OR #5 OR #6	4,991,953
#6	"Randomized Controlled Trial"[pt] OR "Controlled Clinical Trial"[pt] OR "Pragmatic Clinical Trial"[pt] OR "Equivalence Trial"[pt] OR "Clinical Trial, Phase III"[pt] OR "Randomized Controlled Trials as Topic"[mh] OR "Controlled Clinical Trials as Topic"[mh] OR "Random Allocation"[mh] OR "Double-Blind Method"[mh] OR "Single-Blind Method"[mh] OR Placebos[Mesh:NoExp] OR "Control Groups"[mh] OR (random*[tiab] OR sham[tiab] OR placebo*[tiab]) OR ((singl*[tiab] OR doubl*[tiab]) AND (blind*[tiab] OR dumm*[tiab] OR mask*[tiab])) OR ((tripl*[tiab] OR trebl*[tiab]) AND (blind*[tiab] OR dumm*[tiab] OR mask*[tiab])) OR (control*[tiab] AND (study[tiab] OR studies[tiab] OR trial*[tiab] OR group*[tiab])) OR (Nonrandom*[tiab] OR "non random*"[tiab] OR "non-random*"[tiab] OR "quasi-random*"[tiab] OR quasirandom*[tiab]) OR allocated[tiab] OR (("open label"[tiab] OR "open-label"[tiab]) AND (study[tiab] OR studies[tiab] OR trial*[tiab])) OR ((equivalence[tiab] OR superiority[tiab] OR "non-inferiority"[tiab] OR noninferiority[tiab]) AND (study[tiab] OR studies[tiab] OR trial*[tiab])) OR ("pragmatic study"[tiab] OR "pragmatic studies"[tiab]) OR ((pragmatic[tiab] OR practical[tiab]) AND trial*[tiab]) OR ((quasiexperimental[tiab] OR "quasi-experimental"[tiab]) AND (study[tiab] OR studies[tiab] OR trial*[tiab])) OR (phase[ti] AND (III[ti] OR 3[ti]) AND (study[ti] OR studies[ti] OR trial*[ti])) OR (phase[ot] AND (III[ot] OR 3[ot]) AND (study[ot] OR studies[ot] OR trial*[ot]))	4,381,383
#5	"Guideline"[pt] OR "practice guideline"[pt] OR "consensus development conference"[pt] OR "consensus development conference, NIH"[pt] OR guideline*[ti] OR standards[ti] OR consensus*[ti] OR recommendat*[ti] OR guideline*[cn] OR standards[cn] OR consensus*[cn] OR recommendat*[cn] OR "practice parameter*"[ti] OR "position statement*"[ti] OR "practice bulletin*"[ti] OR "policy statement*"[ti] OR CPG[ti] OR CPGs[ti] OR "best practice*"[ti] OR (care[ti] AND (path[ti] OR paths[ti] OR pathway[ti] OR pathways[ti] OR map[ti] OR maps[ti] OR plan[ti] OR plans[ti] OR standard[ti])) OR ((critical[ti] OR clinical[ti] OR practice[ti]) AND (path[ti] OR paths[ti] OR pathway[ti] OR pathways[ti] OR protocol*[ti])) OR (algorithm*[ti] AND (pharmacotherap*[ti] OR chemotherap*[ti] OR therap*[ti] OR treatment*[ti] OR intervention*[ti])) OR (algorithm*[ti] AND (screening[ti] OR examination[ti] OR test[ti] OR tested[ti] OR testing[ti] OR assessment*[ti] OR diagnosis[ti] OR diagnoses[ti] OR diagnosed[ti] OR diagnosing[ti])) OR guideline*[ot] OR standards[ot] OR consensus*[ot] OR recommendat*[ot] OR "practice parameter*"[ot] OR "position statement*"[ot] OR "practice bulletin*"[ot] OR "policy statement*"[ot] OR CPG[ot] OR CPGs[ot] OR	295,099

	"best practice*"[ot] OR (care[ot] AND (path[ot] OR paths[ot] OR pathway[ot] OR pathways[ot] OR map[ot] OR maps[ot] OR plan[ot] OR plans[ot] OR standard[ot])) OR ((critical[ot] OR clinical[ot] OR practice[ot]) AND (path[ot] OR paths[ot] OR pathway[ot] OR pathways[ot] OR protocol*[ot])) OR (algorithm*[ot] AND (pharmacotherap*[ot] OR chemotherap*[ot] OR therap*[ot] OR treatment*[ot] OR intervention*[ot])) OR (algorithm*[ot] AND (screening[ot] OR examination[ot] OR test[ot] OR tested[ot] OR testing[ot] OR assessment*[ot] OR diagnosis[ot] OR diagnoses[ot] OR diagnosed[ot] OR diagnosing[ot])) OR (("Systematic review"[ti] OR "systematic review"[pt] OR "systematic review"[ot]) AND ("practice guideline*"[tiab] OR "treatment guideline*"[tiab] OR "clinical guideline*"[tiab] OR "guideline recommendation*"[tiab]))	
#4	"systematic"[filter] OR "meta-analysis"[pt] OR "meta-analysis as topic"[mh] OR "meta analy*"[tw] OR metanaly*[tw] OR metaanaly*[tw] OR "met analy*"[tw] OR "integrative research"[tiab] OR "integrative review*"[tiab] OR "integrative overview*"[tiab] OR "research integration*"[tiab] OR "research overview*"[tiab] OR "collaborative review*"[tiab] OR "collaborative overview*"[tiab] OR "systematic review"[pt] OR "systematic reviews as topic"[mh] OR "systematic review*"[tiab] OR "technology assessment*"[tiab] OR "technology overview*"[tiab] OR "technology appraisal*"[tiab] OR "Technology Assessment, Biomedical"[mh] OR HTA[tiab] OR HTAs[tiab] OR "comparative efficacy"[tiab] OR "comparative effectiveness"[tiab] OR "outcomes research"[tiab] OR "indirect comparison*"[tiab] OR "Bayesian comparison"[tiab] OR (("indirect treatment"[tiab] OR "mixed-treatment"[tiab]) AND comparison*[tiab]) OR Embase*[tiab] OR Cinahl*[tiab] OR "systematic overview*"[tiab] OR "methodological overview*"[tiab] OR "methodologic overview*"[tiab] OR "methodological review*"[tiab] OR "methodologic review*"[tiab] OR "quantitative review*"[tiab] OR "quantitative overview*"[tiab] OR "quantitative synthes*"[tiab] OR "pooled analy*"[tiab] OR Cochrane[tiab] OR Medline[tiab] OR Pubmed[tiab] OR Medlars[tiab] OR handsearch*[tiab] OR "hand search*"[tiab] OR "meta-regression*"[tiab] OR metaregression*[tiab] OR "data synthes*"[tiab] OR "data extraction"[tiab] OR "data abstraction*"[tiab] OR "mantel haenszel"[tiab] OR peto[tiab] OR "der-simonian"[tiab] OR dersimonian[tiab] OR "fixed effect*"[tiab] OR "multiple treatment comparison"[tiab] OR "mixed treatment meta-analys*"[tiab] OR "umbrella review*"[tiab] OR (("multiple paramet*"[tiab]) AND ("evidence synthesis"[tiab])) OR (("multi-paramet*"[tiab]) AND ("evidence synthesis"[tiab])) OR ((multiparameter*[tiab]) AND ("evidence synthesis"[tiab])) OR "Cochrane Database Syst Rev"[Journal] OR "health technology assessment winchester, england"[Journal] OR "Evid Rep Technol Assess (Full Rep)"[Journal] OR "Evid Rep Technol Assess (Summ)"[Journal] OR "Int J Technol Assess Health Care"[Journal] OR "GMS Health Technol Assess"[Journal] OR "Health Technol Assess (Rockv)"[Journal] OR "Health Technol Assess Rep"[Journal]	654,571
#3	#1 AND #2	11,555
#2	"Electric Stimulation Therapy"[Mesh:NoExp] OR "Deep Brain Stimulation"[Mesh:NoExp] OR "Pulsed Radiofrequency Treatment"[Mesh:NoExp] OR "Ultrasonic Therapy"[Mesh:NoExp] OR "Wearable Electronic Devices"[Mesh:NoExp] OR "Equipment and Supplies"[Mesh:NoExp] OR "Implantable Neurostimulators"[Mesh:NoExp] OR "Electric Stimulation Therapy"[tiab] OR "Therapeutic Electrical Stimulation"[tiab] OR "Therapeutic Electric Stimulation"[tiab] OR "Electrical Stimulation Therapy"[tiab] OR "Electrotherapy"[tiab] OR "Interferential Current Electrotherapy"[tiab] OR "Deep Brain Stimulation"[tiab] OR "Deep Brain Stimulations"[tiab] OR "Electrical Stimulation of the Brain"[tiab] OR "Pulsed Radiofrequency Treatment"[tiab] OR "Pulsed Radiofrequency Treatments"[tiab] OR "Pulsed Radio Frequency Treatment"[tiab] OR "Ultrasonic Therapy"[tiab] OR "Ultrasonic Therapies"[tiab] OR "Therapeutic Ultrasound"[tiab] OR "Ultrasound Therapy"[tiab] OR "Ultrasound Therapies"[tiab] OR "vibrotactile stimulation"[tiab] OR "vibrotactile stimulations"[tiab] OR "magnetic resonance image-guided focused ultrasound"[tiab] OR "MRgFUS"[tiab] OR "Exablate"[tiab] OR "wearable device"[tiab] OR "wearable devices"[tiab] OR "Vercise"[tiab] OR "caloric vestibular stimulation"[tiab] OR "implantable neurostimulator"[tiab] OR "implantable neurostimulators"[tiab] OR "implanted neurostimulator"[tiab] OR "implanted neurostimulators"[tiab] OR "neuropacemaker"[tiab] OR "Reactiv8"[tiab] OR "Resume II"[tiab] OR "ExAblate 2000"[tiab] OR "ExAblate 2100"[tiab] OR "ExAblate 4000"[tiab] OR "MRgFUS"[tiab] OR "MRIgFUS"[tiab] OR "Sonablate"[tiab] OR "ExAblate Neuro"[tiab] OR "non-invasive neuromodulation"[tiab] OR "noninvasive neuromodulation"[tiab] OR "tremor reduction"[tiab] OR "time-varying caloric vestibular stimulation"[tiab] OR "tvCVS"[tiab] OR "Wearable Electronic Devices"[tiab] OR "Wearable Electronic Device"[tiab] OR "Wearable Technology"[tiab] OR "Wearable Technologies"[tiab] OR "Wearable Devices"[tiab] OR "Wearable Device"[tiab] OR "Electronic Skin"[tiab] OR "Medical Devices"[tiab] OR "Medical Device"[tiab] OR "Device"[tiab] OR	628,890

	"devices"[tiab] OR "implantable neurostimulators"[tiab] OR "Implantable Neurostimulator"[tiab] OR "Implanted Neurostimulators"[tiab] OR "Implanted Neurostimulator"[tiab] OR "Implanted Nerve Stimulation Electrodes"[tiab]	
#1	"Parkinsonian Disorders"[Mesh:NoExp] OR "Parkinson Disease"[Mesh:NoExp] OR "Parkinson Disease, Secondary"[Mesh] OR "Essential Tremor"[Mesh:NoExp] OR "Parkinsonian"[tiab] OR "Parkinson"[tiab] OR "Parkinson's"[tiab] OR "Parkinsons"[tiab] OR "Parkinsonism"[tiab] OR "Parkinsonisms"[tiab] OR "Paralysis Agitans"[tiab] OR "hemiparkinsonism"[tiab] OR "MPTP Poisoning"[tiab] OR "MPTP-Induced Parkinsonism"[tiab] OR "MPTP Induced Parkinsonism"[tiab] OR "Postencephalitic Parkinson Disease"[tiab] OR "Postencephalitic Parkinsonism"[tiab] OR "Essential Tremor"[tiab] OR "Essential Tremors"[tiab] OR "Benign Essential Tremor"[tiab] OR "Benign Essential Tremors"[tiab] OR "Familial Tremor"[tiab] OR "Familial Tremors"[tiab] OR "Hereditary Essential Tremor"[tiab] OR "hereditary tremor"[tiab]	159,403
Embase		
28-Aug-2023, Limits: English language, Publication date 2018-2024		
#16	#15 AND ('Article'/it OR 'Article in Press'/it)	2699
#15	#12 AND #13 AND #14	5946
#14	english:la	37258634
#13	[2018-2024]/py	10017551
#12	#10 NOT #11	12541
#11	'juvenile'/exp NOT 'adult'/exp	2816347
#10	#8 NOT #9	12620
#9	('animal'/exp OR 'animal experiment'/de OR 'nonhuman'/de OR 'invertebrate'/exp OR 'amphibia'/exp OR 'fish'/exp OR 'boreoeutheria'/exp OR 'afrotheria'/exp OR 'dermoptera'/exp OR 'glires'/exp OR 'scandentia'/exp OR 'sauropsid'/exp OR 'laurasiatheria'/exp OR 'ungulate'/exp OR 'reptile'/exp OR 'cercopithecidae'/exp OR 'marsupial'/exp OR 'monotremate'/exp OR 'prosimian'/exp OR 'tarsiiform'/exp OR 'hylobatidae'/exp OR 'xenarthra'/exp OR 'platyrrhini'/exp OR 'chimpanzee'/exp OR 'gorilla'/exp OR 'orang utan'/exp OR 'homo neanderthalensis'/exp OR 'cephalochordata'/exp OR 'hyperotreti'/exp OR 'urochordata'/exp OR 'ambulacraria'/exp OR 'coelomata'/exp OR 'protostomia'/exp OR 'pseudocoelomata'/exp OR 'coelenterate'/exp OR 'mesozoa'/exp OR 'placozoa'/exp OR 'porifera'/exp OR 'juvenile animal'/exp OR 'male animal'/exp OR 'female animal'/exp OR 'primate'/de OR 'haplorhini'/de OR 'mammal'/de OR 'catarrhini'/de OR 'simian'/de OR 'ape'/de OR 'amniote'/de OR 'tetrapod'/de OR 'vertebrate'/de OR 'chordata'/de OR 'deuterostomia'/de OR 'bilateria'/de OR 'therian'/de OR 'hominid'/de OR 'euarchontoglires'/de OR 'placental mammals'/de) NOT ('human'/exp OR 'human experiment'/de)	7836559
#8	#3 AND #7	12916
#7	#4 OR #5 OR #6	16453771
#6	'practice guideline'/exp OR 'consensus development'/de OR guideline*:ti OR standards:ti OR consensus*:ti OR recommendat*:ti OR guideline*:au OR standards:au OR consensus*:au OR recommendat*:au OR 'practice parameter*':ti OR 'position statement*':ti OR 'practice bulletin*':ti OR 'policy statement*':ti OR cpg:ti OR cpgs:ti OR 'best practice*':ti OR (care:ti AND (path:ti OR paths:ti OR pathway:ti OR pathways:ti OR map:ti OR maps:ti OR plan:ti OR plans:ti OR standard:ti)) OR ((critical:ti OR clinical:ti OR practice:ti) AND (path:ti OR 'paths':ti OR pathway:ti OR pathways:ti OR protocol*:ti)) OR (algorithm*:ti AND (pharmacotherap*:ti OR chemotherap*:ti OR therap*:ti OR 'treatment*':ti OR intervention*:ti)) OR (algorithm*:ti AND (screening:ti OR examination:ti OR test:ti OR tested:ti OR testing:ti OR assessment*:ti OR diagnosis:ti OR diagnoses:ti OR diagnosed:ti OR diagnosing:ti)) OR guideline*:kw,ok OR standards:kw,ok OR consensus*:kw,ok OR recommendat*:kw,ok OR 'practice parameter*':kw,ok OR 'position statement*':kw,ok OR 'practice bulletin*':kw,ok OR 'policy statement*':kw,ok OR cpg:kw,ok OR cpgs:kw,ok OR 'best practice*':kw,ok OR (care:kw,ok AND ('path':kw,ok OR paths:kw,ok OR pathway:kw,ok OR pathways:kw,ok OR map:kw,ok OR maps:kw,ok OR plan:kw,ok OR plans:kw,ok OR standard:kw,ok)) OR ((critical:kw,ok OR clinical:kw,ok OR practice:kw,ok) AND (path:kw,ok OR paths:kw,ok OR pathway:kw,ok OR pathways:kw,ok OR protocol*:kw,ok)) OR (algorithm*:kw,ok AND (pharmacotherap*:kw,ok OR chemotherap*:kw,ok OR therap*:kw,ok OR treatment*:kw,ok OR intervention*:kw,ok)) OR (algorithm*:kw,ok AND (screening:kw,ok OR examination:kw,ok OR test:kw,ok OR tested:kw,ok OR testing:kw,ok OR assessment*:kw,ok OR diagnosis:kw,ok OR diagnoses:kw,ok OR diagnosed:kw,ok OR diagnosing:kw,ok)) OR (('systematic review':ti OR	932112

	[systematic review]/lim OR 'systematic review (topic)'/de OR 'systematic review':kw,ok) AND ('practice guideline*':ab,ti,kw OR 'treatment guideline*':ab,ti,kw OR 'clinical guideline*':ab,ti,kw OR 'guideline recommendation*':ab,ti,kw))	
#5	[clinical study]/lim OR [clinical trial]/lim OR [controlled clinical trial]/lim OR 'randomized controlled trial'/exp OR 'controlled clinical trial'/de OR 'pragmatic trial'/de OR 'equivalence trial'/de OR 'phase 3 clinical trial'/de OR 'randomized controlled trial (topic)'/de OR 'controlled clinical trial (topic)'/de OR 'randomization'/de OR 'double blind procedure'/de OR 'single blind procedure'/de OR 'placebo'/de OR 'control group'/de OR random*:ab,ti,kw OR sham:ab,ti,kw OR placebo*:ab,ti,kw OR ((singl*:ab,ti,kw OR doubl*:ab,ti,kw) AND (blind*:ab,ti,kw OR dumm*ab,ti,kw OR mask*:ab,ti,kw)) OR ((tripl*:ab,ti,kw OR trebl*:ab,ti,kw) AND (blind*:ab,ti,kw OR dumm*ab,ti,kw OR mask*:ab,ti,kw)) OR (control*:ab,ti,kw AND (study:ab,ti,kw OR studies:ab,ti,kw OR trial*:ab,ti,kw OR group*:ab,ti,kw)) OR nonrandom*:ab,ti,kw OR 'non random*':ab,ti,kw OR 'non-random*':ab,ti,kw OR 'quasi-random*':ab,ti,kw OR quasirandom*:ab,ti,kw OR allocated:ab,ti,kw OR (('open label':ab,ti,kw OR 'open-label':ab,ti,kw) AND (study:ab,ti,kw OR studies:ab,ti,kw OR trial*:ab,ti,kw)) OR ((equivalence:ab,ti,kw OR superiority:ab,ti,kw OR 'non-inferiority':ab,ti,kw OR noninferiority:ab,ti,kw) AND (study:ab,ti,kw OR studies:ab,ti,kw OR trial*:ab,ti,kw)) OR 'pragmatic study':ab,ti,kw OR 'pragmatic studies':ab,ti,kw OR ((pragmatic:ab,ti,kw OR practical:ab,ti,kw) AND trial*ab,ti,kw) OR ((quasiexperimental:ab,ti,kw OR 'quasi-experimental':ab,ti,kw) AND (study:ab,ti,kw OR studies:ab,ti,kw OR trial*:ab,ti,kw)) OR (phase:ti AND (iii:ti OR 3:ti) AND (study:ti OR studies:ti OR trial*:ti)) OR (phase:kw AND (iii:kw OR 3:kw) AND (study:kw OR studies:kw OR trial*:kw))	15472754
#4	[meta analysis]/lim OR 'meta analysis'/exp OR 'meta analysis (topic)'/de OR 'meta analy*':ti OR 'meta-analy*':ti OR metanaly*:ti OR metaanaly*:ti OR 'met analy*':ti OR 'met-analy*':ti OR 'integrative research':ab,ti OR 'integrative review'/de OR 'integrative review*':ab,ti OR 'integrative overview*':ab,ti OR 'research integration*':ab,ti OR 'research overview*':ab,ti OR 'collaborative review*':ab,ti OR 'collaborative overview*':ab,ti OR [systematic review]/lim OR 'systematic review'/de OR 'systematic review (topic)'/de OR 'systematic review*':ab,ti OR 'technology assessment*':ab,ti OR 'technology overview*':ab,ti OR 'technology appraisal*':ab,ti OR 'biomedical technology assessment'/de OR hta:ab,ti OR htas:ab,ti OR 'comparative effectiveness'/de OR 'comparative efficacy':ab,ti OR 'comparative effectiveness':ab,ti OR 'outcomes research'/de OR 'outcomes research':ab,ti OR 'indirect comparison*':ab,ti OR 'bayes theorem'/de OR 'bayesian comparison':ab,ti OR (('indirect treatment':ab,ti OR 'mixed-treatment':ab,ti) AND comparison*:ab,ti) OR embase*:ab,ti OR cinahl*:ab,ti OR 'systematic overview*':ab,ti OR 'methodological overview*':ab,ti OR 'methodologic overview*':ab,ti OR 'methodological review*':ab,ti OR 'methodologic review*':ab,ti OR 'quantitative review*':ab,ti OR 'quantitative overview*':ab,ti OR 'quantitative synthes*':ab,ti OR 'pooled analy*':ab,ti OR cochrane:ab,ti OR medline:ab,ti OR pubmed:ab,ti OR medlars:ab,ti OR handsearch*:ab,ti OR 'hand search*':ab,ti OR 'meta-regression*':ab,ti OR metaregression*:ab,ti OR 'data synthes*':ab,ti OR 'data extraction':ab,ti OR 'data abstraction*':ab,ti OR 'mantel haenszel':ab,ti OR peto:ab,ti OR 'der-simonian':ab,ti OR dersimonian OR 'fixed effect*':ab,ti OR 'multiple treatment comparison':ab,ti OR 'mixed treatment meta-analys*':ab,ti OR 'umbrella review*':ab,ti OR ('multiple paramet*':ab,ti AND 'evidence synthesis':ab,ti) OR ('multi-paramet*':ab,ti AND 'evidence synthesis':ab,ti) OR (multiparameter*:ab,ti AND 'evidence synthesis':ab,ti) OR 'cochrane database syst rev':ta OR 'health technology assessment winchester, england':ta OR 'evid rep technol assess (full rep)':ta OR 'evid rep technol assess (summ)':ta OR 'int j technol assess health care':ta OR 'gms health technol assess':ta OR 'health technol assess (rockv)':ta OR 'health technol assess rep':ta	1125503
#3	#1 AND #2	19119
#2	'vibrotactile stimulation'/exp OR 'deep brain stimulator'/syn OR 'implantable pulse generator'/de OR 'implantable neurostimulator'/de OR 'mr-guided focused ultrasound device'/de OR 'ultrasound ablation device'/de OR 'neurological therapeutic device'/de OR 'implantable neurostimulator'/exp OR 'wearable computer'/de OR 'medical device'/de OR 'electric stimulation therapy':ti,ab,kw,ok OR 'therapeutic electrical stimulation':ti,ab,kw,ok OR 'therapeutic electric stimulation':ti,ab,kw,ok OR 'electrical stimulation therapy':ti,ab,kw,ok OR electrotherapy:ti,ab,kw,ok OR 'interferential current electrotherapy':ti,ab,kw,ok OR 'deep brain stimulation':ti,ab,kw,ok OR 'deep brain stimulations':ti,ab,kw,ok OR 'electrical stimulation of the brain':ti,ab,kw,ok OR 'pulsed radiofrequency treatment':ti,ab,kw,ok OR 'pulsed radiofrequency treatments':ti,ab,kw,ok OR 'pulsed radio frequency treatment':ti,ab,kw,ok OR 'ultrasonic therapy':ti,ab,kw,ok OR 'ultrasonic therapies':ti,ab,kw,ok OR 'therapeutic ultrasound':ti,ab,kw,ok OR 'ultrasound therapy':ti,ab,kw,ok	766825

	OR 'ultrasound therapies':ti,ab,kw,ok OR 'vibrotactile stimulation':ti,ab,kw,ok OR 'vibrotactile stimulations':ti,ab,kw,ok OR 'vt touch':ti,ab,kw,ok OR 'infinity dbs':ti,ab,kw,ok OR 'magnetic resonance image-guided focused ultrasound':ti,ab,kw,ok OR mrgfus:ti,ab,kw,ok OR exablate:ti,ab,kw,ok OR 'tremor mitigation device':ti,ab,kw,ok OR 'tremor mitigation devices':ti,ab,kw,ok OR vercise:ti,ab,kw,ok OR 'cala trio':ti,ab,kw,ok OR 'cala kiq':ti,ab,kw,ok OR 'caloric vestibular stimulation':ti,ab,kw,ok OR 'thermoneuromodulation device':ti,ab,kw,ok OR 'thermomodulation devices':ti,ab,kw,ok OR 'infinity deep brain stimulation':ti,ab,kw,ok OR 'aaxon dual-channel implantable pulse generator':ti,ab,kw,ok OR 'implantable stimulator control magnet':ti,ab,kw,ok OR 'infinity implantable neurostimulator':ti,ab,kw,ok OR 'interstim icon':ti,ab,kw,ok OR 'neural-tissue electrical stimulation lead':ti,ab,kw,ok OR 'neural-tissue electrical stimulation lead adapter':ti,ab,kw,ok OR 'neural-tissue electrical stimulation lead adaptor':ti,ab,kw,ok OR 'neuromuscular electrical stimulation system programmer':ti,ab,kw,ok OR neuropacemaker:ti,ab,kw,ok OR reactiv8:ti,ab,kw,ok OR 'resume ii':ti,ab,kw,ok OR 'specify implantable neurostimulator':ti,ab,kw,ok OR 'mr-guided focused ultrasound device':ti,ab,kw,ok OR 'exablate 2000':ti,ab,kw,ok OR 'exablate 2100':ti,ab,kw,ok OR 'exablate 4000':ti,ab,kw,ok OR 'mrgfus device':ti,ab,kw,ok OR 'mrgfus transducer':ti,ab,kw,ok OR 'mri-guided focused ultrasound device':ti,ab,kw,ok OR 'mrigfus device':ti,ab,kw,ok OR sonablate:ti,ab,kw,ok OR 'vercise dbs':ti,ab,kw,ok OR 'exablate neuro':ti,ab,kw,ok OR 'non-invasive neuromodulation':ti,ab,kw,ok OR 'noninvasive neuromodulation':ti,ab,kw,ok OR 'transcutaneous afferent patterned stimulation therapy':ti,ab,kw,ok OR 'encora therapeutics':ti,ab,kw,ok OR 'tremor reduction':ti,ab,kw,ok OR 'tremor mitigation':ti,ab,kw,ok OR 'time-varying caloric vestibular stimulation':ti,ab,kw,ok OR tvcvs:ti,ab,kw,ok OR 'wearable electronic devices':ti,ab,kw,ok OR 'wearable electronic device':ti,ab,kw,ok OR 'wearable technology':ti,ab,kw,ok OR 'wearable technologies':ti,ab,kw,ok OR 'wearable devices':ti,ab,kw,ok OR 'wearable device':ti,ab,kw,ok OR 'electronic skin':ti,ab,kw,ok OR 'medical devices':ti,ab,kw,ok OR 'medical device':ti,ab,kw,ok OR device:ti,ab,kw,ok OR devices:ti,ab,kw,ok OR 'implantable neurostimulators':ti,ab,kw,ok OR 'implantable neurostimulator':ti,ab,kw,ok OR 'implanted neurostimulators':ti,ab,kw,ok OR 'implanted neurostimulator':ti,ab,kw,ok OR 'implanted nerve stimulation electrodes':ti,ab,kw,ok	
#1	'parkinsonism'/de OR 'parkinson disease'/de OR 'secondary parkinsonism'/exp OR 'essential tremor'/de OR parkinsonian:ti,ab,kw,ok OR parkinson:ti,ab,kw,ok OR parkinson*:ti,ab,kw,ok OR parkinsons:ti,ab,kw,ok OR parkinsonism:ti,ab,kw,ok OR parkinsonisms:ti,ab,kw,ok OR 'paralysis agitans':ti,ab,kw,ok OR 'hemiparkinsonism':ti,ab,kw,ok OR 'ramsay hunt paralysis syndrome':ti,ab,kw,ok OR 'ramsay-hunt paralysis syndrome':ti,ab,kw,ok OR 'mptp poisoning':ti,ab,kw,ok OR 'mptp-induced parkinsonism':ti,ab,kw,ok OR 'mptp induced parkinsonism':ti,ab,kw,ok OR 'mptp neurotoxicity syndrome':ti,ab,kw,ok OR 'mptp neurotoxicity syndromes':ti,ab,kw,ok OR 'mptp-induced degeneration of the striatum':ti,ab,kw,ok OR 'mptp induced degeneration of the striatum':ti,ab,kw,ok OR 'postencephalitis parkinsonian syndrome':ti,ab,kw,ok OR 'von economo encephalitis type parkinsonism':ti,ab,kw,ok OR 'post-encephalitic parkinson disease':ti,ab,kw,ok OR 'post encephalitic parkinson disease':ti,ab,kw,ok OR 'postencephalitic economo-type parkinsonism':ti,ab,kw,ok OR 'postencephalitic economo type parkinsonism':ti,ab,kw,ok OR 'postencephalitic parkinson disease':ti,ab,kw,ok OR 'postencephalitic parkinsonism':ti,ab,kw,ok OR 'encephalitis lethargica type parkinsonism':ti,ab,kw,ok OR 'viral meningoencephalitic parkinsonism':ti,ab,kw,ok OR 'essential tremor':ti,ab,kw,ok OR 'essential tremors':ti,ab,kw,ok OR 'benign essential tremor':ti,ab,kw,ok OR 'benign essential tremors':ti,ab,kw,ok OR 'familial tremor':ti,ab,kw,ok OR 'familial tremors':ti,ab,kw,ok OR 'hereditary essential tremor':ti,ab,kw,ok OR 'hereditary tremor':ti,ab,kw,ok	263583
Food and Drug Administration (FDA)		
28-Aug-2023		
#1	“Parkinson’s disease” OR “essential tremors”	52
#2	“Implant” OR “device”	4
U.S. Department of Health & Human Services National Institutes of Health (NIH)		
28-Aug-2023		
#1	Parkinson’s disease	
Patient-Centered Outcomes Research Institute (PCORI)		
28-Aug-2023		

#1	Searched “Parkinson’s Disease” on main webpage (https://www.pcori.org/)	62
#2	Searched “Essential Tremor” or “Essential Tremors” on main webpage (https://www.pcori.org/)	0
#3	Hand searched PCORNet Research page (https://pcornet.org/research/) for studies on Parkinson’s Disease and Essential Tremor	0
Cochrane		
28-Aug-2023		
#1	Searched “Parkinson’s disease” OR “Parkinson disease” [title/abstract/keyword], Limits: publication date Jan 2018-Aug 2023 in Cochrane Library (https://www.cochranelibrary.com/)	11
#2	Searched “essential tremor” [title/abstract/keyword], Limits: publication date Jan 2018-Aug 2023 in Cochrane Library (https://www.cochranelibrary.com/)	2
Core Outcome Measures in Effectiveness Trials (COMET) Initiative		
28-Aug-2023		
#1	Searched “Parkinson’s Disease” in database (https://www.comet-initiative.org/)	10
#2	Searched “Essential Tremor” in database (https://www.comet-initiative.org/)	0
International Consortium for Health Outcomes Measurement (ICHOM)		
28-Aug-2023		
#1	Hand searched patient-centered outcome measures webpage for relevant sets for Parkinson’s Disease or Essential Tremor (https://www.ichom.org/patient-centered-outcome-measures/)	2
Clinicaltrials.gov		
25-Aug-2023		
#1	Searched "Parkinsonian Disorders" OR "Parkinson Disease" OR "Parkinson Disease, Secondary" OR "Essential Tremor" OR "Parkinsonian" OR "Parkinson" OR "Parkinson's" OR "Parkinsons" OR "Paralysis Agitans" OR "Postencephalitic Parkinson Disease" OR "Essential Tremor" OR "Benign Essential Tremor" OR "Familial Tremor" OR "Hereditary Essential Tremor" OR "hereditary tremor"	3906
#2	Searched “device” or “implant”	94
U.S. Department of Health and Human Services Community Health Applied Research Network (CHARN)		
28-Aug-2023		
#1	Searched “Parkinson’s Disease” on CHARN webpage (https://aspe.hhs.gov/strengthening-expanding-community-health-applied-research-network-charn-registry-conduct-patient), Publication date range: 01/01/2018-08/28/2023, Population: Medicare Beneficiaries	32
#2	Searched “essential tremor” on CHARN webpage (https://aspe.hhs.gov/strengthening-expanding-community-health-applied-research-network-charn-registry-conduct-patient), Publication date range: 01/01/2018-08/28/2023, Population: Medicare Beneficiaries	6
Health Technology Assessment International (HTAi)		
28-Aug-2023		
#1	Searched “Parkinson’s Disease” on main webpage (https://htai.org/)	0
#2	Searched “essential tremor” on main webpage (https://htai.org/)	0
Trip Medical Database		
28-Aug-2023		
#1	Searched "Parkinsonian Disorders" OR "Parkinson Disease" OR "Parkinson Disease, Secondary" OR "Essential Tremor" OR "Parkinsonian" OR "Parkinson" OR "Parkinson's" OR "Parkinsons" OR OR "Paralysis Agitans" OR "Postencephalitic Parkinson Disease" OR "Essential Tremor" OR "Benign Essential Tremor" OR "Familial Tremor" OR "Hereditary Essential Tremor" OR "hereditary tremor" AND “device” OR “implant”	191
#2	Guidelines	19
Professional Societies/Working Groups (American Academy of Neurology, International Parkinson and Movement Disorder Society, Parkinson’s Foundation, National VA Parkinson’s Disease Consortium, American Parkinson Disease Association, International Essential Tremor Foundation)		

29-Aug-2023		
#1	Searched “Parkinson’s Disease” OR “essential tremor” on AAN Practice Guidelines webpage (https://www.aan.com/practice/guidelines)	9
#2	Hand searched AAN Movement Disorders Quality Measures webpage (https://www.aan.com/practice/movement-disorders-quality-measures)	6
#3	Hand searched AAN Position Statements webpage (https://www.aan.com/advocacy/position-statements)	41
#4	Hand searched AAN 2023 Comment Letters webpage (https://www.aan.com/advocacy/comment-letters)	35
#5	Hand searched IPMDS Clinical Outcome Assessments: Critiques and Recommendations webpage (https://www.movementdisorders.org/MDS/MDS-Rating-Scales/Rating-Scales-Critiques-and-Recommendations.htm)	39
#6	Hand searched IPMDS Papers webpage for relevant white papers and evidence-based medicine reviews (https://www.movementdisorders.org/MDS/Resources/MDS-papers.htm)	6
#7	Hand searched Parkinson’s Foundation “Advancing Research: Our Research” webpage and entries under Recent Study Findings (https://www.parkinson.org/advancing-research/our-research/parkinsons-outcomes-project/findings)	12
#8	Hand searched National VA Parkinson’s Disease Consortium website for guidelines, recommendations, and statements (https://www.parkinsons.va.gov/index.asp)	3
#9	Hand searched APDA website for guidelines, recommendations, and statements (https://www.apdaparkinson.org/)	0
#10	Hand searched IETF website for guidelines, recommendations, and statements (https://essentialtremor.org/)	1

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Appendix B. Summary of Included Publications

Table B1a. Table of Included Systematic Reviews, Parkinson's Disease

Review Details	Included Studies	Clinical Endpoints Identified	Instruments/Items Identified
Reference: An et al., 2023 **Objective:** To conduct a meta-analysis and systematic review to explore the improvement of the motor symptoms of PD patients undergoing aDBS and a comparison between aDBS and cDBS **Funding Source:** National Natural Science Foundation of China and the Capital Foundation of Medical Development **Databases:** PubMed, Embase, Cochrane Library database, ClinicalTrials.gov and BioMed Central **Included study types:** 2 Nonrandom, open-label, 8 Nonrandom Blind and 9 Random blind trial **Inclusion Criteria:** (1) PD patients treated with STN-DBS; one feedback physio marker based on the patient's clinical state was used to trigger adaptive stimulation; (2) the paper contained at least one quantitative evaluation, such as UPDRS part III, Unified Dyskinesia Rating Scale, Rush Dyskinesia Rating Scale, Speech Intelligibility Test, TEED; (3) the paper contained a comparison of aDBS with baseline and/or cDBS; (4) no other targets were involved, such as the globus pallidus internus, pedunculopontine nuclei, or ventralis intermedius; (5) the statistical data needed for analysis (e.g., mean and standard deviation) was available and (6) no case reports, abstract-only articles, or conference articles	**Intervention:** aDBS **Comparator:** no-stimulation or cDBS **Number of included studies:** 19 **Number of Patients:** 104 **Diagnosis:** PD **Mean Age, years (range):** 58.4 (64.6-69.2) **Female, n (range %):** 27.7 (25-85) **Minimum duration of follow-up as per eligibility criteria:** NR **Disease severity:** NR	**Primary endpoints:** • Motor function improvements (n=10) (UPDRS-III) **Secondary endpoints:** • Sub-motor improvement ○ Changes in symptoms of rigidity-bradykinesia (n=4) • Dyskinesia (n=2) (Unified Dyskinesia Rating Scale, n=2) Rush Dyskinesia Rating Scale (n=2) ○ Tremor function (n=3) ○ Speech function (n=2) Speech Intelligibility Test (n=2) Note: The primary endpoint measures were all analyzed in the med-off state.	

Review Details	Included Studies	Clinical Endpoints Identified	Instruments/Items Identified
Exclusion Criteria: NR			
Reference: Morelli et al., 2023 **Objective:** To synthesize literature reporting the association of low- and high-beta characteristics to clinical ratings of motor symptoms in person with PD. **Funding Source:** Medtronic **Databases:** EMBASE **Included study types:** All observational **Inclusion Criteria:** Studies which included person with PD and STN-DBS; Studies which recorded LFPs from the STN and compared LFP measures to UPDRS-III; Studies which report low- and high-beta band measure associations to UPDRS-III **Exclusion Criteria:** Studies of DBS in patient populations outside of PD; Studies which recorded LFPs from nuclei other than the STN; Studies which did not delineate between low- and high-beta bands; Case reports; Animal studies; aDBS studies; Review articles; LFP captured through microelectrode recordings.	**Intervention:** DBS-STN **Comparator:** NR **Number of included studies:** 11 **Number of Patients:** 326 **Diagnosis:** PD **Mean Age, years (range):** NR (54-63) **Female, n (range %):** 38.6% **Minimum duration of follow-up as per eligibility criteria:** NR **Disease severity:** NR	Motor function (n=11)	**Motor function** • UPDRS III (n=11)
Reference: Qiu et al., 2023 **Objective:** To comprehensively evaluate the optimal strategy to use rTMS and tDCS to improve motor symptoms in PD. **Funding Source:** National Natural Science Foundation of China and the Suzhou Health Talents Training Project	**Intervention:** High-frequency rTMS, low-frequency rTMS, anodal tDCS and cathode tDCS **Comparator:** Sham stimulation **Number of included studies:** 28 rTMS: 17 tDCS: 10 Combination:1	**Primary endpoints:** • Motor function measured by UPDRS III (n=24) **Secondary endpoints:** • Motor functions measured by TUGT (n=14) • Motor functions measured by FOGQ (n=7)	**Motor function measured by UPDRS III** • Change in UPDRS part III score (n=24) • pre–post Note: Short-term efficacy was defined as a change in the scales measured immediately at the end of NIBS treatment and up to 1 week later, whereas long-term efficacy

Review Details	Included Studies	Clinical Endpoints Identified	Instruments/Items Identified
Databases: PubMed, Embase, and Cochrane electronic databases **Included study types:** All RCTs **Inclusion Criteria:** (1) patients with a diagnosis of idiopathic PD, (2) intervention: patients received interventional NIBS, such as rTMS and tDCS, (3) comparison: patients received Sham stimulation **Exclusion Criteria:** (1) conference abstract, editorial, review, case report, single arm clinical trial, (2) studies not written in English, (3) study with unavailable data, (4) studies that did not include any of the outcome measures	**Number of Patients:** NR **Diagnosis:** Idiopathic PD **Mean Age, years (range):** NR (59-71.9) **Female, n (range %):** NR **Minimum duration of follow-up as per eligibility criteria:** NR **Disease severity:** NR		was defined as a change in the scales at the 2-week follow-up and beyond **Motor functions measured by TUGT** • TUGT time (n=14) **Motor functions measured by FOGQ** • FOGQ score (n=7)
Reference: Razmkon et al., 2023 **Objective:** To evaluate the efficacy of DBS for FOG and its correlation with programmed parameters and the location of the electrodes in the brain **Funding Source:** Nil **Databases:** Medline (via PubMed), Scopus, Embase, Web of Science, and Cochrane Library (including both Cochrane Reviews and Cochrane Trials) **Included study types:** All clinical trials (case series, cross-sectional studies and cohort studies were explicitly excluded) **Inclusion Criteria:** Studies investigating the effect of DBS on FOG of patients with PD **Exclusion Criteria:** Study design other rather than clinical trials, e.g., abstracts and conference papers, letters, commentaries, case reports, case series, editorials, cohort	**Intervention:** DBS that targeted the following subthalamic nucleus (n=8), pedunculopontine nucleus (n=5), substantia nigra (n=2) **Comparator:** NR **Number of included studies:** 13 **Number of Patients:** 134 **Diagnosis:** PD **Mean Age, years (range):** NR (58-70) **Female, n (range %):** NR **Minimum duration of follow-up as per eligibility criteria:** Patients were examined and followed immediately after stimulation for up to 4 years, although most of them were followed up for 1 year or less **Disease severity:** Severe course of PD	**Primary endpoints:** • Gait function • Motor function **Secondary endpoint:** NR	**Gait function** • FOGQ (n=6) • Stand Walk Sit FOG spells (n=4) • FOG AC (n=4) • SWS-Q (n=3) • New FOGQ (n=NR) • FOG duration (n=NR) • FOG item in the UPDRS-II (n=NR) • FOG item in the Rating Scale for Gait Evaluation (RSGE) (n=NR) **Time periods of assessment:** • Before surgery (baseline) • Immediately at start of study (n=4) • 3 weeks (n=1) • 3 months (n=3) • 6 months (n=2) • 12 months (n=3) • 15 months (n=1) • 17 months (n=1) • 24 months (n=1) • 46 months (n=1)

Review Details	Included Studies	Clinical Endpoints Identified	Instruments/Items Identified
studies, cross-sectional studies, non-English articles, and articles that reported no specific measurement tool (for example, no questionnaire, scale, or index) to determine and report the intensity of FOG			**Medication status at baseline, stimulation:** • On medication, on medication (n=1) • Off medication, off medication (n=5) • Off medication, on medication (n=1) • NR, on medication (n=3) • NR, off medication (n=3) **UPDRS-III total score (n=7)**
Reference: Streumer et al., 2023 **Objective:** To evaluate and investigate the possible effects of electrode placement, stimulation settings, presence of comorbidities such as pain or postural problems and concurrent DBS for gait disorders in people with PD **Funding Source:** NR **Databases:** PubMed and EMBASE **Included study types:** 8 retrospective case series/reports, 7 prospective trials, 12 case reports **Inclusion Criteria:** Reports describing human studies involving PD patients who received an epidural SCS procedure and included at least one gait-related outcome measure **Exclusion Criteria:** Articles that did not report original research, animal studies, studies that only included patients with atypical parkinsonism, or studies that only investigated other neurostimulation methods	**Intervention:** Spinal Cord Stimulation • Tonic stimulation • Frequencies ranged from 5 Hz to 300 Hz, pulse width (PW) from 50 µs to 500 µs, and amplitudes from 0.3 mA to 15.9 mA and 1 V to 4 V *(stimulation parameters varied between studies)* • Burst stimulation (N=4) **Comparator:** Combination spinal cord stimulation and subthalamic nucleus deep brain stimulation **Number of included studies:** 27 **Number of Patients:** 103 **Mean Age, years (range):** NR **Female, n (range %):** NR **Minimum duration of follow-up as per eligibility criteria:** Follow up ranged from 1 week to 3 years **Disease severity:** NR	**Primary endpoints:** • Motor • Gait **Secondary endpoints:** NR Note: Authors noted a substantial heterogeneity of endpoint measures used in the studies.	**Motor:** • UPDRS III (n=19) **Gait** • 20 m walk test (n=2) • 10 m walk test (n=5) ○ At 3 and 12 months • 7 m walk test (n=1) • TUG (n=10) • FOG-Q (n=10) • New FOG-Q (n=2) • SWS (n=2) • BBS (n=1) • GFQ (n=1)
Reference: Zhang et al., 2023 **Objective:** To summarize the efficacy of wearable cueing devices for improving gait	**Intervention:** Wearable cueing devices for gait in training **Comparator:** Training without	**Primary endpoints** • Gait function using spatiotemporal parameters (n=7)	**Gait function** Spatiotemporal parameters: • Walking speed (n=6) • Stride length (n=5)

Review Details	Included Studies	Clinical Endpoints Identified	Instruments/Items Identified
and motor function of patients with Parkinson disease **Funding Source:** NR **Databases:** PubMed, Embase, and the Cochrane Library databases **Included study types:** All RCT **Inclusion Criteria:** (1) Participants: Patients with PD diagnosed according to the UK Parkinson's Disease Society Brain Bank Diagnostic Criteria; (2) Intervention: using wearable cueing devices for gait in training; (3) Comparison: training without wearable cueing devices or no training; (4) Endpoint: outcomes related to gait and motor function are reported in no less than 2 studies; (5) Study design: randomized controlled trials **Exclusion Criteria:** NR	wearable cueing devices or no training **Number of included studies:** 7 **Number of Patients:** 167 **Diagnosis:** PD in training (daily training time ranged from 10 min to 4 h, training frequency was 1-6 times per week, and duration was 1-12 weeks) **Mean Age, years (range):** NR (61.4-76.6) **Female, n (range %):** NR **Minimum duration of follow-up as per eligibility criteria:** NR **Disease severity:** NR	**Secondary endpoints:** • Motor function using UPDRS III, FOGQ, and double support time (n=3)	Note: These parameters are obtained from walking processes and objectively describe the patient' s walking ability. Better indicated by higher values) **Motor function** • UPDRS-III (better indicated by lower values) (n=3) • FOGQ (better indicated by lower value) (n=3) • Double support time (reflects stability during walking, better indicated by lower values) (n=2)
Reference: Zhu et al., 2023 **Objective:** To assess the impact of STN-DBS on sleep quality in PD patients **Funding Source:** Medical and Health Science and Technology Plan Project of Zhejiang Province **Databases:** PubMed, Embase, Web of Science, and Cochrane Library **Included study types:** 1 RCT and 5 self-controlled trials **Inclusion Criteria:** Patients with Parkinson disease who had DBS to the STN and had pre and postoperative PDSS scores computed. In this analysis, only original research	**Intervention:** STN-DBS **Comparator:** NR **Number of included studies:** 6 **Number of Patients:** 154 **Diagnosis:** PD **Mean Age, years (range):** NR (56.9-62.8) **Female, n (range %):** 53% **Minimum duration of follow-up as per eligibility criteria:** NR **Disease severity:** NR	**Primary endpoints:** Non motor symptom • Sleep quality (n=6) **Secondary endpoints:** • Motor function (n=6) • PD medication usage (n=2)	**Sleep quality:** • Parkinson disease sleep scale (n=6) • Epworth sleepiness scale (n=2) • Total sleep time (n=2) • Day sleepiness (n=2) • Sleep latency (n=2) Note: The Parkinson disease sleep scale provides insight into the subjective impact of DBS on sleep quality and nocturnal disability. The PDSS is a self-assessment tool comprising 15 items scored based on the degree of visual stimulation, with a scale ranging from 0 (indicating a consistently severe presence) to 10 (indicating an absence of symptoms). Upon summing these scores, it can be inferred that a higher score corresponds to a superior quality of sleep

Review Details	Included Studies	Clinical Endpoints Identified	Instruments/Items Identified
publications were incorporated. Review articles were only used to locate additional pertinent material. The study did not include case reports **Exclusion Criteria:** NR			**Motor function:** • MDS UPDRS scale (n=6)
Reference: Bouça-Machado et al., 2022 **Objective:** To identify and critically appraise which measurement instruments have been used to assess ADL in PD **Funding Source:** Nil **Databases:** CENTRAL, MEDLINE, and PEDro **Included study types:** Cross-sectional (n=40) Prospective cohort (n=35) RCT (n=25) **Inclusion Criteria:** Observational and experimental clinical studies conducted in PD and/or atypical parkinsonism were included. Studies had to include an ADL assessment and describe the measurement tool used **Exclusion Criteria:** Studies written in languages other than English, Portuguese, and Spanish were excluded	**Intervention:** Wearable sensor **Comparator:** NR **Number of included studies:** 129 **Number of Patients:** NR **Diagnosis:** PD and/or atypical parkinsonism **Mean Age, years (range):** NR **Female, n (range %):** NR **Minimum duration of follow-up as per eligibility criteria:** NR; Study duration: range, one to 180-months **Disease severity:** NR	**Primary endpoints:** • ADL assessment **Secondary endpoints:** NR	**ADL assessment** • Unified Parkinson's Disease Rating Scale Part II (n=44) • Schwab and England Daily Living Activities Scale (n=30) • Movement Disorder Society-Unified Parkinson's Disease • Rating Scale Part II (n=9) • Barthel Index (n=9) • Lawton-Brody Instrumental ADL Scale (n=6) • Functional Independence Measure (n=5) • Alzheimer's Disease Cooperative Study – ADL scale (n=5) <u>Note:</u> Total 37 measurement instruments were used, however seven most frequently cited measurement instruments are listed above.
Reference: Carmignano et al., 2022 **Objective:** To conduct a systematic review about the effects on gait of robot-assisted gait training (RAGT) in PD patients and to provide advice for clinical practice **Funding Source:** Nil	**Intervention:** Robot-assisted gait training • Exoskeleton device (n=9) • End-effector robots (n=11) **Comparator:** Conventional gait training or overground gait training (n=10) **Number of included studies:** 20 **Number of Patients:** 547 (primary studies)	**Primary endpoints:** • Clinical gait parameters (n=7) • Instrumental gait parameters (n=3) • Postural instability and balance (n=8) **Secondary endpoints:** • Motor disorders (n=9)	**Clinical gait parameter** (n=7) • 6-minute walking test • 10-meter walking test **Instrumental gait parameters** • FOGQ for FOG frequency and severity (n=3) **Postural instability and balance** • Tinetti scale (n=1) • Berg Balance scale (n=5) • Nutt scale (n=1) • TUG (n=5)

Review Details	Included Studies	Clinical Endpoints Identified	Instruments/Items Identified
Databases: PubMed, Scopus, PEDro, Cochrane library, Web of science, and guideline databases **Included study types:** Systematic reviews (n=2) RCT (n=9) Uncontrolled studies (n=4) Descriptive reports (n=5) **Inclusion Criteria:** Published papers in English, studies that used a robotic system to train the PD patient's gait with details about the intervention, the parameters of robot training, and the outcome measures. The devices could be end-effectors, exoskeletons for TT, or exoskeletons used for overground gait training **Exclusion Criteria:** Non-weight-bearing interventions that used non interactive devices for delivering continuous passive motion or devices used for lower extremity muscle strength training without assisting the gait were excluded. We also excluded studies addressing other movement disorders than PD and mechanism-based reasoning studies (expert opinion, based on physiology, or laboratory studies)	**Diagnosis:** PD, disease disability measured by Hoehn and Yahr scale ranged from 1 to 4. **Mean Age, years (range):** NR **Female, n (range %):** NR **Minimum duration of follow-up as per eligibility criteria:** NR **Disease severity:** The disease disability measured by Hoehn and Yahr scale ranged from 1 to 4	• Spatiotemporal, kinematic, and/or kinetic parameters during gait (n=10) • Quality of life (n=4) • Mobility-related tasks during ADL (n=2) • Fatigue (n=1) • Fear of fall (n=1)	**Motor disorders** • UPDRS part III (n=9) **Spatiotemporal, kinematic, and/or kinetic parameters during gait** • GAITrite and/or 3D quantitative gait analysis (n=9) • Gait automaticity (n=1) **Quality of life** • 12-Item Short-Form Health Survey (n=1) • PDQ-39 (n=3) **Mobility-related tasks during ADL** • Activities Specific Balance Confidence scale (n=2) **Fatigue** • Piper Fatigue scale (n=1) **Fear of fall** • Fear of Falling Efficacy scale (n=1) Note: In all studies, the patients were tested in ON medication State **Time points of assessment:** Follow-up examination (n=10) - One time follow-up (n=8) • 4- weeks (n=4) • 6-weeks (n=1) • 12-weeks (n=3) • 15-weeks (n=1) - Two-time follow-up at 3 and 6 months (n=1) Note: All the studies evaluated the subjects before and after training and in ON state
Reference: Eghlidos et al., 2022 **Objective:** To assess the STN-DBS effects on NMS of PD **Funding Source: NR**	**Intervention:** Bilateral STN-DBS **Comparator:** NR **Number of included studies:** 10 **Number of Patients:** 899 NMSS-Q: 563	**Primary endpoint:** **NMSS score** • At baseline and follow up **NMSQ score** • At baseline and follow up	**NMSS score** NMSS (n=8) **NMSQ score** NMSQ (n=5)

Review Details	Included Studies	Clinical Endpoints Identified	Instruments/Items Identified
Databases: Web of Science (WOS), PubMed/MEDLINE, Scopus, Cochrane, and Embase **Included study types:** Interventional studies **Inclusion Criteria:** Studies that used bilateral STN-DBS as at least one of their interventions to assess its effect on NMS of PD as the outcome that was evaluated, through at least one of the Non-Motor Symptoms Scale for Parkinson's disease (NMSS) or Non-Motor Symptoms Questionnaire (NMSQ) as the measuring tool. **Exclusion Criteria:** Duplicate studies, review studies, case reports and case series, book chapters, unpublished articles, letters and editorials, and articles that were not before and after a clinical trial.	NMSQ: 336 **Mean Age, years (range):** NR **Female, n (range %):** NR **Minimum duration of follow-up as per eligibility criteria:** 3 months; range 4-24-months **Disease severity:** NR	**Secondary endpoints:** NR	
Reference: Fujikawa et al., 2022 **Objective:** To shed light on current progress in the development of devices to alleviate motor symptoms in PD **Funding Source:** Terumo Life Science Foundation, JSPS KAKENHI Grant Numbers 20K17932 and 16KK0182. Department of Advanced Brain Research was supported by the Beauty Life Corporation **Databases:** PubMed and Scopus **Included study types:** All RCT **Inclusion Criteria:** RCT studies in the last 10 years (2011–2021). Concerning the invasive devices, RCTs for DBS and LCIG were extracted **Exclusion Criteria:** NR	**Intervention:** Adaptive DBS, DBS with remote programming, rTMS over M1, rTMS over SMA, rTMS over DLPFC tDCS, Tremor's glove, rTSMS, cueing by smart glass (Google Glass), laser light visual cueing, photobiomodulation, surface electrical stimulation of the neck (submental region) **Comparator:** NR **Number of included studies:** 60 **Number of Patients:** 1929 **Diagnosis:** PD **Mean Age, years (range):** NR **Female, n (range %):** NR **Minimum duration of follow-up as per eligibility criteria:** NR	**Primary endpoints:** • Motor function • Dyskinesia • Gait performance • Non-motor function • Cognitive function • Functional mobility and balance **Secondary endpoints:** NR	**Motor function** • UPDRS Part III (n=17) Subscore ○ Tremor ○ Lateralized • Visual analog scale (n=1) **Dyskinesia** • Increased "On" time without troublesome dyskinesia (n=1) • Levodopa induced dyskinesia (n=1) **Gait** • TUG (n=9) • Walking test (n=5) • FOG-Q (n=7) • Turn steps (n=1) • Stride length (n=6) • Gait speed (n=17) **Non motor** • NMSS at 1 month (n=1) **Cognitive function** • Verbal fluency (n=1) • Stroop test (n=1)

Review Details	Included Studies	Clinical Endpoints Identified	Instruments/Items Identified
			Functional mobility and balance • Berg Balance Scale (n=3) • Dynamic Gait Index (n=1)
Reference: Hamdan et al., 2022 **Objective:** To analyze the use of the Stroop test in the assessment of cognitive functions of patients with PD undergoing DBS **Funding Source:** No funding was provided for this study **Databases:** PubMED **Included study types:** 21 cohort studies, 12 RCT, 2 case control **Inclusion Criteria:** The objective to assess or compare neuropsychological aspects associated with DBS; use of the Stroop test and presented results **Exclusion Criteria:** Stroop was not used; no DBS intervention; no Stroop results	**Intervention:** 7 compared GPi and STN 8 compared DBS with other types of drug treatments 12 compared the performance of individuals in the Stroop test before and after surgery 8 compared the performance of individuals with DBS and a control group consisting of people with PD without DBS **Comparator:** N/A **Number of included studies:** 35 **Number of Patients:** NR **Mean Age, years (range):** NR **Female, n (range %):** NR **Minimum duration of follow-up as per eligibility criteria:** 1 year **Disease severity:** NR	**Primary endpoints:** • Cognitive function Change in result from pre- and post-surgery **Secondary endpoints:** NR	**Cognitive function** Stroop test Described the Stroop application in four stages: "1) Word, 2) Color, 3) Color-word, and 4) Interference." (n=5) Applied shorter or modified versions of the Stroop test, with one test containing only 36 items. (n=5) Used only two or three stages of Stroop, such as 1) Word, 2) Color, and 3) Color-word. (n=18) Did not specify the Stroop application mode (n=7)
Reference: Li et al. 2022 **Objective:** To systematically evaluate the efficacy of rTMS intervention and identify optimal stimulation protocol of rTMS for specific motor symptoms **Funding Source:** National Key R&D Program of China, Clinical Research Project of Shanghai Tongji Hospital, outstanding academic leaders	**Intervention:** rTMS **Comparator:** Sham stimulation **Number of included studies:** 32 **Number of Patients:** 1048 **Diagnosis:** PD **Mean Age, years (range):** NR (57.8-71.9)	**Primary endpoints:** • Motor function (n=32) • Gait symptom (n=7) • Levodopa-induced dyskinesias (n=4) **Secondary endpoints:** NR	**Motor function** • UPDRS-III <u>Sub scores of UPDRS-III</u> (n=4) • Upper limb score (UPDRS-III item 20-25) • Lower limb score (UPDRS-III item 20, 22, 26, 29) • Axial score (UPDRS-III item 27–30) • Tremor (UPDRS-III item 20, 21) • Rigidity (UPDRS-III item 22) • Postural instability (UPDRS-III item 30)

Review Details	Included Studies	Clinical Endpoints Identified	Instruments/Items Identified
plan of Shanghai Municipal Science and Technology Committee and science and technology innovation program of Shanghai Municipal Science and Technology **Databases:** PubMed, Cochrane Library, and Web of Science **Included study types:** All RCT **Inclusion Criteria:** (1) RCT in which the PD participants were given TMS or sham stimulation; (2) involved patients who reported motor symptoms of PD45; and (3) included motor scales and standard deviation or enough data to calculate these figures **Exclusion Criteria:** Second-hand unoriginal research (reviews, meta-analyses, commentaries, letters, reports, conference abstracts, and editorials) and duplicated studies	**Female, n (range %):** NR (30-50) **Minimum duration of follow-up as per eligibility criteria:** NR **Disease severity:** NR		• Akinesia (UPDRS-III item 23–26) • Bradykinesia (UPDRS-III item 31) **Gait function** • TUG • FOGQ • Walking time **Levodopa-induced dyskinesias** • Abnormal Involuntary Movement Scale
Reference: Rajan et al. 2022 **Objective:** We will also evaluate and investigate the possible effects of electrode placement, stimulation settings, presence of comorbidities such as pain or postural problems and concurrent DBS for gait disorders in people with PD **Funding Source:** No funding **Databases:** MEDLINE, SCOPUS, EMBASE, Web of Science, and the Cochrane central register of controlled trials **Included study types:** All randomized clinical trials **Inclusion Criteria:** The population includes patients with PD experiencing motor	**Intervention:** STN-DBS, GPi-DBS, CSAI, IJLI, MT, Unilateral pallidotomy **Comparator:** NA **Number of included studies:** 26 **Number of Patients:** NR **Mean Age, years (range):** NR **Female, n (range %):** NR **Minimum duration of follow-up as per eligibility criteria:** For studies that did not report 6-month outcomes, the nearest reported follow up to 6 months was used for analysis. **Disease severity:** Advanced PD	**Primary Endpoints** • Quality of Life (n=13) ○ Change from baseline on a validated QoL scale for PD at 6 months after the intervention **Secondary Endpoints** • Activities of daily living ○ Change from baseline • Motor symptoms • Durations of OFF medication time and ON medication time without dyskinesia • Levodopa equivalent daily dose (n=10)	**Quality of Life (n=13)** • PDQ-L (n=3) • PDQ-8 (n=2) • PDQ-39 (n=8) **Activities of daily living** • UPDRS II **Motor symptoms** • UPDRS III **Durations of OFF medication time and ON medication time without dyskinesia** • UPDRS II off medication (n= 12) • UPDRS II on medication (n=18) • UPDRS III on medication (n=18) • UPDRS III off medication (n=18)

Review Details	Included Studies	Clinical Endpoints Identified	Instruments/Items Identified
complications (motor fluctuations and/or drug induced dyskinesias). The intervention includes one of the following therapies: STN DBS, GPi DBS, radiofrequency lesioning (pallidotomy, subthalamotomy), CSAI, or IJLI. Includes a comparator arm that is either best medical therapy or any of the above-mentioned interventions. Outcomes reported include at least one among the following: change in motor symptoms as assessed by the UPDRS motor scores, duration of OFF time, duration of ON time without dyskinesia, ADL (UPDRS II) or QoL. The study design is a randomized clinical trial. **Exclusion Criteria:** Population is restricted to specific phenotypes of PD (e.g., tremor dominant PD, PD with freezing of gait). Reports the effect of intervention on specific motor or non-motor symptoms only (e.g., cognitive impairment, freezing of gait). Compares different DBS stimulation protocols with each other, without a comparison to another therapy. Reports DBS targets other than the STN or GPi. Study design is nonrandomized (i.e., quasi-randomized, prospective studies, cohort studies, retrospective studies, case series, etc.)			
Reference: Ramanathan et al. 2022 **Objective:** To synthesize the literature comparing clinical and therapeutic outcomes of dDBS relative to oDBS in patients with PD **Funding Source:** Nil **Databases:** PubMed, Ovid MEDLINE, and Web of Science databases **Included study types:** Cross-over cohort (n=8) Non-overlapping cohort (n=2)	**Intervention:** STN DBS (n=9) and VIM DBS (n=1) **Comparator:** dDBS vs oDBS **Number of included studies:** 10 **Number of Patients:** 468 **Diagnosis:** PD **Mean Age, years (range):** NR (60-70.8) **Female, n (range %):** 42.5%	**Primary outcomes:** • Motor performance (n=3) • ADL (n=2) • QoL (n=3) • TW (n=4) • Surrogate measure (n=2) • Hand tremor (n=1) • Ataxia (n=1) **Secondary endpoints:** • Sensory modulation (pain, Von Frey, pinprick, vibration, and pressure) (n=1) 12months post operatively	**Motor performance** • UPDRS III (n=3) ○ Medication-off state (n=1) ○ Medication-on state (n=3) **ADL** • UPDRS-II (n=2) **QoL** • PDQ-39 (n=2) **Gait** • Comfortable walking speed (n=1) **TW** • Value for TW in milliamperes (n=4)

Review Details	Included Studies	Clinical Endpoints Identified	Instruments/Items Identified
Inclusion Criteria: Studied humans with PD with direct comparison outcomes between oDBS and dDBS. Clinical outcomes included but were not limited to established Parkinson motor scoring systems **Exclusion Criteria:** lack of an English version or work with nonhuman subjects. Studies that lacked a direct comparison of patients with PD in oDBS and dDBS were excluded (i.e., studies that grouped outcome analyses of both patients with PD and patients with ET receiving oDBS or dDBS intervention). Review articles were excluded, as were abstracts, editorials, and case reports. Studies that did not evaluate measurable outcomes between oDBS and dDBS intervention in patients with PD were excluded	**Minimum duration of follow-up as per eligibility criteria:** NR. range, immediate to 12 months **Disease severity:** NR	• Levodopa equivalent daily dose (n=1) 12months post operatively	**Surrogate measure of therapeutic current strength or side effect threshold (n=2)** **Functional consequence of TW** • TEED (n=2) **Hand tremor** • FTM-TRS (n=1) **Ataxia** • International Cooperative Ataxia Rating Scale (n=1) **Time of assessment:** Outcome data were collected at 3 time points: intraoperatively, postoperatively during the monopolar review (the initial DBS programming session at 4 weeks after surgery), and postoperatively at a later follow-up. Note: Patients studied in the medication-off, or unmedicated, state when assessed intraoperatively or at the monopolar review, but assessed in the medication-on state at a later postoperative follow-up
Reference: Zou et al. 2022 **Objective:** To investigate the effectiveness of spDBS versus cDBS in patients with PD **Funding Source:** NR **Databases:** PubMed, Cochrane, Web of Science, and Embase **Included study types:** 6 RCTs, 1 observational. **Inclusion Criteria:** Clinical diagnosis of Parkinson's disease; use of short-pulse width DBS; at least one outcome of interest including Movement Disorder Society–Sponsored Revision Unifed Parkinson's	**Intervention:** Short pulse width DBS **Comparator:** Conventional DBS **Number of included studies:** 7 **Number of Patients:** NR **Mean Age, years (range):** NR **Female, n (range %):** NR **Minimum duration of follow-up as per eligibility criteria:** NR **Disease severity:** NA	**Primary endpoints:** • Therapeutic window • Difference between the minimum stimulus current required to produce side effects **Secondary endpoints:** • Disease severity MDS-UPDRS • Speech • Gait • Efficacy threshold • Side effect threshold	**Disease severity** • MDS-UPDRS III off medication (n=4) **Speech related scales** • SIT (n=3) **Gait related scales** • FOG-Q (n=2) Note: A total of four studies including 58 patients assessed MDS-UPDRS part III scores in the medication-off state, FOG-Q scores involved only two studies and 36 patients between the two groups; The speech

Review Details	Included Studies	Clinical Endpoints Identified	Instruments/Items Identified
Disease Rating Scale (MDS-UPDRS), Speech Intelligence Test (SIT), Freezing of Gait Questionnaire (FOG-Q), therapeutic window (TW), efficacy threshold, and side effect threshold. **Exclusion Criteria:** Meta-analysis and review articles; missing data or inability to extract data; repeated patient data; animal experiments; trial protocols.			intelligence test (SIT) included three studies with 38 patients in each group
Reference: Ge et al., 2021 **Objective:** To understand the efficacy, safety, and improvement of nonmotor neurological symptoms of the MRgFUS technique in PD **Funding Source:** NR **Databases:** Pubmed, EMBASE, and Cochrane Library **Included study types:** RCT **Inclusion Criteria:** Study design: RCT that compares the FUS group with a sham procedure group on tremor, non-motor symptoms, and safety in PD patients. (2) Participants: Firstly, these patients fit the diagnosis of PD. Diagnostic criteria in line with the UK Brain Bank Criteria [12]. Secondly, the main symptom in these patients is tremor. Despite adequate doses of dopaminergic drugs, the patient's tremor was not well controlled **Exclusion Criteria:** Studies with the same data as previously published studies	**Intervention:** MRgFUS **Comparator:** Sham surgery **Number of included studies:** 2 **Number of Patients:** 67 MRgFUS: 47 Sham: 20 **Mean Age, years (range):** 56.6-68.3 **Female, n (range %):** NR **Minimum duration of follow-up as per eligibility criteria:** NR **Disease severity:** NR	**Primary endpoints:** • USPDRS III motor score ○ Change from baseline to 3 or 4 months • **Tremor score** ○ Change from baseline to 3 or 4 months **Secondary endpoints:** • Improvements in QoL • ADL • Non-motor symptoms	**USPDRS III motor score** • USPDRS III (n=2) • MDS-USPDRS III [off medication state] (n=1)
Reference: Lin et al., 2021[18] **Objective:** To compare the efficacy of DBS and MRI-guided focused ultrasound (MRIgFUS) in parkinsonian tremor	**Intervention:** DBS **Comparator:** MRIgFUS **Number of included studies:** 24	**Primary endpoints:** • Tremor (medication off) • Improvement of PD motor symptoms	**Tremor** USPDRS III Tremor (n=24)

Review Details	Included Studies	Clinical Endpoints Identified	Instruments/Items Identified
Funding Source: Sponsored by grants from the Fujian Province Joint Funds for the Innovation of Science and Technology(2019Y9070), Fujian Provincial Health Technology Project(2019-ZQN-48), Fujian Provincial Science and Technology Guiding Project (2018Y0033) and Fujian University of Medical Sciences Innovation and Entrepreneurship Training Program(C19080) **Databases:** PubMed, Embase and Cochrane Library (The Cochrane Database of Systematic Reviews) **Included study types:** NR **Inclusion Criteria:** Clinical trials that use DBS and MRIgFUS on idiopathic PD; Subjects: patients with clinical diagnosis of PD; Outcomes: studies that used the UPDRS III and UPDRS III items 20 and 21 to measure therapeutic efficacy; Studies that include one or several types of the following nine surgical options: PPN-DBS, STN-DBS, VIM-DBS, GPi-DBS, cZI-DBS, VIM-MRIgFUS, GPi-MRIgFUS, combined cZI and PPN-DBS, and combined cZI and STN-DBS **Exclusion Criteria:** Trials that employ DBS and MRIgFUS therapy in diseases except for PD, such as essential tremor; Not simultaneous clinical controlled trials; Missing data or data that could not be extracted	**Number of Patients:** 784 **Mean Age, years (range):** NR **Female, n (range %):** NR **Minimum duration of follow-up as per eligibility criteria:** Less than 24 months after DBS and more than or equal to 24 months after DBS **Disease severity:** NR	**Secondary endpoints:** NR	(UPDRS Part III tremor sub score was used to assess tremor. It was defined as the sum of UPDRS III items 20 and 21) **Motor symptoms** USPDRS III (n=24) (Total scores of UPDRS III was used to assess motor symptoms)
Reference: Manez-Miro et al., 2021 **Objective:** To review the state of the art regarding subthalamotomy for PD and discuss the challenges for the near future **Funding Source:** Study was not funded **Databases:** Medline and OVID	**Intervention:** Unilateral subthalamic nucleus lesions (n=8) **Comparator:** Bilateral subthalamic nucleus lesions (n= 6) **Number of included studies:** 15 **Number of Patients:** NR	**Primary endpoint** • Motor function (n=15)	**Motor function** • UPDRS-III off medication (n=15)

Review Details	Included Studies	Clinical Endpoints Identified	Instruments/Items Identified
Included study types: Interventional **Inclusion Criteria:** studies with a minimum of 5 subjects for unilateral studies; at least 6 months of follow-up time; presence of motor outcome data, including at least pre- and post-treatment Unified Parkinson's Disease Rating Scale (UPDRS) III scores **Exclusion Criteria:** NR	**Mean Age, years (range):** NR **Female, n (range %):** NR **Minimum duration of follow-up as per eligibility criteria:** 6 months **Disease severity:** NR		
Reference: Nijhuis et al., 2021 **Objective:** To assess the scientific evidence about effectiveness of advanced treatments for outcomes that PD patients find crucial for their treatment choice **Funding Source:** Study was not funded **Databases:** PubMed, EMBASE, and Cochrane Central Register of Controlled Trials **Included study types:** 18 RCT, 26 Non-RCT, 35 Prospective cohort >50 patients, 109 Prospective cohort <50 patients **Inclusion Criteria:** study population consists of advanced PD patients with severe motor fluctuations and/or dyskinesias despite best medical treatment; the study includes at least one outcome measure of our interest (QoL, ADL, ON or OFF time, adverse events); the study either directly compares all three treatments (CSAI, DBS, and LCIG) or compares one of the treatments (CSAI, DBS, or LCIG) to best medical treatment; (4) the study includes at least 10 participants; and (5) the study is a randomized controlled trial (RCT), prospective non-RCT, or prospective cohort study	**Intervention:** DBS, LCIG, and CSAI **Comparator:** Interventions were compared to each other and best medical treatment **Number of included studies:** 184 **Number of Patients:** NR **Mean Age, years (range):** NR **Female, n (range %):** NR **Minimum duration of follow-up as per eligibility criteria:** range from 4 days to 5 years **Disease severity:** Advanced PD	**Primary endpoints:** (out of 30 publications) • Quality of life (n=21) • Activities of daily living (n=17) • Physical effects OFF medication time and ON medication time, were used as a representation of physical effects, were expressed in hours. Study defined a good ON time as ON time without troublesome dyskinesia. **Secondary endpoints:** NR	**Quality of life** • PDQ-39 • PDQ-8 **Activities of daily living** • UPDRS II (n=17) **Physical effect** • On/off time (n=14) • Off time (n=3)

Review Details	Included Studies	Clinical Endpoints Identified	Instruments/Items Identified
Exclusion Criteria: study compares different DBS targets, unless it also compares DBS to BMT; the study concerns stimulation of other than the subthalamic or pallidal nuclei; the study compares an intervention with placebo instead of BMT, unless the placebo group also continues BMT; the study compares an intervention with oral levodopa alone and not BMT; the study is a retrospective study			
Reference: Picelli et al., 2021 **Objective:** To assess the effects of robot-assisted gait training on postural instability in patients with Parkinson's disease **Funding Source:** Italian Society of Physical and Rehabilitative Medicine (SIMFER, Società Italiana di Medicina Fisica e Riabilitativa) and Italian Society of Neurological Rehabilitation (SIRN, Società Italiana di Riabilitazione Neurologica **Databases:** PubMed, Cochrane Library, Pedro **Included study types:** 2 systematic reviews, 9 randomized controlled trials, 4 uncontrolled studies and 3 case series/case reports **Inclusion Criteria:** Participants (adults with PD), type of intervention (robot-assisted gait training for treating postural instability), comparators (no treatment; conventional exercises; overground walking training; treadmill training) and outcomes (balance control and related skills). **Exclusion Criteria:** NR	**Intervention:** Robot-assisted gait training for treating postural instability. Only the studies reporting original data, exoskeleton devices (Lokomat, Hocoma, Volketswil, Switzerland; Robotic Gait Trainer – RGT Rehastim, Berlin, Germany; Walkbot_S, P&S Mechanics, Seoul, South Korea) were used in 9 studies, while end-effector devices (Gang 1 Trainer GT1, Reha-Stim, Berlin, Germany; G-EO System Evolution, Reha Technology, Olten, Switzerland) were used in 7 studies **Comparator:** No treatment; conventional exercises; overground walking training; treadmill training **Number of included studies:** 18 **Number of Patients:** NR **Mean Age, years (range):** NR **Female, n (range %):** NR **Minimum duration of follow-up as per eligibility criteria:** Between 4-5 weeks **Disease severity:** Most of the studies enrolled subject's suffering from both early-moderate (Hoehn and Yahr <3) and advanced (Hoehn and Yahr ≥3) stage of Parkinson's disease	**Primary endpoints:** Balance control **Secondary endpoints:** Related skills	**Balance control** Berg Balance Scale (n=6) **Posture instability** Hoehn and Yahr Scale

Review Details	Included Studies	Clinical Endpoints Identified	Instruments/Items Identified
Reference: Wang et al., 2021 **Objective:** To investigate the effects of subthalamic nucleus DBS on neurocognitive function in patients with PD **Funding Source:** NR **Databases:** PubMed and Embase **Included study types:** Interventional case control **Inclusion Criteria:** Bilateral STN-DBS; A drug control group; Report of interval or digital data; Use of at least one standardized neuropsychological scale; Sufficient research results reported to calculate the effect size **Exclusion Criteria:** Interventions that affect the results were not involved	**Intervention:** Bilateral STN DBS **Comparator:** Drug control **Number of included studies:** 6 **Number of Patients:** NR **Mean Age, years (range):** NR **Female, n (range %):** NR **Minimum duration of follow-up as per eligibility criteria:** NR **Disease severity:** NR	**Primary endpoints:** • Cognitive screen • Attention and concentration • Executive functions • Psychomotor speed • Learning and memory • Visuospatial skills • Language verbal fluency **Secondary endpoints:** NR	**Cognitive screen** (n=5) Dementia rating scale Mini mental status exam Wisconsin card sorting test-Categories **Attention and concentration** (n=5) Attentive matrices Corsi's block tapping test Digit span Verbal span **Executive functions** (n=5) Trail making test Wisconsin/Modified card sorting tasks Stroop Color/Word Stroop interference **Psychomotor speed** (n=4) Stroop color naming Stroop word reading Symbol digit modalities test Trail making test A WAIS digit symbol coding **Learning and memory** (n=4) WMS-III word list learning WMS-III memory for faces Rey auditory verbal learning test Brief visuospatial memory test Benton **Visuospatial skills** (n=4) Judgment of Line Orientation RBANS: Line orientation RBANS: Figure copy Clock command **Language verbal fluency** Boston naming test (n=3) Phonemic fluency (n=5) Semantic fluency (n=5)
Reference: Geraedts et al., 2020	**Intervention**: STN DBS	**Primary endpoints:** **Quality of life**	**Quality of life** PDQ8/39 (n=11)

Review Details	Included Studies	Clinical Endpoints Identified	Instruments/Items Identified
Objective: Identify preoperative factors associated with QoL after STN DBS, and their potential utility in improving DBS screening **Funding Source:** A grant from Stichting ParkinsonFonds **Databases:** NR **Included study types:** Interventional studies **Inclusion Criteria:** separate cohorts with idiopathic PD; intervention STN DBS; outcome QoL scale; association between preoperative factors and postoperative QoL reported; follow-up duration post-DBS ≥6 months; original peer-reviewed article, n≥10, article in English **Exclusion Criteria:** Studies pooling the results of STN DBS and other targets	**Comparator:** NR **Number of included studies:** 18 **Number of Patients:** NR **Mean Age, years (range):** NR **Female, n (range %):** NR **Minimum duration of follow-up as per eligibility criteria:** 6 months **Disease severity:** NR	Both change in QoL from baseline and postoperative absolute QoL scores **Secondary endpoints:** • Severity of motor function [On medication or OFF] (n=8) • Motor subtype [tremor dominant vs postural instability gait difficulty] (n=8) • Severity of dyskinesia(n=8) • Severity of medication-related motor complications (n=8) • Symptoms laterality (n=8) • Levodopa effect [On vs OFF] (n=8) • Brain atrophy (n=8) • Disease duration (n=8) • Nonmotor severity (n=8)	Short Form Survey-36 (n=3) PDQL (n=1)
Abbreviations: aDBS: adaptive deep brain stimulation; ADL, Activities of Daily Living; BBS, Berg Balance Scale; cDBS: conventional deep brain stimulation; CSAI, continuous subcutaneous apomorphine infusion; DBS: Deep brain stimulation; dDBS: Directional DEBS; oDBS: omnidirectional DBS; FOG-Q: Freezing of Gait Questionnaire; FOG AC, Freezing of Gait Assessment Course; FTM-TRS: Fahn-Tolosa-Marin Tremor Rating Scale; FUS**:** Focused ultrasound**;** GFQ: Gait and Fall Questionnaire; GPi-DBS: Bilateral globus pallidus interna DBS; IJLI: Intrajejunal levodopa infusion; LCIG: continuous infusion of levodopa-carbidopa gel; LFP: Local field potential; MDS-UPDRS: Movement Disorder Society–Sponsored Revision Unified Parkinson's Disease Rating Scale; NMSS: Non-Motor Symptoms Scale for Parkinson's Disease; NMSQ: Non-Motor Symptoms Questionnaire; MRIgFUS,magnetic imaging-guided FUS; MT: Medical therapy; NR: not reported; oDBS: Omnidirectional DBS; PD, Parkinson's Disease; PDQ: Parkinson's Disease Questionnaire; QoL: Quality of life; RCT: Randomized controlled trial; rTMS: Repetitive transcranial magnetic stimulation; SIT: Speech Intelligibility Test; spDBS: Short pulse width DBS; STN-DBS: Subthalamic nucleus deep brain stimulation; SWS-Q: Stand Walk Sit Questionnaire; tDCS, transcranial direct current stimulation; TEED: Total electrical energy delivered; tDCS: Transcranial DBS; TUGT: Time Up and Go Test; TW, therapeutic window; UPDRS: Unified Parkinson's Disease Rating Scale; VIM: Ventral intermediate nucleus			

Table B1b. Table of Included Systematic Reviews, Essential Tremor

Review Details	Included Studies	Clinical Endpoints Identified	Instruments/Items Identified
Reference: Kondapavulur et al. 2023 **Objective:** To present a comprehensive systematic review with network meta-analysis examining both efficacy and adverse events of FUS-T vs SRS-T for treating medically refractory ET. **Funding Source:** This study did not receive any funding or financial support **Databases:** PubMed and Embase **Included study types:** NR **Inclusion Criteria:** the study population comprised patients with only ET, the 333patients received either unilateral SRS-T or FUS-T, and tremor severity in the study was scored using a validated tremor scoring scale **Exclusion Criteria:** all articles not available in English; studies that involved animals, without any human participants; technical analyses; editorials; literature or systematic reviews; case reports or series with <5 patients; and follow-up ≤3 months	**Intervention:** FUS-T and SRS-T, also known as Gamma Knife thalamotomy **Comparator:** NR **Number of included studies:** 18 **Number of Patients:** 526 FUS-T: 464 SRS-T: 62 **Diagnosis:** Medically refractory ET **Mean Age, years (range):** FUS-T: 63.3 (38-72.8) SRS-T: 71.1 (70-75) **Female, n (range %):** FUS-T: 30% SRS-T: 50% **Minimum duration of follow-up as per eligibility criteria:** 1-year **Disease severity:** NR	**Primary endpoints:** • Tremor reduction (n=18) Note: Authors stated that definition of failure was most commonly <50% contralateral FTM-TRS improvement with FUS-T, whereas with SRS-T it was more commonly little or no reduction in tremor3.	**Tremor reduction:** • Fahn-Tolosa-Marin Tremor Rating Scale (n=18) • Clinical Rating Scale for Tremor or the tremor score for the treated hand Note: All results were reported as FTM TRS scores as the CRST scores were relabeled as FTM-TRS scores. Although referred to with different names, each of these scales record information about subcomponents of tremor on the same numerical scale; the maximum possible unilateral tremor score is 58.

Review Details	Included Studies	Clinical Endpoints Identified	Instruments/Items Identified
Reference: Fan et al 2022 **Objective:** To identify the superior target of deep brain stimulation for essential tremor **Funding Source:** NR **Databases:** PubMed, Embase, Cochrane Movement Disorders Group Trials Register, Cochrane Central Register of Controlled Trials, Google Scholar **Included study types:** Observational **Inclusion Criteria:** Study reported PSA-DBS and VIM-DBS treatments for ET; the study used objective scales including the ETRS and/or the FTM-TRS scores to report clinical outcomes; the studies recorded the number of SRCs; the study reported DBS targets, age at surgery, disease duration, total tremor rating scale scores both at baseline and the last follow-up or postoperative percentage improvement; the follow-up duration was longer than 3 months **Exclusion Criteria:** indications for surgery other than ET; a target other than PSA or VIM; re-implantation after failed DBS; reports that included data that could not be extracted; conference articles; editorials; reviews; duplicate publications; non-English articles; low-quality studies	**Intervention:** Posterior subthalamic area (PSA) DBS **Comparator:** VIM DBS **Number of included studies:** 32 **Number of Patients:** 448 PSA-DBS: 122 VIM-DBS: 326 **Mean Age, years (range):** NR **Female, n (range %):** NR **Average duration of follow-up as per eligibility criteria:** PSA-DBS: 12.81 months VIM-DBS: 14.66 **Disease severity:** NR	**Primary endpoints** • Improvement of total TRS scores • Change from baseline characteristics **Secondary endpoints:** NR	**Improvement of TRS scores** ETRS or FTM-TRS (n=NR)
Reference: Shukla et al., 2022 **Objective:** To discuss the rationale, background, and potential mechanisms for peripheral stimulation devices with a specific focus on the role of Cala system in ET. **Funding Source:** Grants from the NIH and has received grant support from Benign Essential Blepharospasm Research foundation, Dystonia coalition, Dystonia Medical Research foundation, National Organization for Rare Disorders. Author has received consultant fees from Merz, Jazz and Acadia. She is the current Vice	**Intervention:** Peripheral nerve stimulation **Comparator:** NR **Number of included studies:** 8 **Number of Patients:** NR	**Primary endpoints:** • TETRAS upper limb score • TETRAS spiral item **Secondary endpoints:** • Arm tremor severity • ADL	**Arm tremor/ tremor power** Electromyography (n=4) **TETRAS total score** TETRAS (n=3) **FTM-CRS score** FTM-CRS (n=3) **ADL** Bain and Findley ADL (n=2)

Review Details	Included Studies	Clinical Endpoints Identified	Instruments/Items Identified
President for the Tremor Research Group and advisor for Biogen. **Databases:** PubMed **Included study types:** 2 RCT, 6 open label with objective physiology **Inclusion Criteria:** articles written in English and studies conducted on human subjects; MeSH filter terms **Exclusion Criteria:** NR	**Mean Age, years (range):** NR (56.6 to 68.3) **Female, n (range %):** NR **Minimum duration of follow-up as per eligibility criteria:** Real time **Disease severity:** NR		
Reference: Agrawal et al., 2021 **Objective:** To summarize the latest available evidence in literature in terms of efficacy and complications of MRgFUS for ET **Funding Source:** NR **Databases:** PubMed, Google Scholar, Cochrane library database, Medline **Included study types:** 1 RCT, 28 observational studies **Inclusion Criteria:** Studies describing the use of MRgFUS for the treatment of medically refractory ET (unilateral or bilateral) in the adult population **Exclusion Criteria:** studies that reported outcomes on patients with tremors secondary to any other causes, such as drug-induced tremor, history of preceding trauma within 3 months, psychogenic tremor, or co-morbid Parkinson disease and dystonia, cases where a previous procedure such as DBS, radiosurgery or stereotactic ablation was done	**Intervention:** MRgFUS **Comparator:** NR **Number of included studies:** 29 **Number of Patients:** NR **Mean Age, years (range):** 61.7 ± 8.1 to 78 ± 6 **Female, n (range %):** NR **Range of duration of follow-up as per eligibility criteria:** 3 months – 5 years **Disease severity:** NR	**Primary endpoints:** • **Tremor** ○ Change in CRST score pre and postoperatively at 3 and 12 months **Secondary endpoints:** • **Difference in disability and QoL scores** ○ Change in baseline scores at 3, 6, and 12 months	**Tremor** CRST Part A (n=16) Hand score (n=4) **Difference in disability and QOL scores** QUEST (n=3) CRST Part C (n=5)
Reference: Giordano et al., 2020 **Objective:** To compare the results of MRgFUS in the treatment of medication-refractory ET with the gold standard technique of DBS	**Intervention:** MRgFUS **Comparator:** DBS	**Primary endpoints:** • **Temor severity** ○ Percentage change between pre-operative and postoperative score	**Tremor severity** Fahn-Tolosa-Marìn Tremor Rating Scale (n=42) Bain and Findley Tremor Scale (n=1) **QoL/ADL**

Review Details	Included Studies	Clinical Endpoints Identified	Instruments/Items Identified
Funding Source: NR **Databases:** PubMed, Cochrane Database of Systematic Reviews, Cochrane Central Register of Controlled Trials and SCOPUS **Included study types:** 15 retrospective interventional; 30 prospective studies, 3 of which were RCTs **Inclusion Criteria:** All articles reporting the use of DBS or MRgFUS thalamotomy for the treatment of drug-refractory ET **Exclusion Criteria:** Articles in non-English language, studies that involved animals, case reports, technical notes, editorials, case series with less than 10 patients, paediatric series (patients <18 years), studies considering a follow-up <6 months and studies considering a follow-up >80 months	**Number of included studies:** 45 **Number of Patients:** 1679 **Mean Age, years (range):** MRgFUS: 70.4 $\pm$1.7 DBS: 66.1 $\pm$ 3.6 **Female, n:** 563 **Average duration of follow-up as per eligibility criteria:** MRgFUS: 14.4 months DBS: 16.6 months **Disease severity:** NR	• **QoL/ADL** **Secondary endpoints:** NR	Part C of the FTM-TRS (n=11) Quality of life in Essential Tremor Questionnaire (n=7) Frenchay Activity Index (n=1) ADL Taxonomy Scale (n=2) Bain and Findley Tremor ADL Scale (n=2) Modified Parkinson Disease's Questionnaire-39 (n=2)
Reference: Kondapavulur et al. 2022 **Objective:** Systematic review and network meta-analysis to examine the efficacy of VIM versus PSA DBS for treating medically refractory ET **Funding Source:** Nil **Databases:** Pubmed and Embase **Included study types:** NR **Inclusion Criteria:** (1) the study population consists of patients with essential tremor; (2) the patients received DBS implantation in either e Vim or PSA (for simplification, studies with caudal zona incerta stimulation were grouped together with PSA studies); and (3) the study included tremor severity from a validated tremor scoring scale.	**Intervention:** DBS VIM stimulation **Comparator:** DBS PSA stimulation **Number of included studies:** Short-term follow-up: 21 For VIM: 10 For PSA: 9 Long-term follow-up: For VIM: 6 For PSA: 5 **Number of Patients:** 751 Short-term follow-up:	**Primary endpoints:** • Tremor reduction from baseline (n=21) **Secondary endpoints:** • Percent tremor reduction on-stimulation relative to off-stimulation (n=8)	**Tremor reduction** • FTM-TRS scores (n=21) **Time period** • Short-term (≤12 months) (n=19) • Long-term (>12 months) (n=11)

Review Details	Included Studies	Clinical Endpoints Identified	Instruments/Items Identified
Exclusion Criteria: (1) all articles in non-English languages; (2) studies that involved animals; (3) technical notes; (4) editorials; (5) systematic or literature reviews; (6) case reports or series with <5 patient; and (7) pediatric series (patients <18 years) (Fig. 1). In the case of mixed series, studies were considered only where data regarding patients with ET could be differentiated from those of other patients. In the case where the same patient data were reported in multiple studies, the most recent study with most comprehensive study population was included	For VIM: 300 For PSA: 200 Long-term follow-up: For VIM: 165 For PSA: 86 **Diagnosis:** Medically refractory ET **Mean Age, years (range):** Short-term follow-up: 62.8 (58-70) Long-term follow-up: 64.3 (54-70) **Female, n (range %):** Short-term follow-up: 58% Long-term follow-up: 45% **Minimum duration of follow-up as per eligibility criteria:** NR Short-term: weighted average follow-up • For VIM: 9.96 months • For PSA: 11.3 months Long-term: weighted average follow-up • For VIM: 36.3 months		

Review Details	Included Studies	Clinical Endpoints Identified	Instruments/Items Identified
	• For PSA: 38.6 months **Disease severity**: NA		
Reference: Miller et al., 2022 **Objective:** To inform movement disorder specialists and neurosurgeons when selecting appropriate treatment modalities for medication-refractory ET. **Funding Source:** NR **Databases:** PubMed **Included study types:** 1 prospective randomized controlled trial representing level II evidence. Twenty studies used pre-treatment values as controls; seventeen were prospective and three were retrospective **Inclusion Criteria:** At least some of the reported data must describe patients who received MRgFUS treatment for patients with a diagnosis of ET; The data for ET patients must be presented separately from the data for patients with other included diseases (chiefly, Parkinson's disease); Reported relevant data must include total CRST scores, QUEST scores, or HTS prior to and at regularly scheduled intervals after MRgFUS lesioning; Data must be presented alongside measures of variance to enable calculation of Hedges' g as a measure of effect size. **Exclusion Criteria:** NR	**Intervention:** MRgFUS treatment **Comparator:** NR **Number of included studies:** 21 **Number of Patients:** 395 **Mean Age, years (range):** 70.2 ± 8.9 **Female, n (range %):** 30% **Minimum duration of follow-up as per eligibility criteria:** 3 months **Disease severity:** NR	**Primary endpoints:** • **Hand tremor scores** ○ Change in scores from baseline to follow up ○ Follow up after 3 months: 6 studies ○ Follow up after 12 months: 9 studies ○ Follow up after 24 months: 4 studies • **CRST scores** ○ Change in scores from baseline to follow up ○ Follow up after 3 months: 5 studies ○ Follow up after 6 months: 5 studies ○ Follow up after 12 months: 6 studies • **QUEST scores** ○ Change in scores from baseline to follow up ○ Follow up after 3 months: 6 studies	**Hand tremor scores** (n=19) • Hand tremor score (HTS) is a modified 32-point score derived from parts A and B of the CRST **CRST scores** (n=20) • Clinical Rating Scale for Tremor (CRST) **QUEST scores** (n=6) • Quality of Life in Essential Tremor Questionnaire (QUEST)

Abbreviations: ADL: Activities of Daily Living; DBS: deep brain stimulation; CRST: Clinical Rating Scale for Tremor; DBS: Deep brain stimulation; ET, essential tremor; ETRS, Essential Tremor Rating Scale; FTM-(CRS/TRS): Fahn-Tolosa-Marin (Clinical Rating Scale/Tremor Rating Scale); FUS-T: Focused ultrasound-thalamotomy; MRgFUS: Magnetic resonance-guided ultrasound; NR, not reported; PSA: Posterior subthalamic area; QUEST: Quality of Life in Essential Tremor Questionnaire; QoL: Quality of life; RCT: Randomized controlled trial; SRS-T: stereotactic radiosurgery thalamotomy; TETRAS: Tremor Research Group Essential Tremor Rating Assessment Scale; VIM: Ventral intermediate nucleus

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Table B1c. Table of Included Professional Guidance Documents

Document Summary	Studies Included	Clinical Endpoints (Measurement Tools) Identified
Reference: Deuschl et al. 2022 **Objective:** Update of the treatment guidelines commissioned by the European Academy of Neurology and the European section of the Movement Disorder Society on the treatment of Parkinson's disease, invasive therapies **Funding Source:** Grant from Medtronic, Boston Scientific, Aleva, Functional Neuromodulation, Roche, and Thieme Publishers **Databases:** References used in the current guidelines were identified by performing a systematic search in the PubMed, Embase, Web of Science, and Cochrane Library databases as well as clinical trials registration via clinicaltrials.gov **Included study types:** RCT and/or meta-analysis/systematic review **Inclusion Criteria:** Patients with a confirmed diagnosis of PD who are eligible for these therapies. Studies must include a minimum of 10 participants per arm. **Exclusion Criteria:** NR	**Intervention:** DBS surgery of: STN, GPi. Thalamus, Pedunculopontine nucleus, Zona incerta, Levodopa-carbidopa intestinal gel, and Apomorphine pump **Comparator:** Placebo / Usual care/ best medical treatment / no treatment /sham treatment **Number of included studies:** 13 **Number of Patients:** NR **Diagnosis:** Advanced stage of Parkinson's disease **Mean Age, years (range):** NR **Female, n (range %):** NR **Minimum duration of follow-up as per eligibility criteria:** NR	**Clinical endpoints specified in the PICO statement for the systematic literature search:** *Critical endpoints* • QoL (PDQ-39 or PDQ-8) • ADL (UPDRS-II • Change in motor score (UPDRS-III) • Reduction of complications of therapy, i.e., motor complications* (UPDRS-IV) • Reduction of motor fluctuation (patient-reported diary) • Surgical and medical SAEs *Important endpoints* • Staging (Hoehn and Yahr) • Cognition (UPDRS-I, MoCA, MMSE • Depression (BDI, HDRS) • Apathy • Impulsive-compulsory behavior (Ardouin-scale, QUIP, QUIP-RS, MIDI, BIS-impulsivity • Gait • Speech • Daily dose of anti-PD medication (levodopa mg equivalent Note: the critical endpoints were considered more relevant for decision making than the "important" endpoints. Time period: The data were analyzed as short-term effects
Reference: Saba et al 2022 **Objective:** To disseminate knowledge about the management of PD treatment, adapting the best evidence to the Brazilian reality **Funding Source:** NR	**Intervention:** No inclusion criteria specified. Studies of pharmaceutical therapy and DBS are cited. **Comparator:** NR	**Endpoints discussed** • Motor symptoms (UPDRS III) • ADL (UPDRS II) • Reduction/delay in motor complications* • Delay in need for levodopa (Through use of selegine)

Document Summary	Studies Included	Clinical Endpoints (Measurement Tools) Identified
Databases: NR **Included study types:** NR **Inclusion Criteria:** NR **Exclusion Criteria:** NR	**Number of included studies:** NR **Number of Patients:** NR **Diagnosis:** Advanced stage PD **Mean Age, years (range):** NR **Female, n (range %):** NR **Minimum duration of follow-up as per eligibility criteria:** NR	• Duration of response • Discontinuation of treatment (for either lack of tolerability or lack of efficacy) • Delay in drug therapy intensification
Reference: Fox et al. 2018 **Objective:** To update evidence-based medicine recommendations for treating motor symptoms of Parkinson's disease **Funding Source:** International Parkinson and Movement Disorder Society **Databases:** Medline, Cochrane Library and systematic checking of references from review articles and other reports **Included study types:** Level I studies of interventions **Inclusion Criteria:** Pharmacological, surgical, and other therapies commercially available in at least 1 country, assessed using level I, RCT methodology and where motor symptoms were the primary endpoint measured with an established rating scale or well-described outcome. The included studies had to have a minimum of 20 patients who were treated for a minimum of 4 weeks **Exclusion Criteria:** NR	**Intervention:** No inclusion criteria specified. Studies of pharmaceutical therapy, physical therapy, and DBS are cited. **Comparator:** NR **Number of included studies:** 143 **Number of Patients:** NR **Diagnosis:** Advanced PD **Mean Age, years (range):** NR **Female, n (range %):** NR **Minimum duration of follow-up as per eligibility criteria:** NR	**Endpoints discussed** • Global motor symptoms • Specific motor symptoms (tremor, gait, balance, speech; no surgical therapies mentioned for gait or balance) • Safety ("acceptable risk" with/without specialized monitoring or "unacceptable risk • Gait • Balance • Reduction in number of falls (mentioned in the context of pharmaceutical treatment and physical therapy) • Reduction/delay in motor complications (motor fluctuations and dyskinesia)
Reference: Rughani et al. 2018 **Objective**: To assess if bilateral STN DBS is more, less,or as effective as bilateral GPi DBS in treating Parkinson's disease **Funding Source**: Congress of Neurological Surgeons (CNS) and the American Society for Stereotactic and Functional Neurosurgery	**Intervention:** STN DBS and GPi DBS **Comparator:** NR **Number of included studies:**18 **Number of Patients:** NR	**Endpoints discussed:** • Motor score improvements at various time points, up to 5 years postoperatively, in various medication and stimulation conditions (n=12) (UPDRS III) • Reduction in dopaminergic medications (n=11)

Document Summary	Studies Included	Clinical Endpoints (Measurement Tools) Identified
Databases: PubMed **Included study types:** Class I, II and III studies as classified according to criteria for evidence on therapeutic effectiveness as detailed in the Joint Guidelines Committee Guideline Development Methodology **Inclusion Criteria**: NR **Exclusion Criteria**: NR	**Diagnosis:** PD **Mean Age, years (range):** NR **Female, n (range %):** NR **Minimum duration of follow-up as per eligibility criteria:** NR	• Reduction in motor complications* (severity of "on" medication dyskinesias) (n=3) • QoL (PDQ-39) or ADL (UPDRS-II) (n=9) • Neurocognitive function (n=5) • Mood disturbance (n=5) (Depression, BDI, HDRS; Suicidal ideation and suicidal behaviors, deduced from depression assessment according to UPDRS-I, as described in the cited reference) • Composite of mood, cognition and behaviorial effects • AEs
Reference: Odin et al. 2018 **Objective:** To provide viewpoint and practical recommendations from a movement disorder specialist panel on use of FDA-approved wearable devices (sensors), otherwise referred to as *objective measurement*, in the clinical management of Parkinson's disease objective measurement in **Funding** **Source:** Global Kinetic Corporation **Databases:** A panel of 11 internationally recognized movement disorder specialists in the care of PD **Included study types:** NR **Inclusion Criteria:** NR **Exclusion Criteria:** NR	**Intervention:** PKG and Kinesia **Comparator:** NR **Number of included studies:** NR **Number of Patients:** NR **Diagnosis:** PD **Mean Age, years (range):** NR **Female, n (range %):** NR **Minimum duration of follow-up as per eligibility criteria:** NR	**Endpoints relevant to continuous assessment by wearable sensors, derived by expert consensus:** • Motor symptoms and motor complications (bradykinesia, tremor, motor fluctuations, dyskinesia). UPDRS and AIMS scales cited for purposes of showing correlations with sensor measurements. • Immobility during sleep (risk marker measured by the sensor) • Impulsivity-compulsivity • QoL (assumed to be improved through continuous assessment)
Abbreviations: ADL, activities of daily living; AE, adverse events; BDI: Beck Depression Inventory; BIS: Barrett Impulsivity Scale; DBS: Deep brain stimulation; HDRS: Hamilton Depression Rating Scale; MoCA: Montgomery Cognition Assessment; MMSE: Mini-Mental State Examination; NR: not reported; PD: Parkinson's Disease; PDQ: Parkinson's Disease Questionnaire; QoL: Quality of life; QUIP(-RS): Questionnaire for Impulsivity-Conpulsivity Disorders in PD (-Rating Scale); RCT: Randomized controlled trial; UPDRS: Unified Parkinson's Disease Rating Scale		

Table B2. Summary of Clinical Endpoint Citation Volume Across Systematic Reviews

Clinical Endpoints	Citation Volume*	Primary/Secondary Endpoint Citation Volume	Prioritized Instruments (citation volume)†	Measurement Details
PARKINSON'S DISEASE				
Clinician-Assessed Health Outcomes				
Global change in motor severity	180/278 (64.78%)	157/228 (68.85%) and 23/50 (46.00%)	**UPDRS III** (176/180; 97.77%) <u>Sub scores of UPDRS-III</u> • Upper limb score (UPDRS-III item 20-25) • Lower limb score (UPDRS-III item 20, 22, 26, 29) • Axial score (UPDRS-III item 27–30) • Tremor (UPDRS-III item 20, 21): Reported in 24 publications. • Rigidity (UPDRS-III item 22) • Postural instability (UPDRS-III item 30) • Akinesia (UPDRS-III item 23–26) • Bradykinesia (UPDRS-III item 31) **MDS-UPDRS** • MDS UPDRS (6/180; 3.33%) • MDS UPDRS III OFF medication (5/180; 2.77%)	• Change from baseline to followed-up every 2 to 3 months • Reported in ○ Medication-off state ○ Medication-on state

Clinical Endpoints	Citation Volume*	Primary/Secondary Endpoint Citation Volume	Prioritized Instruments (citation volume)†	Measurement Details
Gait function, postural instability and balance	63/159 (39.62%)	60/152 (39.47%) and 13/27 (48.14%)	Freezing of Gait • FOG-Q (38/63; 60.31%) • TUG (38/63; 60.31%) • Stand Walk Sit FOG spells (4/63; 6.34%) • FOG AC (4/63; 6.34%) • SWS-Q (5/63; 7.93%) • New FOGQ (2/63; 3.17%) • Other parameters: FOG duration, FOG item in the UPDRS-II, FOG item in the Rating Scale for Gait Evaluation Walking test • Walking test (5/63; 7.93%) • 20-meter walking test (2/63; 3.17%) • 10-meter walking test (12/63; 19.04%) • 7-meter walking test (1/63; 1.58%) • GFQ (1/63; 1.58%) • Tinetti scale (1/63; 1.58%) • Berg Balance scale (15/63; 23.80%) • Nutt scale (1/63; 1.58%) • Dynamic Gait Index (1/63; 1.58%) • DS time (3/63; 4.76%) Spatiotemporal, and kinematic parameters for gait analysis: • GAITrite and/or 3D quantitative gait analysis (9/63; 14.28%) • Gait automaticity (1/63; 1.58%) • Gait/walking speed (24/63; 38.09%) • Stride length (11/63; 17.46%) • Stride time variability, Swing time variability, DFA fractal scaling exponent, improvement in fastest walking speed, turn steps (NR)	**Time periods of assessment** • Before surgery (baseline) • Immediately at start of study • 3 weeks • 3 months • 6 months • 12 months • 15 months • 17 months • 24 months • 46 months **Medication status at baseline, stimulation:** • On medication, on medication • Off medication, off medication • Off medication, on medication • NR, on medication • NR, off medication
Ataxia	1/10 (10.00%)	1/10 (10.00%) and 0%	International Cooperative Ataxia Rating Scale (1/10; 10.00%)	NR
Dyskinesia	39/135 (28.88%)	37/116 (31.89%) and 2/19 (10.52%)	• Unifed Dyskinesia Rating Scale (2/39; 5.12%) • Rush Dyskinesia Rating Scale (2/39; 5.12%) • Levodopa-induced dyskinesias (5/39; 12.82%) (using Abnormal Involuntary Movement Scale) • Increased on medication time without dyskinesia (33/39; 84.61%)	• OFF medication time • ON medication time: ON time without troublesome dyskinesia

Clinical Endpoints	Citation Volume*	Primary/Secondary Endpoint Citation Volume	Prioritized Instruments (citation volume)†	Measurement Details
			• Off medication time (21/39; 53.84%) ○ UPDRS II off medication (12/39; 30.76%) ○ UPDRS II on medication (18/39; 46.15%) ○ UPDRS III on medication (18/39; 46.15%) ○ UPDRS III off medication (18/39; 46.15%)	
PD medication usage	11/36 (30.55%)		Levodopa equivalent daily dose (11/11; 100.00%)	12 months post-operatively
Speech function	5/26 (19.23%)	3/7 (42.8%) and 2/19 (10.52%)	Speech Intelligibility Test (5/26; 19.23%)	Change from baseline characteristics
Cognitive function	42/101 (41.58%)	42/101 (41.58%) and 0%	• MMSE (5/42; 11.90%) • Stroop test (36/42; 85.71%) • Verbal fluency (1/42; 2.38%) • Dementia rating scale (5/42; 11.90%) • Wisconsin card sorting test-categories (5/42; 11.90%)	Change in result from pre- and post-surgery
ADL	19/40 (47.50%)	19/40 (47.50%)	UPDRS II (19/19; 100.00%)	Change from baseline characteristics
Patient-Reported Outcomes				
QoL	55/104 (52.88%)	51/84 (60.71%) and 4/20 (20.00%)	• PDQ-39 (24/55; 43.63%) • PDQ-8 (2/55; 3.6%) • PDQ L (4/55; 7.27%) • 12-Item Short-Form Health Survey (4/55; 7.27%)	The difference (comparison) pre- post-intervention Percentage of change from baseline every 3 months after the intervention.
Sleep quality	6/60 (10.00%)	10.00% and 0%	• Parkinson disease sleep Scale (6/6; 100.00%) • Epworth sleepiness scale (2/6; 33.33%) • Total sleep time (2/6; 33.33%) • Day sleepiness (2/6; 33.33%) • Sleep latency (2/6; 33.33%)	Change from baseline characteristics
Nonmotor symptoms	11/70 (15.71%)		• NMSS (9/11; 81.81%) • NMSQ score (5/11; 45.45%)	Change from baseline characteristics
Physical function	2/20 (10.00%)	2/20 (10.00%) and 0%	Activities Specific Balance Confidence scale (2/19; 10.52%)	Change from baseline characteristics
Fatigue	1/20 (5.00%)		Piper Fatigue scale (1/2; 100.00%)	NR
Fear of falling	1/20 (5.00%)		Fear of Falling Efficacy scale (1/1; 100.00%)	NR
Essential Tremor				
Reduction of tremor	127/142 (89.43%)	127/142 (89.43%) and 0%	• Fahn-Tolosa-Marin Tremor Rating Scale (84/127; 66.14%) • TETRAS (3/127; 2.36%)	Change from baseline characteristics.

Clinical Endpoints	Citation Volume*	Primary/Secondary Endpoint Citation Volume	Prioritized Instruments (citation volume)†	Measurement Details
			• Electromyography (4/127; 3.14%) • Bain and Findley Tremor Scale (1/127; 0.78%) • CRST (n=20/127; 15.74%) • HTS: a modified 32-point score derived from parts A and B of the CRST (39/127; 30.78%)	
Impact of motor symptoms on ADL and QoL	45/103 (43.68%)	45/103 (43.68%) and 2/8 (25.00%)	• Bain and Findley Tremor ADL Scale (4/45; 8.88%) • QUEST (3/45; 6.66%) • CRST Part C (5/45; 11.11%) • FTM-TRS Part C (11/45; 24.44%) • Quality of life in Essential Tremor Questionnaire (19/45; 42.22%) • Frenchay Activity Index (1/45; 2.22%) • ADL Taxonomy Scale (2/45; 4.44%) • Modified Parkinson Disease' Questionnaire –39 (2/45; 4.44%)	Change from baseline characteristics.

Abbreviations: ADL: Activities of daily living; BIS MoCA: Behavioral Inhibition Scale - Montreal Cognitive Assessment; CRST: Clinical Rating Scale for Tremor; FOG-Q: Freezing of Gait Questionnaire; FTM-TRS: Fahn-Tolosa-Marin Tremor Rating Scale; GFQ: Gait and Fall Questionnaire; HTS: Hand Tremor Score; MIDI: Motor Impairment in Drug-induced Impulse Control Disorders; MDS-UPDRS: Movement Disorder Society–Sponsored Revision Unified Parkinson's Disease Rating Scale; MMSE: Mini-Mental State Examination; NA: Not applicable; NMSS: Non-Motor Symptoms Scale; NMSQ: Non-Motor Symptoms Questionnaire; NSTAPS: Neurologic Soft Signs and Tremor in Parkinsonian Syndrome; PD: Parkinson's disease; PDQ: Parkinson Disease's Questionnaire; QoL: Quality of life; QUEST: Quality of Life in Essential Tremor Questionnaire; QUIP: Questionnaire for Impulsive-Compulsive Disorders in Parkinson's Disease; QUIP-RS: Questionnaire for Impulsive-Compulsive Disorders in Parkinson's Disease-Rating Scale; RDRS: Rush Dyskinesia Rating Scale; RSGE: Rating Scale for Gait Evaluation; SIT: Speech Intelligibility Test; SWS-Q: Stand Walk Sit Questionnaire; TEED: Total electrical energy delivered; TETRAS: Tremor Research Group Essential Tremor Rating Assessment scale; TSTH: Tremor score for the treated hand; TUG: Time Up and Go Test; TW: Therapeutic Window; UDRS: Unified Dyskinesia Rating Scale; UPDRS: Unified Parkinson's Disease Rating Scale

*Citation volume was calculated according to the number of studies investigating the clinical endpoint as a percentage of the total number of studies across the systematic reviews that evaluated that endpoint. For example, the systematic reviews that discussed change in motor severity collectively included 278 primary studies and 180 of those studies (64.78%) investigated change in motor severity.

†Citation volume was calculated a manner analogous to that used for clinical endpoint citation volume.

Appendix C. Instrument and Device Details

Table C1. Instruments Used to Measure Important Clinical Endpoints

Clinical Endpoint*	Instruments	MCID or MDC	Instrument properties (e.g., items, dimensions, recall, description, etc.)	Validity/Reliability	Other Notes
PARKINSON'S DISEASE					
Domain: Clinician-Assessed Health Outcomes					
Global change in motor symptom severity	MDS UPDRS III	MCID: -3.25 points for detecting minimal, but clinically pertinent, improvement and 4.63 points for minimal, but clinically pertinent, worsening (Horváth et al., 2016)	Assessment Type: ClinRO Estimated Time to Complete: Under 15 minutes for full assessment. The MDS-UPDRS has four parts: Part I (non-motor experiences of daily living), Part II (motor experiences of daily living), Part III (motor examination) and Part IV (motor complications). Part III retains the objective assessments of parkinsonism, but all tasks have specific instructions. Part III has instructions for the rater to give or demonstrate to the patient; it is completed by the rater. The performance of each task as the patient performs is rated in the context of co-morbidities. Rater involvement time for administering this section is 15 minutes. Part III contains 33 scores based on 18 items, several with right, left, or other body distribution scores. Each question is anchored with five responses that are linked to commonly accepted clinical terms: 0 = normal, 1 = slight, 2 = mild, 3 = moderate, and 4 = severe. Higher scores indicate greater impact of PD symptoms or lower performance (Goetz et al., 2008).	The MDS-UPDRS III has high internal consistency (Cronbach's alpha = 0.79–0.93 across parts) and correlates with the original UPDRS (ρ = 0.96). MDS-UPDRS III across-part correlations ranged from 0.22 to 0.66. Reliable factor structures for each part were obtained (comparative fit index > 0.90 for each part), which support the use of sum scores for each part in preference to a total score of all parts (Goetz et al., 2008).	If the patient is receiving medication for treating the symptoms of PD, the patient's clinical state is marked using the following definitions: ON is the typical functional state when patients are receiving medication and have a good response. OFF is the typical functional state when patients have a poor response in spite of taking medications.

Clinical Endpoint*	Instruments	MCID or MDC	Instrument properties (e.g., items, dimensions, recall, description, etc.)	Validity/Reliability	Other Notes
Gait function, postural instability and balance	FOG-Q	MCID for improvement based on expert clinician rating was three scale points with a sensitivity of 0.67 and a specificity of 0.96 (Fietzek et al., 2020)	6-item questionnaire to quantify FOG, each with a score ranging from 0 to 4, and a total score between 0 to 24. A higher score denotes more severe freezing of gait. The first two items focus on common difficulties with gait in PD patients. The last 4 items assess FOG frequency (item 3) and duration (items 4 to 6). It requires 5–10 minutes to fill in the FOG-Q (Taghizadeh et al., 2021).	The Cronbach alpha was high (α=0.92). The test-retest showed high reliability (ICC=0.89). The FOG-Q was unidimensional according to the EFA and had acceptable convergent validity with moderate to high correlation with other clinical scales. The optimal cutoff point to discriminate fallers from non-fallers during the "off" state was 9/10, with an AUC of 0.92. The ICC for the total scores of the FOGQ was 0.89, indicating satisfactory test-retest reliability, and the value of the SEM was 2.21 (SD pooled =6.68) (Taghizadeh et al., 2021).	Reports freezing of gait in the "off" state. When the level of L-Dopa has a drop, the patient experiences unwanted motor symptoms; the state is called the "off" state.
	TUG	MDC: 3.82 points (da Silva et al., 2017)	A method for assessing patients' levels of functional mobility. It measures the time taken for an individual to stand up from a chair, walk three meters, turn, walk back, and sit back down da Silva et al., 2017).	The inter-examiner, test-retest and intra-examiner reliabilities were classified as excellent (0.95 ≤ intra-class correlation coefficient (ICC)≤0.99). The TUG presented excellent internal consistency (α = 0.98). The construct validity between the TUG and the UPDRS III was classified as moderate (ρ = -0.62) da Silva et al., 2017).	The TUG is a highly studied outcome measure in the geriatric population but lacks research of its applicability to other populations.[41]
ADL	MDS UPDRS II	MCID: 3.05 and 2.51 points for improvement and deterioration respectively (Horváth et al., 2017)	Motor Aspects of Experiences of Daily Living. It comprises of 13 questions and is designed to be a self-administered questionnaire but can be reviewed by the investigator to ensure completeness and clarity. Patient answers questions on the following: Speech, saliva, and drooling, chewing, and swallowing, eating tasks, dressing, hygiene, handwriting, doing hobbies	Internal consistency for Part II was excellent (α = 0.90) and concurrent validity between the original UPDRS and the MDS-UPDRS was excellent (*r* = 0.92) for part II (Goetz et al., 2008).	Not validated to be scored in "on" or "off" states.

Clinical Endpoint*	Instruments	MCID or MDC	Instrument properties (e.g., items, dimensions, recall, description, etc.)	Validity/Reliability	Other Notes
			and other activities, turning in bed, tremor, getting out of bed, walking and balance, and freezing. All items have 5 response options with uniform anchors of 0 = normal; 1 = slight (symptoms/signs with sufficiently low frequency or intensity to cause no impact on function); 2 = mild (symptoms/signs of frequency or intensity sufficient to cause a modest impact on function 3 = moderate (symptoms/signs sufficiently frequent or intense to impact considerably, but not prevent function); 4 = severe (symptoms/signs that prevent function). Higher scores indicate greater impact of PD symptoms (Colosimo et al., 2010).		
Cognitive function	Stroop test	MCID: 5.5 (Borland et al., 2022)	A measure of verbal processing speed and response inhibition in neuropsychological assessment. It consists of three timed trials. The first two trials measure the speed at which participants can read color words (red, green, blue; Word Reading, W) and name the color of blocks of ink in red, green, and blue (Color Naming, C). The third "Color-Word" (CW) trial is called the 'interference trial' and requires the examinee to name the ink color of printed words (red, green, blue) in which the ink color and word are incongruent. The speed of performance on the Color-Word trial is subtracted from the speed on the Color Naming trial to calculate interference. Interference occurs when the processing of one type of information disrupts the simultaneous	The Stroop processing speed and interference scores correlate with other standardized measures of speed and executive function to help determine convergent and divergent validity. The Stroop processing speed scores (Word Reading, Color Naming) correlates positively with each of the processing speed tasks (WAIS-III Digit-Symbol Coding, Symbol Search; Color Naming correlated with Trail Making Test A) (Sisco et al., 2016).	NA

Clinical Endpoint*	Instruments	MCID or MDC	Instrument properties (e.g., items, dimensions, recall, description, etc.)	Validity/Reliability	Other Notes
			processing of another type of information (Sisco et al., 2016).		

Clinical Endpoint*	Instruments	MCID or MDC	Instrument properties (e.g., items, dimensions, recall, description, etc.)	Validity/Reliability	Other Notes
Depression	HDRS	HRSD-17 [clinical anchor, CGI scale]: • 6.2 points (Rush et al., 2003) • 5-6 points (Bobo et al., 2016) HRSD-17 [clinical anchor, QoL scale, within-patient]: 4-5 points (Hengartner & Plöderl, 2022) HRSD-17 [clinical anchor, QoL scale, between-patient]: 3-5 points (Hengartner & Plöderl, 2022) HRSD-6 [clinical anchor, CGI scale]: 3-4 points (Hengartner & Plöderl, 2022) HRSD-6 [clinical anchor, QoL scale, within-patient]: 2-3 points (Hengartner & Plöderl, 2022)	HRSD-17 (17 items): 0–6: no depression 7–17: mild depression 18–24: moderate depression 24: severe depression HRSD-21: 0 to 64 HRSD-24: 0 to 75	Reliability of the HRSD-17 was demonstrated (correlation between 2 raters, 0.90) in 70 patients already diagnosed as suffering from a depressive type affective disorder; patient ages were not reported. (Hamilton et al., 1960). In participants with MDD in a trial of citalopram or escitalopram, the HDRS-17 was validated against both the Clinical Global Impression-Improvement (CGI-I), considered the gold standard, and the Bech 6 instruments (Bobo et al., 2016).	
Domain: Patient-Reported Outcomes					
Depression	BDI	Clinical anchor, QoL scale, within-patient: 6 points (Hengartner & Plöderl, 2022) Patient anchor, QoL scale, within-patient: 6-7 points (Hengartner & Plöderl, 2022) Clinical anchor, QoL scale, between-patient: 3-6 points (Hengartner & Plöderl, 2022)	Revised (BDI-II) replaced 4 items in response to depression diagnosing revisions in DSM-IV 21 items, 0-3 scale Minimal range: 0-13 Mild depression: 14-19 Moderate depression: 20-28 Severe depression: 29-63	Reliability and validation of the BDI were demonstrated in patients seen in the outpatient psychiatric department of 2 hospitals (Beck et al. 1961). These patients were predominately white and generally between the ages of 15 and 44 (6.1% of patients ≥55 years). Many were of low socioeconomic status. Reliability was demonstrated by 1) a statistically significant association between the BDI's 21 symptom-attitude categories and the total BDI score and between the even and odd symptom-attitude categories and by	

Clinical Endpoint*	Instruments	MCID or MDC	Instrument properties (e.g., items, dimensions, recall, description, etc.)	Validity/Reliability	Other Notes
				2) similarity in scores across 3 interviewers. Validation was demonstrated multiple types of comparison between psychiatrist assessments of Depth of Depression and BDI scores.	
QoL	PDQ-39	MCID for PDQ-39 summary indices: -4.72 and +4.22 for detecting minimal clinically important improvement and worsening respectively (Horváth et al., 2017)	A 39-item, PD-specific, health-related quality-of-life measure that evaluates 8 different domains: mobility (10 items), activities of daily living (6 items), emotional well-being (6 items), stigma (4 items), social support (3 items), cognitions (4 items), communication (3 items), and bodily discomfort (3 items). The PDQ-39 consists of 39 items, presented with a 5-point ordinal Likert scale (0 = never, 1 = occasionally, 2 =sometimes, 3 = often, 4 = always). A lower score indicates a better-perceived quality state (Horváth et al., 2017).	The PDQ-39 has been tested for validity and reliability with a satisfactory level of internal consistency, content and convergent validity, and stability.	Varies with the populations, disease severity, type of study (natural progression of disease vs. intervention), and length of the follow-up. The endpoint is focused on the difference (comparison) pre- post-intervention and the percentage of change.
ESSENTIAL TREMOR					
Clinician-Assessed Health Outcomes					
Reduction in tremor	FTM-TRS	MDC of the mean FTM spiral rating is 0.8 points, which is 20% of the maximum rating 4 (Elble & Ellenbogen, 2017).	Assesses postural tremor in the limbs-extended-forward posture, kinetic tremor in the finger-nose-finger reaching task, and rest tremor while both upper limbs are relaxed on the patient's lap, all of which are performed while the patient is seated. Uses 0–4 anchors to assess tremor (0: no tremor, 1: barely perceptible tremor, 2: < 2 cm, 3: 2-4 cm, and 4: > 4 cm) (Ondo et al., 2018).	Test-retest intraclass correlations for the FTM composite scores (rest + postural + kinetic scores) was 0.81. Cronbach α values for the FTM rest, postural, and kinetic tremor ratings was 0.64 (Ondo et al., 2018).	FTM (postural and kinetic ratings) has a ceiling effect for severe tremor (tremor amplitude >4 cm; grade 4) Postural and kinetic tremor ratings for both scales had floor effects, which will be important when tremor is mild (Ondo et al., 2018).
	TETRAS	Relative MCD (defined as % decrease or increase of geometric mean for patients	A validated clinical scale designed specifically for the assessment of ET severity. TETRAS has anchors that span	Both expert and novice raters perform TETRAS with excellent inter-rater and intra-rater reliability. (Ondo, 2018)	The developers of TETRAS included an assessment of upper limb tremor in the wing-beating

Clinical Endpoint*	Instruments	MCID or MDC	Instrument properties (e.g., items, dimensions, recall, description, etc.)	Validity/Reliability	Other Notes
		with each tremor rating) for mean displacement tremor and mean rotation tremor were 66% and 65% reduction in baseline geometric mean. The MDCs for maximum burst displacement and rotation tremor were 66% and 67% reduction in the baseline geometric means (Elbe, 2016)	a larger range of tremor amplitudes (>20 cm = grade 4), making it more suitable for assessing patients with severe ET. Assessment of postural tremor is done in the "wing-beating" position, in which the elbows are flexed and extended laterally with shoulders abducted, such that the upper limbs are held horizontally with the hands in front of the upper chest. This scale requires only a pen and paper and can be completed in about 10 minutes (Ondo et al., 2018).	Test-retest intraclass correlations for the TETRAS composite scores (postural + wing-beating + kinetic scores) was 0.87. Cronbach α values for the TETRAS postural, wing-beating, and kinetic tremor ratings were 0.83 (Ondo et al., 2018).	posture and omitted an assessment of rest tremor. This was done because rest tremor is rarely a source of disability in ET and because it was the anecdotal experience of the authors of TETRAS that the wing-beating posture frequently elicited more tremor than the limbs-extended-forward posture. (Ondo et al., 2018).
	Clinical Rating Scale for Tremor	None identified	CRST consists of part A (assessing global tremor severity), part B (action tremors of the upper extremity), and part C (tremor interference with daily activities). Each item is rated on a scale from 0 to 4. The maximum possible scores of the first version of CRST are 80, 36, and 28 for Parts A, B, and C, respectively; thus the maximum possible total score is 144 (Miller et al., 2022).	No information identified	A clinically significant tremor is defined as a score of 2 or more on the postural or action item of the CRST (ranging from 0 to 4) and Substantial disability in the performance of at least 2 daily activities from the disability subsection of the scale.[52]
	HTS	None identified	A modified 32-point score derived from parts A and B of the CRST. HTS is used to standardize the pre- and postoperative evaluation of hand-specific ET symptoms (Miller et al., 2022).	No information identified	NA
ADL	FTM-TRS (part C)	None identified	Part C of the FTM-TRS is the subject's self-assessment of their tremor's functional impact on several activities of daily living: speaking, feeding, drinking, hygiene, dressing, writing, and working (Western et al., 2019).	No information identified	NA
	CRST (part C)	None identified	CRST Part C consists of a structured interview where patients rate how	No information identified	NA

Clinical Endpoint*	Instruments	MCID or MDC	Instrument properties (e.g., items, dimensions, recall, description, etc.)	Validity/Reliability	Other Notes
			much their tremor interferes with their ADL (van der Stouwe et al., 2023).		
Patient-Reported Outcomes					
QoL	QUEST	None identified	A 30-item scale developed specifically for patients with essential tremor to measure items impacting perceived QoL that generic QoL measures do not effectively capture, including activities of daily living that are affected by essential tremor. The QUEST was made to be relatively brief and easy for patients to use (Tröster et al., 2005).	Test-retest reliability is adequate for the QUEST questionnaire summary index (ICC 5 0.77) but is lower for the dimensions work/finances and hobbies/leisure (ICC 5 0.60 and ICC 5 0.57, respectively) (Elble et al., 2013).	NA

Abbreviations: ADL: Activities of daily living; BDI: Beck Depression Inventory; CRST: Clinical Rating Scale for Tremor; ET, essential tremor; FOG-Q: Freezing of Gait Questionnaire; FTM-TRS: Fahn-Tolosa-Marin Tremor Rating Scale; HRDS, Hamilton Depression Rating Scale; ICC: interclass correlation coefficient; MDC: minimum detectable change; MCID, minimal clinically important difference; MDS-UPDRS: Movement Disorder Society-sponsored revision of UPDRS; NA: Not applicable; PD: Parkinson's disease; PDQ: Parkinson Disease's Questionnaire; QoL: Quality of life; QUEST, Quality of Life Essential Tremor Questionnarie; TETRAS: Tremor Research Group Essential Tremor Rating Assessment scale; TUG: Timed Up and Go Test; UPDRS: Unified Parkinson's Disease Rating Scale

*This table includes clinical endpoints derived from the systematic reviews included in this report and cited frequently enough to meet the prioritization threshold plus clinical endpoints that were emphasized by at least two of the five included professional guidance documents.

Table C2: Devices Studied According to Each Prioritized Clinical Endpoint

Clinical Endpoint Studied	Devices and Volume Citation[1]	Instrument Used
PARKINSON'S DISEASE		
Clinician-Assessed Health Outcomes		
Global change in motor symptom severity	**DBS:** 73/108 (68%) **rTMS:** 49/49 (100%) **Wearable sensors:** 3/7 (42%) **Subthalamotomy:** 15/15 (100%) **MRIgFUS:** 26/26 (100%) **Gamma knife thalatomy:** NA **Spinal cord stimulation:** 19/27 (70%)	**UPDRS III** Sub scores of UPDRS-III • Upper limb score (UPDRS-III item 20-25) • Lower limb score (UPDRS-III item 20, 22, 26, 29) • Axial score (UPDRS-III item 27–30) • Tremor (UPDRS-III item 20, 21): Reported in 24 publications. • Rigidity (UPDRS-III item 22) • Postural instability (UPDRS-III item 30) • Akinesia (UPDRS-III item 23–26) • Bradykinesia (UPDRS-III item 31) **MDS UPDRS** • MDS UPDRS (6/6) • MDS UPDRS III OFF medication (5/9)
Gait function, postural instability and balance	**DBS:** 12/20 (60%) **Robot assisted gait training**: 36/38 (94%) **rTMS**: 7/32 (21%) **Wearable sensors**: 7/7 (100%) **Subthalamotomy**: NA **Gamma knife thalatomy**: NA **Spinal cord stimulation**: 27/27 (100%)	Freezing of Gait • FOG-Q • TUG • Stand Walk Sit FOG spells • FOG AC • SWS-Q • New FOGQ • Other parameters: FOG duration, FOG item in the UPDRS-II, FOG item in the Rating Scale for Gait Evaluation Walking test • Walking test • 20-meter walking test • 10-meter walking test • 7-meter walking test • GFQ • Tinetti scale • Berg Balance scale • Nutt scale • Dynamic Gait Index • DS time Spatiotemporal, and kinematic parameters for gait analysis:

Clinical Endpoint Studied	Devices and Volume Citation[1]	Instrument Used
		• Stride time variability, Swing time variability and DFA fractal scaling exponent, improvement in fastest walking speed, turn steps • GAITrite and/or 3D quantitative gait analysis • Gait automaticity • Gait/walking speed • Stride length
Disease severity	**DBS**: 4/7 (57%)	Hoehn and Yahr Scale
Ataxia	**DBS**: 1/10 (10%)	International Cooperative Ataxia Rating Scale
Changes in symptoms of rigidity-bradykinesia	**DBS**: 4/19 (21%)	NR
Dyskinesia	**DBS**: 10/37 (27%) **rTMS**: 4/32 (12%) **Multiple devices**: 1/60 (1%)	• Unified Dyskinesia Rating Scale • Rush Dyskinesia Rating Scale • Levodopa-induced dyskinesias (using Abnormal Involuntary Movement Scale) • Increased time on medication without dyskinesia • Time Off medication without dyskinesia • UPDRS II
PD medication usage	**DBS**: 4/26 (15%)	Levodopa equivalent daily dose
Speech function	**DBS**: 5/26 (19%)	Speech Intelligibility Test
Cognitive function	**DBS**: 59/60 (98%)	• MMSE • Stroop test • Verbal fluency • Dementia rating scale • Wisconsin card sorting test- categories
ADL	**DBS**: 17/30 (56%) **Wearable sensors**: 129/129 (100%)	• Unified Parkinson's Disease Rating Scale Part II • Schwab and England Daily Living Activities Scale • Movement Disorder Society-Unified Parkinson's Disease Rating Scale Part II • Barthel Index • Lawton-Brody Instrumental ADL Scale • Functional Independence Measure • Alzheimer's Disease Cooperative Study – ADL Scale
Patient-Reported Outcomes		
QoL	**DBS**: 39/48 (81%)	• PDQ-39 • PDQ-8 • PDQ L • 12-Item Short-Form Health Survey
Self-reported physical function	**Robot assisted gait training**: 2/20 (10%)	Activities Specific Balance Confidence Scale

Clinical Endpoint Studied	Devices and Volume Citation[1]	Instrument Used
Fear of Fall	**Robot assisted gait training**: 1/20 (5%)	Fear of Falling Efficacy Scale
Nonmotor function	**DBS**: 10/10 (100%) **Multiple devices**: 1/60 (1%)	• NMSS • NMSQ
Sleep quality	**DBS**: 6/60 (10%)	• Parkinson disease sleep Scale • Epworth sleepiness scale • Total sleep time • Day sleepiness • Sleep latency
Fatigue	**Robot assisted gait training**: 1/20 (5%)	Piper Fatigue Scale
ESSENTIAL TREMOR		
Reduction in tremor	**DBS**: 50/65 (76%) **MRgFUS**: 45 63/74 (93%) **Gamma knife thalatomy**: 18/18 (100%) **Cala system**: 8/8 (100%)	• Fahn-Tolosa-Marin Tremor Rating Scale • TETRAS • Electromyography • Bain and Findley Tremor Scale • CRST • Hand tremor score: a modified 32-point score derived from parts A and B of the CRST
QoL or ADL	**DBS**: 5/10 (50%) **MRgFUS**: 63/74 (93%)	• CRST Part C • FTM-TRS Part C • QUEST • Frenchay Activity Index • ADL Taxonomy Scale • Modified Parkinson Disease's Questionnaire-39

Abbreviations: ADL: Activities of daily living; BIS MoCA: Behavioral Inhibition Scale - Montreal Cognitive Assessment; CRST: Clinical Rating Scale for Tremor; FOG-Q: Freezing of Gait Questionnaire; FTM-TRS: Fahn-Tolosa-Marin Tremor Rating Scale; GFQ: Gait and Fall Questionnaire; MIDI: Motor Impairment in Drug-induced Impulse Control Disorders; MDS-UPDRS: Movement Disorder Society–Sponsored Revision Unified Parkinson's Disease Rating Scale; MMSE: Mini-Mental State Examination; MRgFUS: MRI-guided focused ultrasound; NA: Not applicable; NMSS: Non-Motor Symptoms Scale; NMSQ: Non-Motor Symptoms Questionnaire; NSTAPS: Neurologic Soft Signs and Tremor in Parkinsonian Syndrome; PD: Parkinson's disease; PDQ: Parkinson Disease's Questionnaire; QoL: Quality of life; QUEST: Quality of Life in Essential Tremor Questionnaire; QUIP: Questionnaire for Impulsive-Compulsive Disorders in Parkinson's Disease; QUIP-RS: Questionnaire for Impulsive-Compulsive Disorders in Parkinson's Disease-Rating Scale; RDRS: Rush Dyskinesia Rating Scale; RSGE: Rating Scale for Gait Evaluation; SIT: Speech Intelligibility Test; SWS-Q: Stand Walk Sit Questionnaire; TEED: Total electrical energy delivered; TETRAS: Tremor Research Group Essential Tremor Rating Assessment scale; TSTH: Tremor score for the treated hand; TUG: Timed Up and Go Test; TW: Therapeutic Window; UDRS: Unified Dyskinesia Rating Scale; UPDRS: Unified Parkinson's Disease Rating Scale

[1]Volume citation was calculated on the basis of the number of studies investigating a particular device as a percentage of the total number of studies across the systematic reviews that evaluated the clinical endpoint.

Citations for Included CPG/Consensus Statements

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Appendix D. Citations for Included Systematic Reviews

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