





natural inhibitors of MMPs. (23) Treatment of the AM with both lactoferrin and interleukin-1 receptor antagonists make the AM both anti-microbial and anti-inflammatory.(24) . In a study, Chorionic membranes were found to have an inhibitory effect on Hemolytic streptococcus group A, Staphylococcus aureus, Staphylococcus saprophyticus, Enterococcus faecalis, Escherichia coli, Pseudomonas aeruginosa, Acinetobacter calcoaceticus and Lactobacillus species.(25) Similar antimicrobial profile of chorion and amnion against several bacterial and fungal pathogens has been reported, although it was suggested that amnion has maximum activity. (26)

2. Revascularization and angiogenesis: Human amniotic membranes have been successfully used to treat chronic cutaneous wounds.(27,28) dHACM is a dehydrated human allograft comprised of laminated amnion and chorion membranes derived from the placenta. Treatment with dHACM allografts has also demonstrated improved healing in patients with a variety of additional wound types for which traditional therapies were ineffective, including venous leg ulcers, crush injury, arterial insufficiency, immunological skin disease/scleroderma, and snake bite.(29) In another study, RT-PCR shows the expression of pro-angiogenic factors such as Tie2, Ang1, VEGF, VEGFR, vWF, KDR and Flt4 in native AMMSCs. The results demonstrated that MSCs from an avascular amnion have a natural ability to initiate endothelialization and angiogenesis *in vitro*, suggesting an inherent propensity for promoting angiogenesis and could be an ideal choice in wound healing, stroke and ischemic diseases that require rapid vascularization and tissue restoration.(30) Chorionic villi has high vascular system characterized by maturation of luminized vessels from primitive haemangioblastic cords, and margination to a situation of peripherally located vessels.the increase number of peripheral vessels is required for the normal development mechanisms.(31). In another study, PURION® Processed and dehydrated human amnion/chorion membrane (dHACM) allograft has shown to contain a multitude of pro-angiogenic growth factors including PDGF-AA, PDGF-BB, PlGF, granulocyte colony-stimulating factor (GCSF), and VEGF, among others. It has also been demonstrated that dHACM grafts contain angiogenic growth factors retaining biological activity, promote amplification of angiogenic cues by inducing endothelial cell proliferation and migration and by upregulating production of endogenous angiogenic growth factors by endothelial cells; and support the formation of blood vessels *in vivo*. dHACM grafts are a promising wound care therapy with the potential to promote revascularization and tissue healing within poorly vascularized, non-healing wounds.(32)

3. Promotion of Epithelialization: Fetal membranes have been used for the management of skin burn, superficial wounds and for skin transplantation. Lately, the area of use has expanded to these fetal membranes being used as a graft or dressing in the reconstruction of the oral cavity, bladder, and vagina; tympanoplasty; arthroplasty and so forth. Amniotic membrane serves as a basement membrane which facilitates epithelial cell migration, reinforces adhesion of basal epithelial cells, promotes epithelial differentiation and prevents epithelial apoptosis.(33,34) Laminin isoforms,

present in the basement membrane, facilitate adhesion and expansion of corneal epithelial cells. The ability of the basement membrane of the amnion to support expansion of progenitor cells can explain application of AMT for treatment of partial limbal stem cell deficiency.(35) Good biocompatibility and mechanical properties like permeability, stability, elasticity, flexibility, plasticity, and resorbability also makes it a promising scaffolding material in tissue engineering as in cell adhesion and the potential for delivery of biomodulatory agents such as growth factors and genetic materials.(36,37)

#### 2.4 Uses of chorion and amniotic membranes in dentistry

The biological properties of amniotic and chorion membrane as antimicrobial, anti inflammatory, in promoting rapid vasculogenesis, epithelialization and above all an abundant source of stem cells has made these fetal tissues a suitable choice in the field of reconstructive and regenerative medicine. In the field of dentistry, these tissues find an application especially in Oral maxillofacial surgery and Periodontology. Antiinflammatory and antiscarring property of AM have shown decreased necrosis and rapid healing of ulcers with herpes simplex virus (HSV), varicella zoster virus–infected tissues, erythema multiforme major (Stevens-Johnson syndrome) and cervical necrotizing fasciitis.(38) HAM has been tried in the reconstruction of TMJ ankylosis as it prevents fibrosis and reankylosis when used as an interpositional material.(39) AM is even used as a carrier for local delivery of the various drugs like antibiotic netilmycin (NTM) and antiviral drugs like acyclovir (ACV) and trifluridine (40) Demineralized freeze dried bone allograft (DFDBA) and bovine derived xenogenic bone graft (BDX) [Bio-Oss] with amniotic membrane (AM) has been used as guided tissue regeneration (GTR) in the treatment of human periodontal Grade II buccal furcation defects. The clinical and radiographic parameters were recorded at baseline, 6 and 9 months. At 9 months after surgery, healing was uneventful. There was statistical significant gain in bone fill along with reduction in pocket depth and gain in clinical attachment levels. (41) Cryopreserved amniotic membrane (CAM) has been known to promote periodontal soft tissue healing and is also effective in helping cicatrization, wound healing, epithelialization, facilitated migration and reinforced adhesion.(42) Gurinsky demonstrated that the processed allograft amnion may provide an effective alternative to autograft tissue in the treatment of recession defects. (43) Similarly, many studies have reported the effectiveness of amnion membranes in root coverage and increase in thickness of gingival biotype. (44) A recent case report compares the effectiveness of amniotic membrane in comparison with Platelet-rich Fibrin (PrF) in bilaterally occurring multiple Millers class I recession. The clinical outcome of the surgical procedure accounted for 100% root coverage, an enhanced gingival biotype, with both the membranes. Furthermore, the results were stable even after seven months in the amniotic membrane-treated site.(45)

Chorion membrane, which is a rich source of various collagen and non-collagen proteins, such as laminin, fibronectin, and proteoglycans, has been used for root coverage and enhancement of thin gingival biotype to thick biotype.(46) Chorion membrane has extensive healing and

revascularization properties, and this has been proved in another study. The Chorion membrane covered by a modified coronally advanced flap, is a new approach that has shown promising results in terms of root coverage, increased width of keratinized tissue and thickness of the gingival biotype.(47) Chorion has also been assessed for its properties in treating periodontal infrabony pockets in severe periodontitis patients. Clinical parameters included gingival index (GI), plaque index (PI), pocket probing depth (PPD) and relative attachment level (RAL). Digital images were analysed for bone gain (BG) and density. Statistical significant differences were found at 12 months for GI, PI, PPD and RAL with increase in bone fill. (48)

Recently, second generation placental membrane- Bio-Xclude™ (Citagenix Inc.) has been developed from the amniotic sac that has anti-inflammatory properties and known to promote cell migration. It is available in convenient sizes, which requires minimal trimming and can be folded into any shape to cover the exposed roots. This membrane also does not require any suturing.

### 3. Conclusion

It can be concluded that placental tissues hold great promise in the clinical setting. The existence of various sources of the mesenchymal stem cells in these tissues presents an opportunity for the development of new therapeutic strategies. The properties of amnion and chorion as

### 8. Contribution details

	Study design	Manuscript preparation	Data collection	Revision of manuscript
Dr.Swati Gupta	✓	✓	✓	✓
Dr.Richa Gupta		✓	✓	✓

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antimicrobial, anti-inflammatory, promoting epithelialization and revascularization and most of all the mechanical properties of amnion makes these as an ideal scaffold for tissue engineering. However, despite the current knowledge indicating various possibilities of amnion in regenerative science, many questions still remain to be answered regarding the immunomodulatory and mechanical properties of chorion membrane. Further long term clinical trials and research is required to verify this hypothesis of placental tissues as the novel approach in regeneration in dentistry.

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