Botulinum toxin (Botox) for prevention of hypertrophic scars: a WHAM evidence summary

Katrina Hulsdunk, RN, STN, P Grad Dip Wound, Ostomy and Continence Nurs
Curtin University, Curtin School of Nursing, Wound Healing and Management (WHAM) Collaborative

Emily Haesler, PhD, P Grad Dip Adv Nurs (Gerontics), BN, Fellow Wounds Australia
Adjunct Professor, Curtin University, Curtin School of Nursing, Wound Healing and Management (WHAM) Collaborative

For referencing Hulsdunk K, Haesler E for Wound Healing and Management (WHAM) Collaborative. Botulinum toxin (Botox) for prevention of hypertrophic scars: a WHAM evidence summary. Wound Practice and Research 2026;34(3):152-155.

DOI https://doi.org/10.33235/wpr.34.3.152-155

CLINICAL QUESTION

What is the best available evidence for the use of botulinum toxin type A (BoNT-A) in the prevention of hypertrophic scars?

SUMMARY

Hypertrophic scars are raised fibroproliferative scars that develop after aberrant wound healing and remain confined to the original wound boundaries, often causing cosmetic concerns, discomfort and functional problems. Botulinum toxin type A (BoNTA), commonly known as Botox, has been proposed as an adjunct intervention for hypertrophic scar prevention because it temporarily reduces muscle activity and wound-edge tension and may also influence inflammatory and fibroblast-mediated pathways involved in scar formation.

Level 1 evidence[1-5] indicates that BoNT-A administered at the time of wound closure or early post-operatively might reduce the severity of hypertrophic scarring, particularly in high-tension wounds and facial sites. BoNT-A might be associated with improved scar appearance, higher patient satisfaction, and minimal adverse events compared to placebo or no treatment.[1-5] However, the certainty of evidence is limited by small sample sizes, heterogeneity in dosing and administration, short follow-up periods and other methodological limitations.

CLINICAL PRACTICE RECOMMENDATIONS

All recommendations should be applied with consideration to the clinical presentation, the person, the health professional and the clinical context.

Botulinum toxin type A could be considered as an adjunct to standard wound closure techniques to prevent hypertrophic scarring, especially in high-risk wounds (e.g., facial or high-tension surgical wounds). Clinical decisions should consider preferences of the individual, scar location, and potential contraindications (Grade B).

SOURCES OF EVIDENCE

This summary was conducted using methods published by the Joanna Briggs Institute.[6-8] The summary is based on a systematic literature search combining search terms related to 'botulinum toxin', 'Botox', 'BoNT-A' 'hypertrophic scar', and 'prevention'. First, a preliminary search was conducted in PubMed to determine the volume and type of evidence available. This search identified a substantial number of systematic reviews. Next, a comprehensive search was made in Medline (Ovid), CINAHL, the Cochrane Library and Google Scholar published in English from 01 January 2015 until 31 October 2025.

BACKGROUND

Hypertrophic scars are raised, erythematous scars that remain within the boundaries of the original wound, resulting from excessive collagen deposition during wound healing. They typically develop within weeks to months after injury in response to wound tension or delayed remodelling and can improve over time. Genetic predisposition (familial history), previous history of scarring, wound tension, anatomical site and depth of injury are recognised risk factors for hypertrophic scar development. Hypertrophic scars are associated with pain, pruritus, cosmetic concerns, and functional impairment.[1-5, 9-13]

Table 1. Levels of evidence for included intervention studies included reporting on effectiveness of BoNT-A for hypertrophic scar prevention.

Level 1 evidence	Level 2 evidence	Level 3 evidence	Level 4 evidence	Level 5 evidence
Experimental designs	**Quasi-experimental designs**	**Observational – analytic designs**	**Observational – descriptive studies**	**Expert opinion/ bench research**
1.a Systematic review of RCTs[1-5]	Not eligible for inclusion	Not eligible for inclusion	Not eligible for inclusion	Not eligible for inclusion

BoNT-A, commonly known as Botox, is a neurotoxin produced by *Clostridium botulinum* that is widely used in cosmetic and therapeutic medicine. Its mechanism of action in scar management centres on the temporary paralysis of local muscles by blocking acetylcholine release at the neuromuscular junction, thereby reducing muscle contraction and tension at wound edges.[14-18] This reduction in mechanical tension is crucial because excessive movement can disrupt tissue repair and promote hypertrophic scar formation.[9, 13-18] Additionally, BoNT-A modulates fibroblast activity, decreases collagen production, and reduces the expression of inflammatory markers, all of which may contribute to improved scar outcomes.[9, 15, 17, 18]

CLINICAL EVIDENCE

The clinical evidence on BoNT-A for the prevention of hypertrophic scars comes from five meta-analyses of RCTs. All the reviews were at high risk of bias and most studies included in the reviews were at moderate or high risk of bias. There was substantial overlap in the primary studies included across the five reviews. Consequently, concordant findings across reviews should not be interpreted as independent confirmation of treatment effect. The studies that were pooled in the meta-analyses had small sample sizes and were heterogeneous, particularly with respect to dosing regimens and duration of therapy after which outcomes were measured. Most studies focused on facial or high-tension surgical wounds; evidence for other anatomical sites remains limited. Additionally, most of the studies included in the meta-analyses were designed as split-scar studies rather than comparing clearly independent study groups.

Efficacy in scar evaluation outcomes

Most of the reviews in this evidence summary reported the Vancouver Scar Score (VSS) as the primary outcome measure. The VSS is a four-component scar severity score that includes scar height, vascularity, pigmentation and pliability.[19] A higher score represents worse scarring.[19] In general, the included studies did not use and/or report standardised methods for evaluating these components. Nevertheless, the tool is demonstrated to have acceptable interrater reliability.[19] Other scar outcomes included scar width and quality.

A meta-analysis[2] at high risk of bias reported early postoperative BoNT-A injections (were associated with improved VSS (mean difference [MD] –1.18, 95% confidence interval [CI] –1.94 to –0.42, p = 0.001, 7 studies) compared to controls.[2] Treatment was administered from immediately after closure up to 14 days post-surgery. Across the studies, outcomes were measured at different time frames (from one to six months). The review also reported improved scar quality reported on a 10-point VAS compared to controls (MD 1.03, 95% CI 0.01 to 2.05, p < 0.0001)[2] *(Level 1).*

A meta-analysis[3] at high risk of bias found that BoNT-A was associated with lower scar severity score compared to standard treatment (MD –0.97, 95% CI –1.56 to –0.39, p = 0.001, 7 studies). This analysis pooled results from different scar severity assessment tools (the VSS and the Manchester Scale Score [MSS]), which might have influenced the result. Other scar appearance outcome measures also favoured BoNT-A including cosmetic appearance measured on a 10-point visual analogue scale (VAS, MD 1.26, 95% CI 1.04 to 1.47, p<0.00001, 8 studies) and scar width (MD –0.25 mm, 95% CI –0.37 to –0.12, p < 0.0001, 6 studies)[3] *(Level 1).*

A meta-analysis[5] at very high risk of bias found that compared with standard treatment BoNT-A was associated with improved reduction in scar width (weight mean difference [WMD] –0.41 mm, 95% CI –0.68 to –0.14, p = 0.003) and improved cosmetic appearance measure on a 10-point VAS scores (WMD 1.30, 95% CI 1.00 to 1.60, p < 0.00001).[5] The analysis on effect on scar width counted the same scars multiple times but from different angles, which is a serious limitation for this result *(Level 1).*

A meta-analysis[4] at high risk of bias found that BoNT-A was associated with better postoperative facial scar outcomes. Compared to controls, BoNT-A was associated with lower VSS scores (standardised mean difference [SMD] –0.64, 95% CI –1.03 to –0.25, p = 0.001, 7 studies). Scar width was also significantly smaller (MD –1.05 mm, 95% CI –1.27 to –0.83, p < 0.00001, 5 studies). Scores on both the Observer Scar Assessment Scale (OSAS; MD –0.83, 95% CI –1.33 to –0.34, p=0.001, 2 studies) and observer-rated cosmetic appearance rated on a 10-point VAS (MD 1.10, 95% CI 0.89 to 1.30, p<0.00001, 7 studies) were lower with BoNT-A compared to standard treatment. However, scores on the Patient Scar Assessment Scale (PSAS) did not differ (2 studies)[4] *(Level 1).*

A 2020 meta-analysis[1] at very high risk of bias reported that BoNT-A was associated with lower VSS scores compared with control groups receiving placebo (MD –1.24, 95% CI –2.22 to –0.26, p = 0.001, 5 studies). Scar width was also improved (MD –0.15 mm, 95% CI –0.26 to –0.04, p = 0.007, 4 studies), as was subjective cosmetic scar appearance rated on a 10-point VAS (MD 1.30, 95% CI 0.87 to 1.73, p<0.001, 5 studies)[1] *(Level 1).*

Patient satisfaction with treatment

In one meta-analysis[3] individuals treated with BoNT-A were about 3.4 times more likely to be satisfied with the treatment compared with standard treatment (relative risk [RR] 3.38, 95% CI 1.45 to 7.89, p=0.005, 5 studies). *(Level 1)*. BoNT-A was also associated with higher patient satisfaction (MD 1.51, 95% CI 1.13 to 1.89, p<0.00001, 2 studies) in a second meta-analysis[1] *(Level 1).* Although a third meta-analysis also reported improved patient satisfaction with BoNT-A compared to control (odds ratio [OR] 25.76, 95% CI 2.58 to 256.67, p = 0.006, 4 studies),[5] the estimate was highly imprecise and statistical heterogeneity was substantial *(Level 1)*.

Table 2. Meta-analyses reporting effectiveness of BoNT-A for hypertrophic scar prevention.

Study	Trials/ participants included in review	Anatomical focus	Follow-up/outcome measurement timeframe used in included studies	Effectiveness outcome measures
Mortada et al (2025)[2]	12 RCTs (n = 523 participants)	Mixed (predominantly facial)	• Outcome measurement was variably 1 month – 6 months across the studies	• VSS • Cosmetic appearance on a 10-point VAS • Scar width
Qiao et al (2021)[3]	17 RCTs (n = 633 participants)	Post-operative (predominantly facial)	• Predominantly 6 months, some for 12 months	• VSS and MSS • Cosmetic appearance on a 10-point VAS • Scar width • Patient satisfaction
Zhang et al (2016)[5]	9 RCT (n = 539 participants)	Face/neck	• 6-12 months	• Scar width • Cosmetic appearance on a 10-point VAS • Scar width • Patient satisfaction
Yue et al (2021)[4]	10 RCTs (n = 114 participants)	Facial	• At least six months for inclusion; predominantly 6 months and one was 12 months.	• VSS • Cosmetic appearance on a 10-point VAS • OSAS • PSAS • Scar width
Guo et al (2020)[1]	11 RCTs (n = 374 participants)	Face/neck	• Predominantly 6 months, some for 12 months	• VSS • Pain on VAS • Scar width • Patient satisfaction • Adverse events

CONSIDERATIONS FOR USE

- To receive optimal outcomes, BoNT-A is generally administered at wound closure or within the first two weeks post-operatively.[17]
- Optimal dosing varies by anatomical site and risk profile; higher doses may be needed for high-tension areas.[17]
- BoNT-A was generally well tolerated. Adverse events were generally mild and transient (e.g., local discomfort, mild weakness).[1-5]

FUNDING

The development of this evidence summary is supported by a grant from Curtin University School of Nursing.

CONFLICT OF INTEREST

The author declares no conflicts of interest in accordance with International Committee of Medical Journal Editors (ICMJE) standards.

ABOUT WHAM EVIDENCE SUMMARIES

Wound Healing and Management Collaborative (WHAM) evidence summaries are consistent with methodology published in Munn Z, Lockwood C, Moola S. *The development and use of evidence summaries for point of care information systems: A streamlined rapid review approach*, Worldviews Evid Based Nurs. 2015;12(3):131-8. Methods are provided in detail in resources published by the Joanna Briggs Institute as cited in this evidence summary and on the WHAM website. WHAM evidence summaries undergo peer-review by an international multidisciplinary Expert Reference Group. More information: https://www.whamwounds.com

WHAM evidence summaries provide a summary of the best available evidence on specific topics and make suggestions that can be used to inform clinical practice. Evidence contained within this summary should be evaluated by appropriately trained professionals with expertise in wound prevention and management, and the evidence should be considered in the context of the individual, the professional, the clinical setting and other relevant clinical information.

Copyright © 2026 Wound Healing and Management Collaborative, Curtin University.

REFERENCES

1. Guo X, Song G, Zhang D, Jin X. Efficacy of botulinum toxin type a in improving scar quality and wound healing: A systematic review and meta-analysis of randomized controlled trials. Aesthet Surg J, 2020. Apr 14;40(5):273-85.
2. Mortada H, Alowais FA, Alassaf H, al. e. Efficacy of botulinum toxin type A injections in improving hypertrophic scarring and keloid formation: A systematic review and meta-analysis of randomised controlled trials. J Cutan Aesthet Surg, 2025;18(3):161–74.
3. Qiao Z, Yang H, Jin L, Li S, Wang X. The efficacy and safety of botulinum toxin injections in preventing postoperative scars and improving scar quality: A systematic review and meta-analysis. Aesthetic Plast Surg, 2021. Oct;45(5):2350-62.
4. Yue S, Ju M, Su Z. A effect on postoperative facial scar prevention: systematic review and meta-analysis. Aesthetic Plast Surg, 2022. Feb;46(1):395-405.
5. Zhang DZ, Liu XY, Xiao WL, Xu YX. Botulinum toxin type A and the prevention of hypertrophic scars on the maxillofacial area and neck: A meta-analysis of randomized controlled trials. PLoS One, 2016;11(3):e0151627.
6. Aromataris E, Munn Z, editors. Joanna Briggs Institute Reviewer's Manual. https://reviewersmanual.joannabriggs.org/ The Joanna Briggs Institute; 2017.
7. Joanna Briggs Institute Levels of Evidence and Grades of Recommendation Working Party. New JBI Grades of Recommendation. Adelaide: Joanna Briggs Institute, 2013.
8. The Joanna Briggs Institute Levels of Evidence and Grades of Recommendation Working Party. Supporting Document for the Joanna Briggs Institute Levels of Evidence and Grades of Recommendation. www.joannabriggs.org: The Joanna Briggs Institute, 2014.
9. Fang X, Wang Y, Chen H, Yan Z, Jin S, Wu Y, Shu F, Xiao S. Hypertrophic scarring and keloids: Epidemiology, molecular pathogenesis, and therapeutic interventions. MedComm (2020), 2025. Oct;6(10):e70381.
10. Frech FS, Hernandez L, Urbonas R, Zaken GA, Dreyfuss I, Nouri K. Hypertrophic scars and keloids: Advances in treatment and review of established therapies. Am J Clin Dermatol, 2023. Mar;24(2):225-45.
11. Mony MP, Harmon KA, Hess R, Dorafshar AH, Shafikhani SH. An updated review of hypertrophic scarring. Cells, 2023. Feb 21;12(5).
12. Shirakami E, Yamakawa S, Hayashida K. Strategies to prevent hypertrophic scar formation: A review of therapeutic interventions based on molecular evidence. Burns Trauma, 2020;8:tkz003.
13. Tripathi S, Soni K, Agrawal P, Gour V, Mondal R, Soni V. Hypertrophic scars and keloids: A review and current treatment modalities. Biomedical Dermatology, 2020. 2020/05/20;4(1):11.
14. Bae DS, Koo DH, Kim JE, Cho JM, Park JO. Effect of botulinum toxin a on scar healing after thyroidectomy: A prospective double-blind randomized controlled trial. J Clin Med, 2020. Mar 21;9(3).
15. Baranowska A, Baranowska K, Czyżewski F, Filipek K, Kawka J, Maciek M, al. e. Botulinum toxin type A in scar treatment: Review article. Medical Science, 2024;28:e123ms3436.
16. Hussein RS. Botulinum neurotoxin BoNT-A in the management of hypertrophic scars and keloids: A comprehensive review. Int J Biomedicine, 2024;14(1):15-9.
17. Shi H, Zhang P, Zhang J, Sun J, Lv T. Dose-dependent effects of botulinum toxin type a on prevention of postoperative scars in various regions in the body: A prospective, double-blind randomized controlled trial. Aesthetic Plast Surg, 2025. Feb;49(3):862-74.
18. Tanous H, Karawita JA, Boueri M, Emmanuel N. Advances in botulinum toxin applications: Enhancing wound healing and optimizing scar management. Curr Dermatol Rep, 2025. 2025/03/25;14(1):11.
19. Baryza MJ, Baryza GA. The Vancouver Scar Scale: An administration tool and its interrater reliability. J Burn Care Rehabil, 1995. Sep-Oct;16(5):535-8.

CURTIN MEDICAL RESEARCH INSTITUTE | Curtin University