

Clinical Highlights

PROGRESS: Directional or Omnidirectional Deep Brain Stimulation for Parkinson's Disease¹ (2019)

Schnitzler A, Mir P, Brodsky M, Verhagen L, Cheeran B, Karst E, Defresne F, Vesper J. "Directional or omnidirectional Deep Brain Stimulation for Parkinson's Disease: Results of a prospective blinded-comparison multi-centre study." Poster presented at: 3rd International Brain Stimulation Conference; February 27, 2019; Vancouver.

OVERVIEW

Three- and six-month results of post-market clinical follow-up study to characterize clinical performance of Abbott's St. Jude Medical Infinity™ DBS system with directional deep brain stimulation (DBS) leads.

KEY TAKEAWAYS

- Directional stimulation demonstrated superiority of therapeutic window (TW)
- Directional DBS required less amplitude to achieve equivalent therapeutic benefit
- Clinicians and subjects preferred directional stimulation over conventional (omnidirectional) stimulation when compared sequentially

STUDY SUMMARY

- An international, multicenter (37 sites, 7 countries), prospective, blinded-observer/blinded-subject, single-arm crossover study to evaluate clinical performance of directional DBS
- Subjects, who were blinded to stimulation type, received conventional stimulation for 0–3 months and then directional stimulation for 3–6 months. 6–12 month stimulation type programmed at clinician discretion
- Post-market study requirement was satisfied with n = 66 subjects
- Primary endpoint (3-month): Percentage of subjects with wider TW using directional stimulation compared to a performance goal (superiority > 60%)
- Secondary endpoints (3- and 6-month):
 - Percentage of subjects with a wider TW using directional stimulation must be > 40% to show non-inferiority
 - Comparison of Unified Parkinson Disease Rating Scale (UPDRS) part III motor exam at 3 months after using conventional stimulation vs. 6 months after switching to directional stimulation
- Descriptive endpoints:
 - Comparison of TW and therapeutic current strength (TCS) for directional stimulation versus conventional stimulation
 - Subject and clinician preference at 6 months

RESULTS

- Primary endpoint was achieved: 89.4% (59/66) of patients had wider TW with directional stimulation ($p < 0.001$) (Figure 1)
- 35% wider TW with directional stimulation ($p < 0.001$) (Figure 2)
- Both conventional and directional stimulation showed significant reduction in UPDRS III scores. No statistical difference between the two methods
- Clinicians preferred directional over conventional stimulation in 4X as many subjects (65.5%; 42/64) when compared sequentially:
 - 83% preference due to additional symptom relief, 7% due to side effect avoidance
- 2X as many subjects (52.4%; 33/63), who were blinded to stimulation type, preferred the directional over conventional stimulation option when compared sequentially
- *Post hoc* analysis:
 - 30% reduction in TCS to achieve meaningful therapeutic benefit with directional stimulation (Conventional: 1.70 [± 1.51]; Directional: 1.19 [± 1.34]) ($p < 0.001$) (Figure 3)
 - Single Segment Activation (SSA) produced wider TW than conventional stimulation in 84.8% subjects
 - Therapeutic window percentage (TW%) (ratio of TW to TCS) identifies electrodes that have relatively higher TW at lower TCS; directional stimulation allows for an additional 69% increase in TW percentage compared to conventional stimulation (Figure 4)

DISCUSSION

The ability to reduce TCS may offer additional longevity for a recharge-free system.² The TW%-based ranking, available in the Informity™ programming software, enables clinicians to identify electrodes that have relatively higher TW at lower TCS.

CONCLUSIONS

Directional stimulation offers superior TW compared to conventional stimulation, an important programming consideration in progressive diseases like Parkinson's disease. SSA achieved wider TW in 84.8% of subjects compared to conventional stimulation. This finding suggests the value of prioritizing screening single segments. Clinicians preferred directional stimulation in four times as many subjects and twice as many subjects preferred directional stimulation when compared sequentially.

SUPERIOR THERAPEUTIC WINDOW

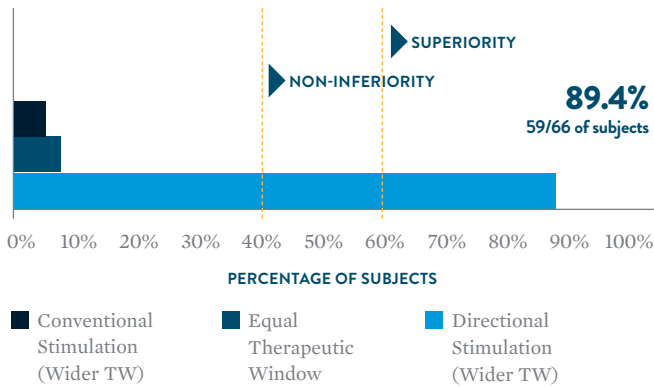


Figure 1: Percentage of patients that had (a) wider TW with conventional stimulation, (b) equal TW and (c) wider TW with directional stimulation. Both superiority (> 60%) and non-inferiority endpoint (> 40%) were achieved with directional stimulation ($p < 0.001$)

THERAPEUTIC WINDOW

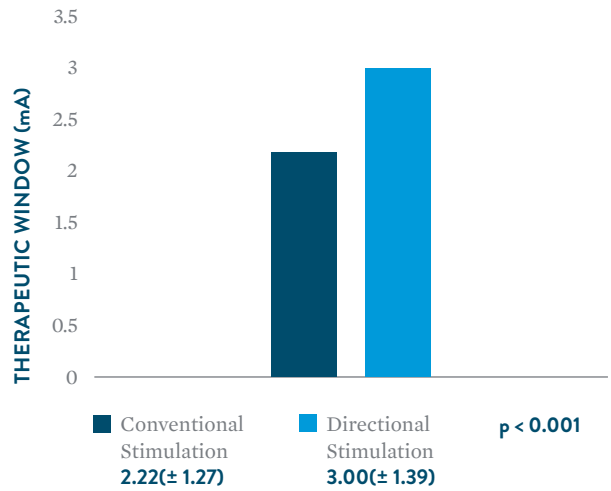


Figure 2: Comparison of TW between conventional and directional stimulation

REDUCTION IN STIMULATION AMPLITUDE

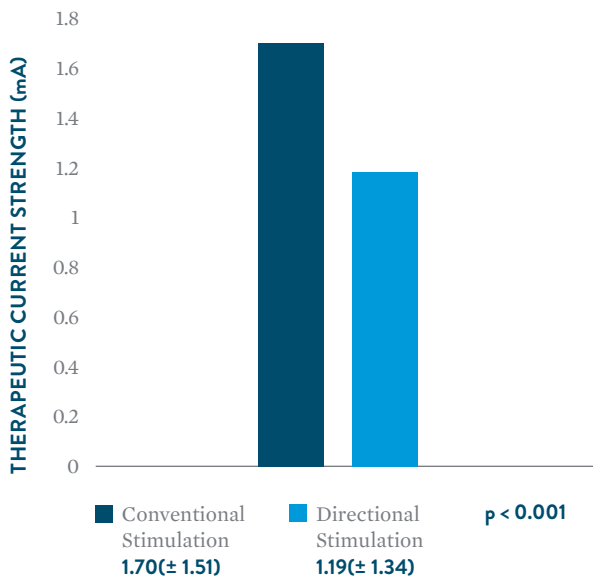


Figure 3: Comparison of TCS between conventional and directional stimulation

THERAPEUTIC WINDOW PERCENTAGE

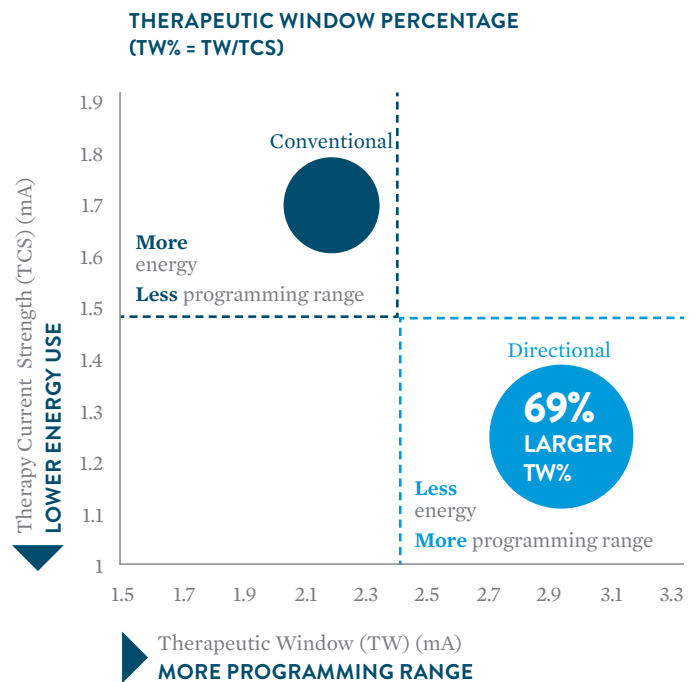


Figure 4: TW percentage based on mean TW as a percentage of mean TCS, between directional and conventional stimulation

Conventional Stimulation (TW: 2.22 ± 1.27; TCS: 1.70 ± 1.51)
 Directional Stimulation (TW: 2.94 ± 1.39; TCS: 1.22 ± 1.34)

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- Rebelo P, Green AL, Aziz TZ, Kent A, Schafer D, Venkatesan L, Cheeran B. Thalamic Directional Deep Brain Stimulation for Tremor: Spend less, get more. *Brain Stimulation*. 2018;11(3):600-606.

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Brief Summary: Prior to using these devices, please review the Instructions for Use for a complete listing of indications, contraindications, warnings, precautions, potential adverse events and directions for use.

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