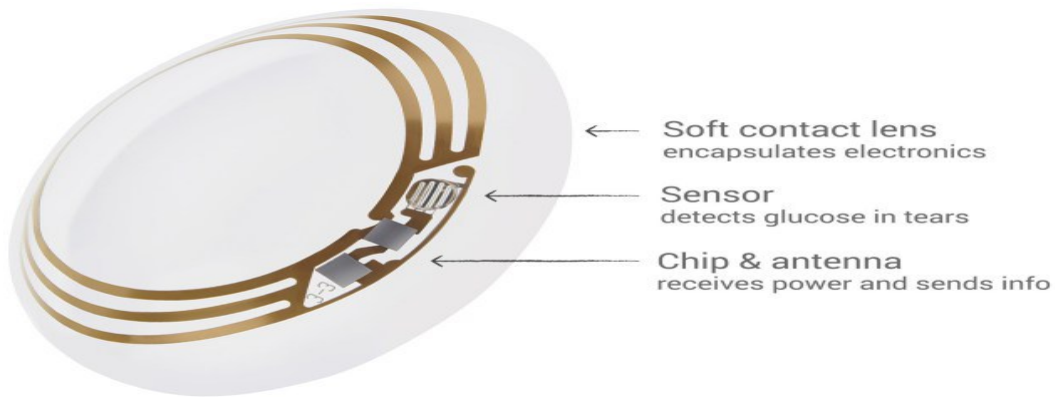


IIPRO

EXEMPLARY LANDSCAPE REPORT ON THERAPEUTIC CONTACT LENS (TCL)



Content

- 1) Introduction to Therapeutic Contact Lens (TCL)
- 2) Types of TCL
- 3) Applications of TCL
- 4) Growth Prospects of TCL
- 5) Assumptions for the Instant Landscape Analysis
- 6) Study Methodology and Modus-Operandi for Report
- 7) Graphical and Analytical Representation

Introduction-Therapeutic Contact Lens (TCL)

- **Definition**

- ✓ Lens used for treatment and management of non-refractive disorders of the eye

- **Aim of TCL**

- ✓ To maintain the Ocular tissue integrity;
- ✓ To provide an alternative to medicines and surgery;
- ✓ To relief of ocular pain

- **Materials Specific for TCL**

- ✓ Silicone
- ✓ Acrylamide
- ✓ HEMA
- ✓ Hydrogels

- **Applications**

- ✓ Mechanical protection & Support;
- ✓ Maintenance of lubrication in eye;
- ✓ Drug Delivery;
- ✓ Post-surgical management

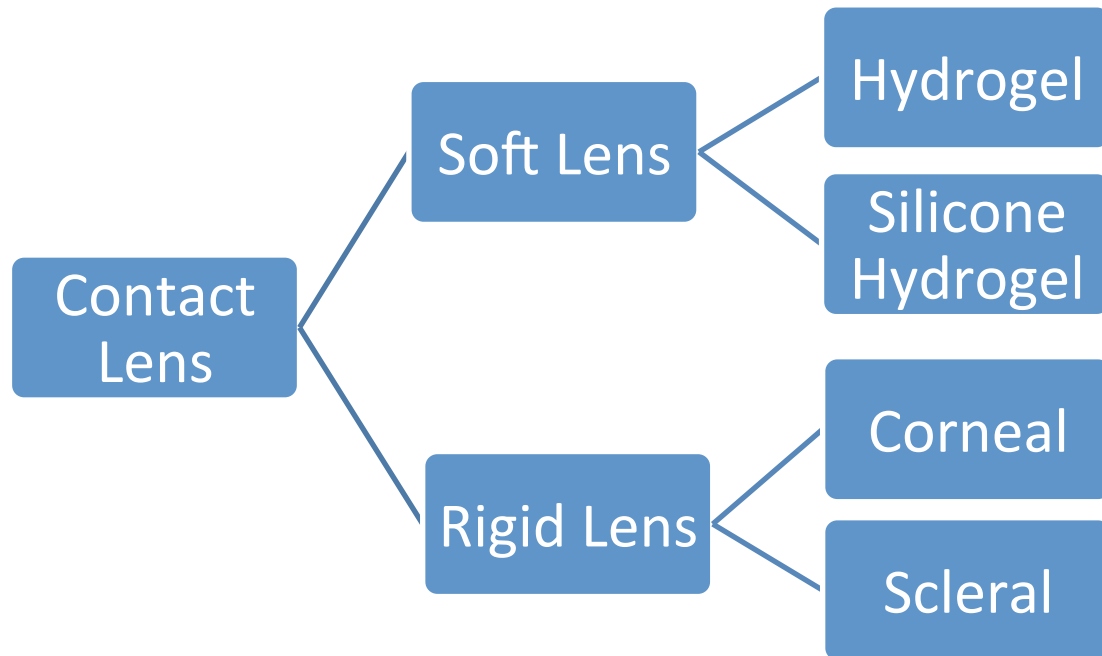
- **Drug Delivery**

- ✓ Various types of Drugs;
- ✓ Different target organs;
- ✓ Modified release parameter;
- ✓ Improves compliance of therapeutic regimes

- **Diagnostic Application**

- ✓ Detection of Glucose;
- ✓ Hypertension;
- ✓ Intraocular Pressure

Types of Therapeutic Contact Lens



Lens Type	Primary indications
1) Hydrogels	Pain relief
a) Thin mid water content with high bound water	● First choice incl. - irregular corneas, mild to moderate dry eye
b) Steep hydrogel lenses	● For steep corneas - standard disposable lenses too loose
c) Large hydrogel lenses	● For limbal or scleral defects and buphthalmos
2) Silicone hydrogels	For wound healing (persistent epithelial defects) apposition of wound edges, short term mechanical protection
3) Rigid gas permeable (RGP/Limbal)	Corneal protection, maintain corneal hydration, promotion of epithelial healing
4) Scleral	Mechanical protection of ocular surface, maintain corneal hydration

Image Courtesy: optometry.co.uk/uploads/articles

Applications of TCL

Relief from Pain

Promotion of Corneal Healing

Maintenance of Ocular Hydration

Vehicle for Drug Delivery

Diagnostic Purposes

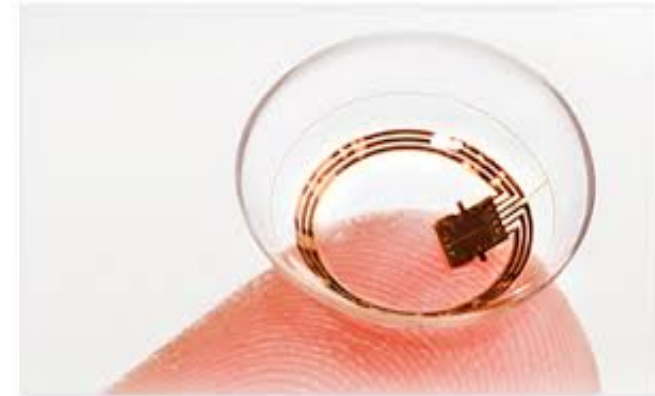


Image Courtesy: www.sensimed.ch

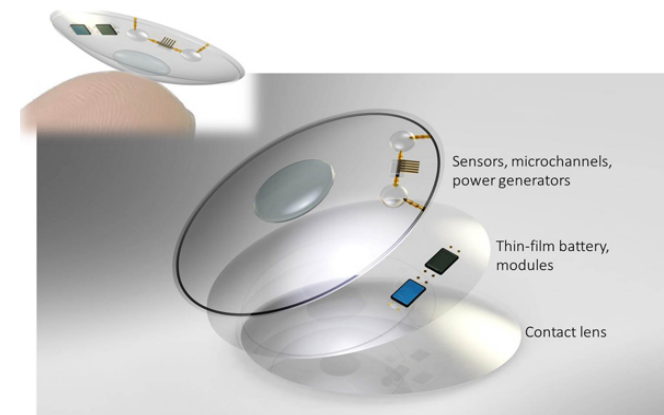


Image Courtesy: <http://koreajoongangdaily.joins.com/news/article/article.aspx?aid=2992517>

Applications of TCL- Recent Successes

- Field of contact lens drug delivery has begun a rapid pace of exploration and study. Researchers in the field have identified different material development strategies to extend release time of pharmaceuticals from these lenses.
- Surfaces of commercially available lenses can be modified so that they prevent rapid diffusion and loss of drug. Recent studies have investigated use of coatings or diffusion barriers, and have demonstrated success in decreasing release time of glaucoma, anaesthetic, and anti-inflammatory drugs from contact lenses.
- Modern soft and scleral RGP contact lenses are no longer thought of as just refractive devices. They are important tools to help medically manage anterior segment disorders also.
- Clinical trial of bandage contact lenses have commenced, wherein therapeutic devices that protect cornea and soothe dry eye, irritation, redness and light sensitivity suffered by many stem cell transplant patients are being implemented.
- Google and Novartis are into producing smart contact lens that contain a low power microchip and an almost invisible hair-thin electronic circuit. The lens would be able to measure diabetics' blood sugar levels directly from tear fluid on the surface of the eyeball. The system will send data to a mobile device to keep the individual informed.

Growth Prospects of TCL

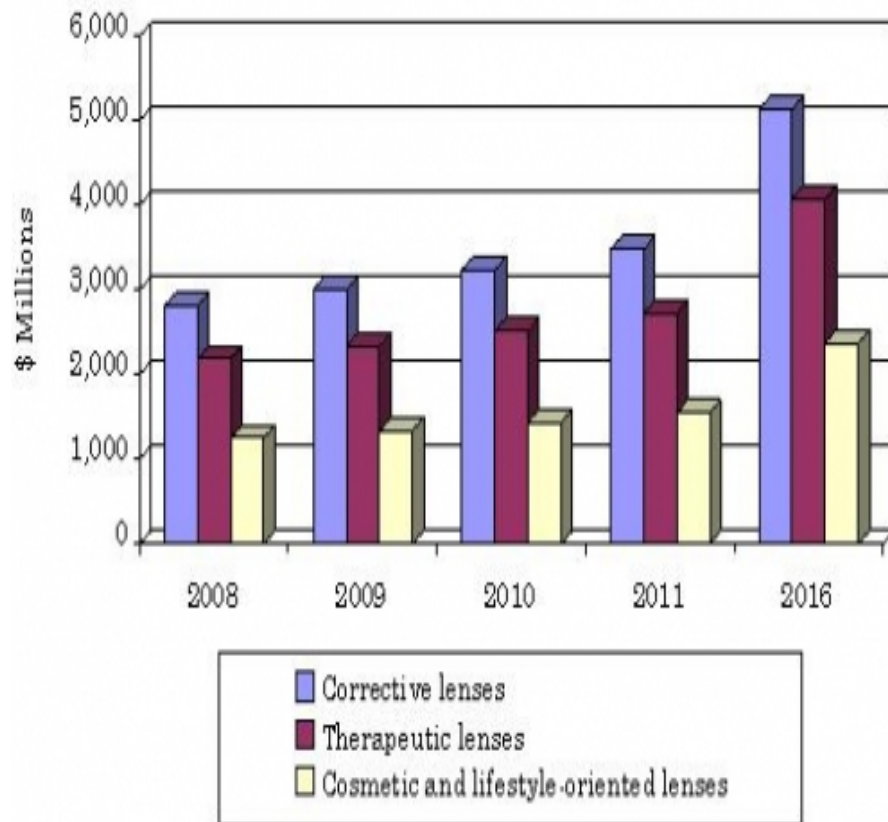
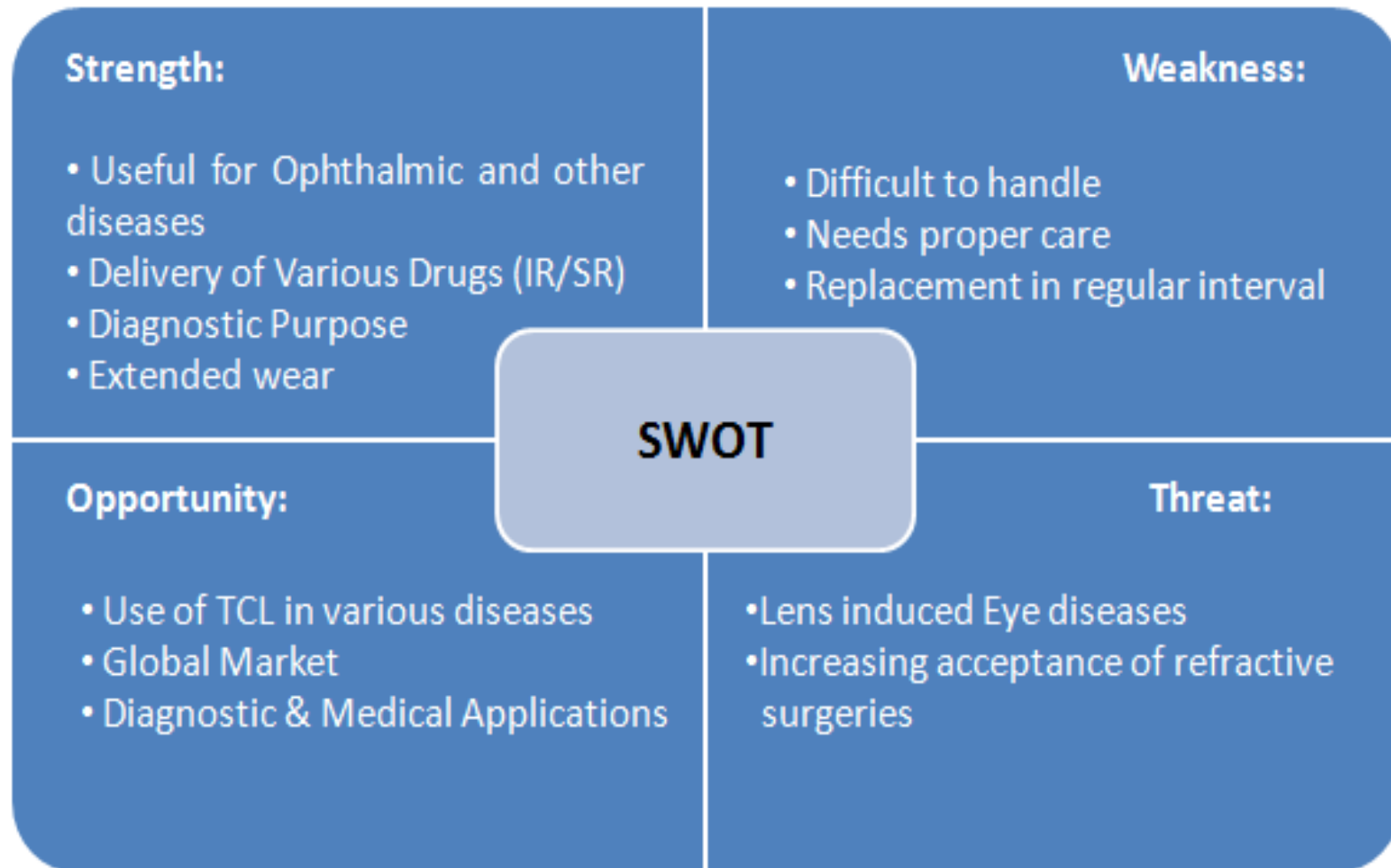


Image Courtesy: [http://www.bccresearch.com/pressroom/hlc/global-market-contact-lenses-reach-nearly-\\$11.6-billion-2016](http://www.bccresearch.com/pressroom/hlc/global-market-contact-lenses-reach-nearly-$11.6-billion-2016)

- Market for contact lenses can be broken down into three segments by lens type: corrective lenses, **therapeutic lenses**, and cosmetic and lifestyle-oriented lenses.
- Corrective lenses segment of the market, worth nearly \$3.5 billion in 2011, is expected to increase at a CAGR of 8.1% to reach \$5.1 billion in 2016.
- **Therapeutic lenses segment of the market**, worth \$2.7 billion in 2011, is expected to increase at a CAGR of 8.4% to reach nearly \$4.1 billion in 2016.
- Cosmetic and lifestyle-oriented lenses segment was valued at nearly \$1.6 billion in 2011 and, by 2016, that value should reach nearly \$2.4 billion, a CAGR of 8.9%.

SWOT Analysis of TCL



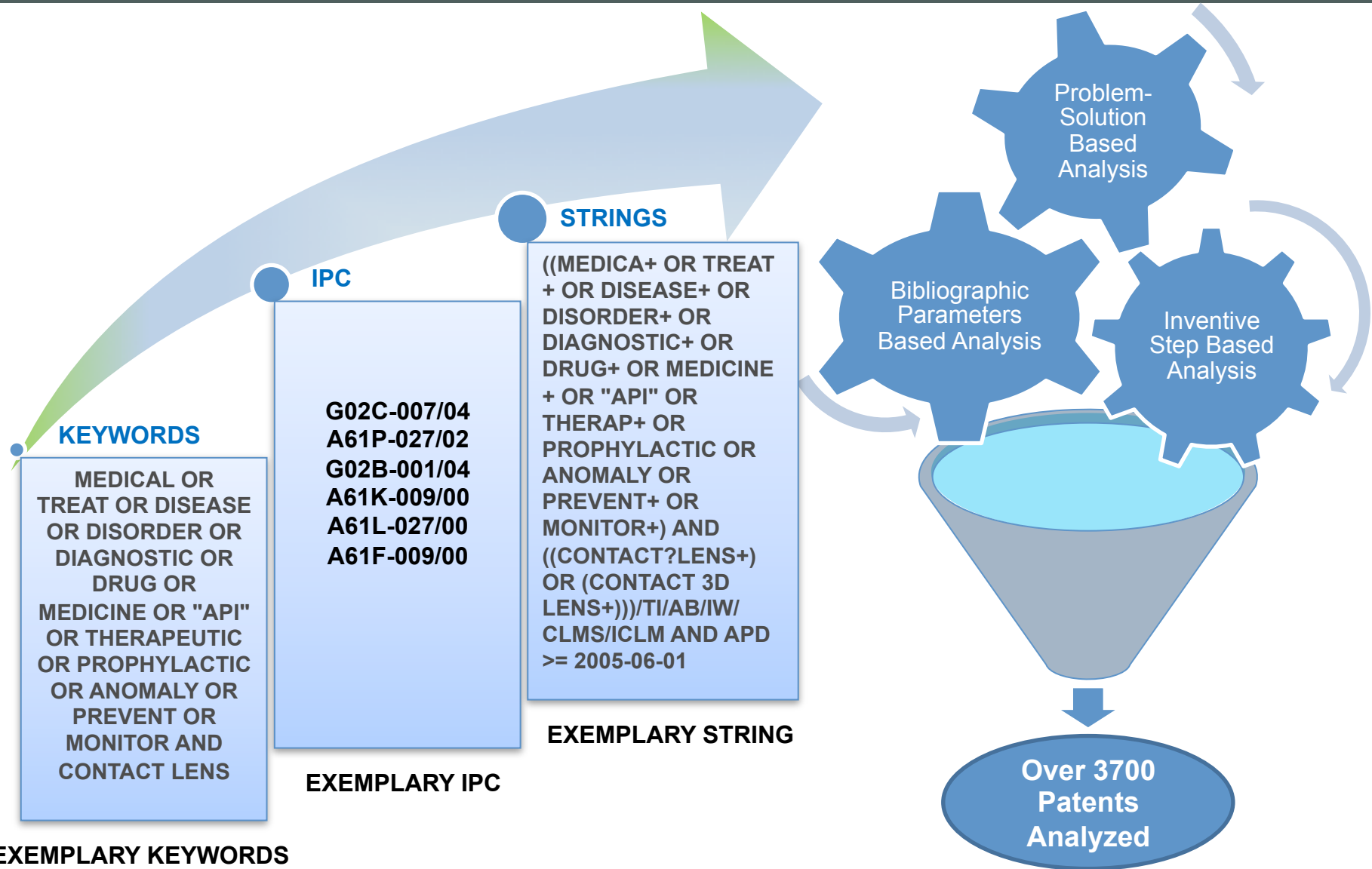
Objectives of the Landscape/Study

- To Understand technology and patent landscape
- To Understand major patent holders, geographical distribution of patents, top sub-technologies based on classification codes
- To Analyze of patent filing trends over the years, top assignees, top patent classifications, among others
- To Conduct problem-solution approach based study of patents relating to applications of TCL in medical field
- To Understand the materials used for preparation of TCL and various technologies used in contact lens

Assumptions

- Report provides patent analysis for Therapeutic Contact Lens (TCL) market, which includes study of manufacturing of TCL, Applications, and Advance Technology based patents
- Study was focused to find out patents pertaining to and solving prior art problems with respect to applications of TCL
- Study does not focus on patents pertaining to TCL in fields such as Cosmetic use, Vision correction, Colour lens, and have therefore not been analyzed part of the study

Snapshot of Working Methodology



Patent Filing Trend

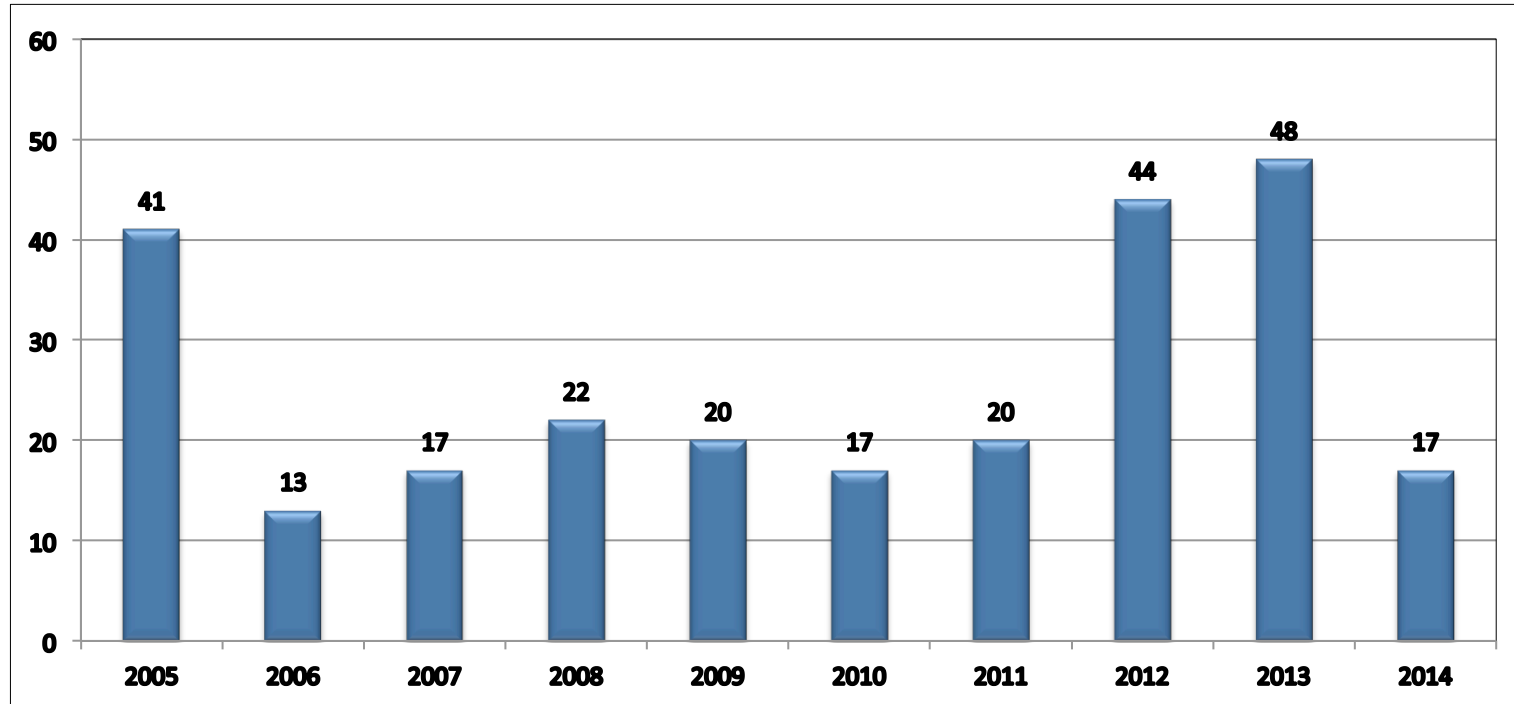


Exhibit 1. Patent Application Filing Trend For Last Ten Years

As evident from the above Exhibit 1, patent filing was highest in years 2012-2013 with 48 and 44 filings respectively. Further, patent filing activities were consistent from 2006 to 2011 with more than 17 patents per year, indicating consistent research work in the subject technical domain.

Geographical Filing Trend

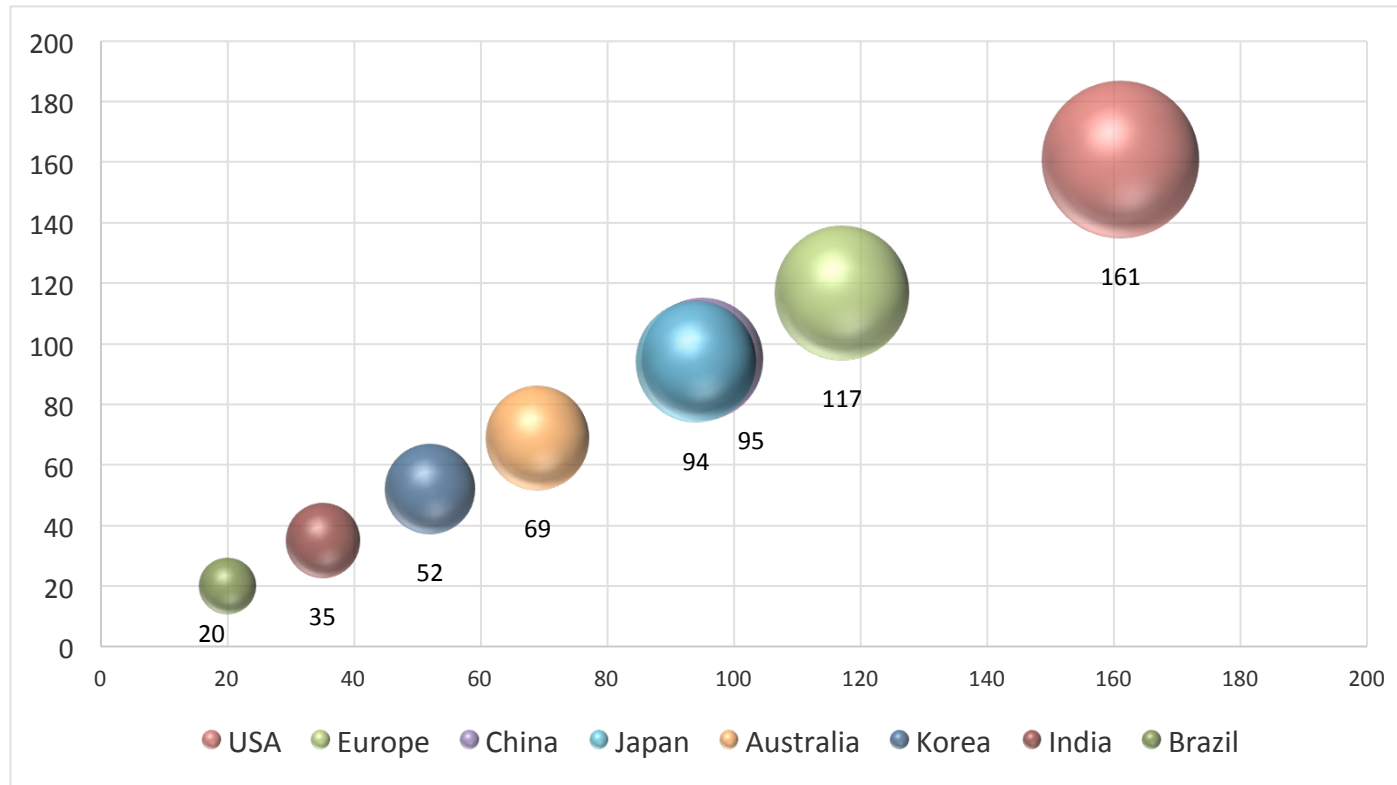


Exhibit 2. Geographical Filing Trend

Exhibit 2 shows global patent distribution and it is evident that geographical patent distribution is lead by US. US is the world leader in patent filing in Therapeutic Contact lens technology, followed by Europe & China.

Overall Top Assignees

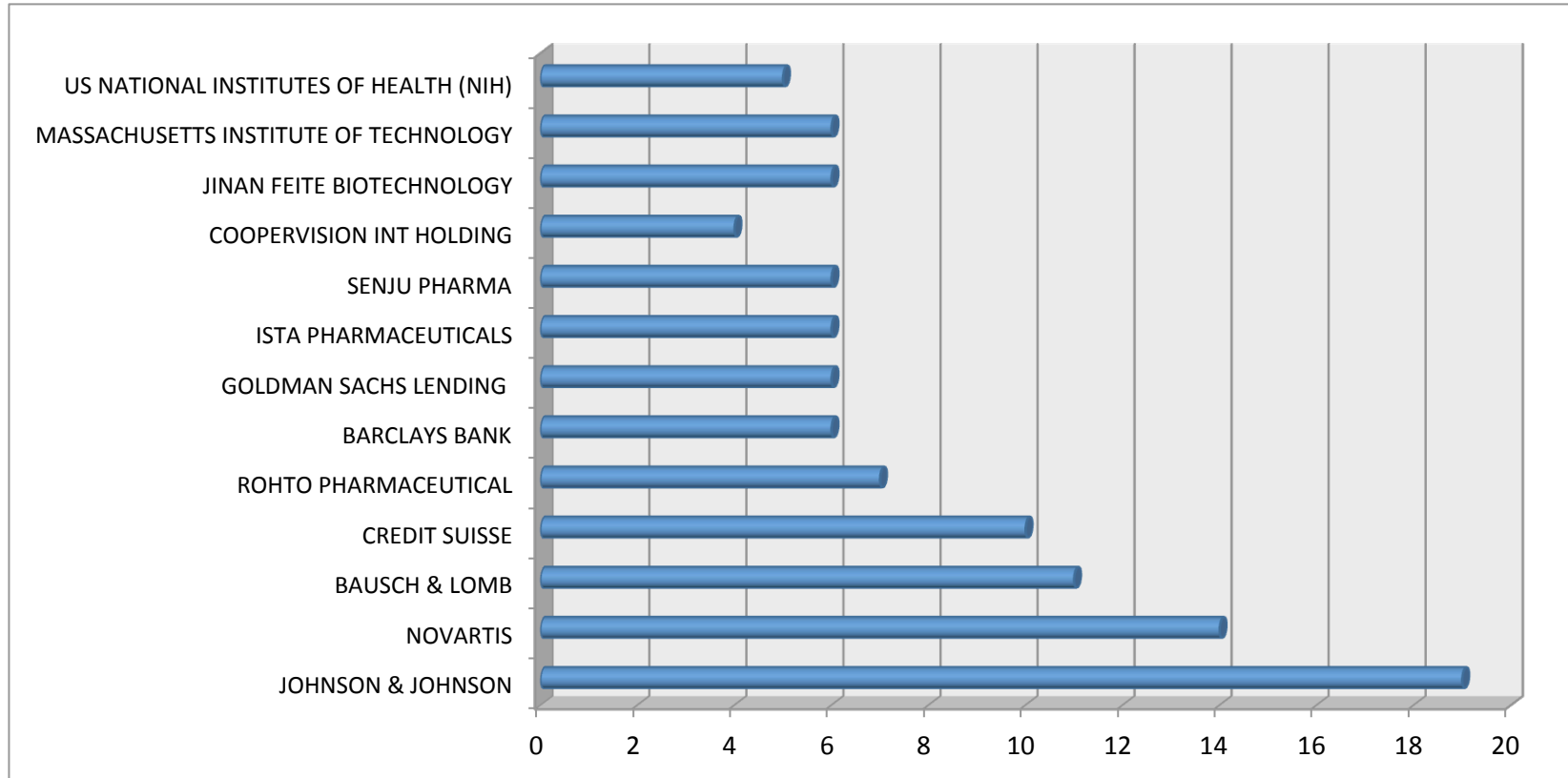


Exhibit 3. Top Patent Asset Holders

Exhibit 3 shows that Johnson & Johnson is among leading patent filers in Therapeutic Contact Lens technology. Novartis follows the leading patent filer and also has a significant patent portfolio.

Corporate Top Assignees

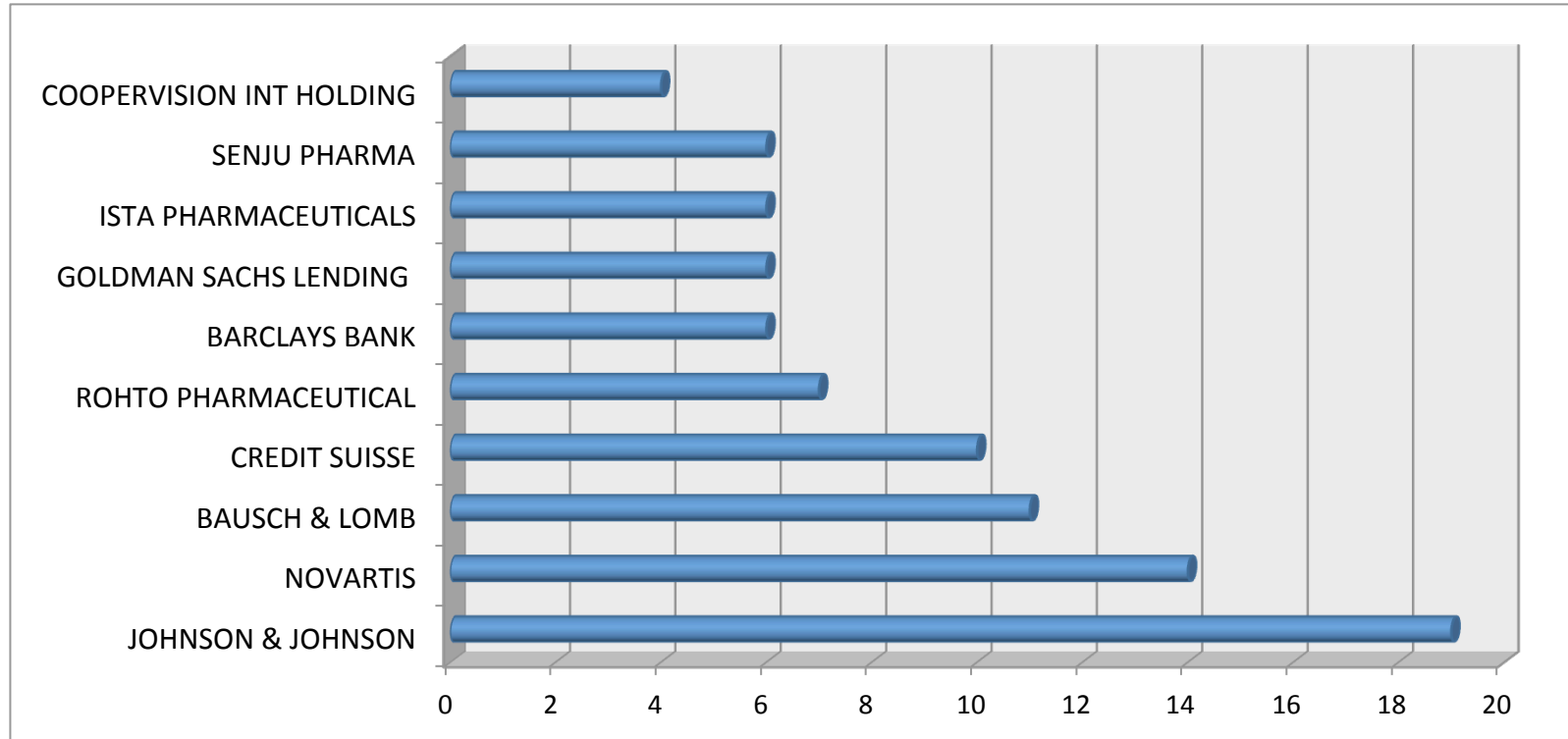


Exhibit 4. Top Corporate Patent Asset Holder

Exhibit 4 shows that Johnson & Johnson is among leading patent filer in Therapeutic contact Lens Technology. Novartis follows the leading patent filer and has significant patent portfolio.

Top Assignees v/s Last Ten Year Filing Trend

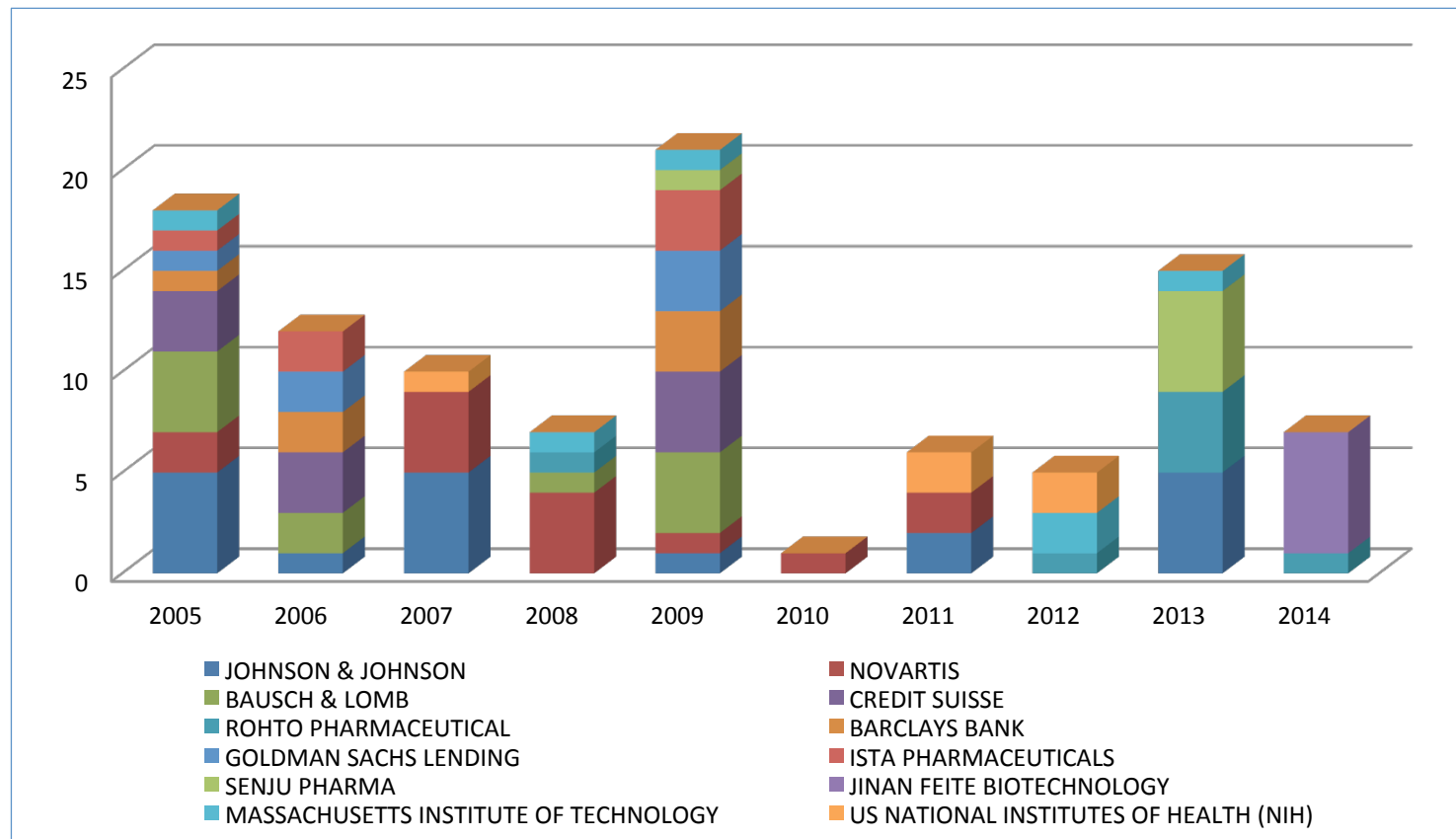


Exhibit 5. Top Assignee & Last Ten Years Filing Trend

Exhibit 5 shows last ten years filing trend for Top Assignees. It is evident from exhibit that patent filing activities were highest in the year of 2005 & 2009 respectively.

Top International Patent Classifications (IPCs)

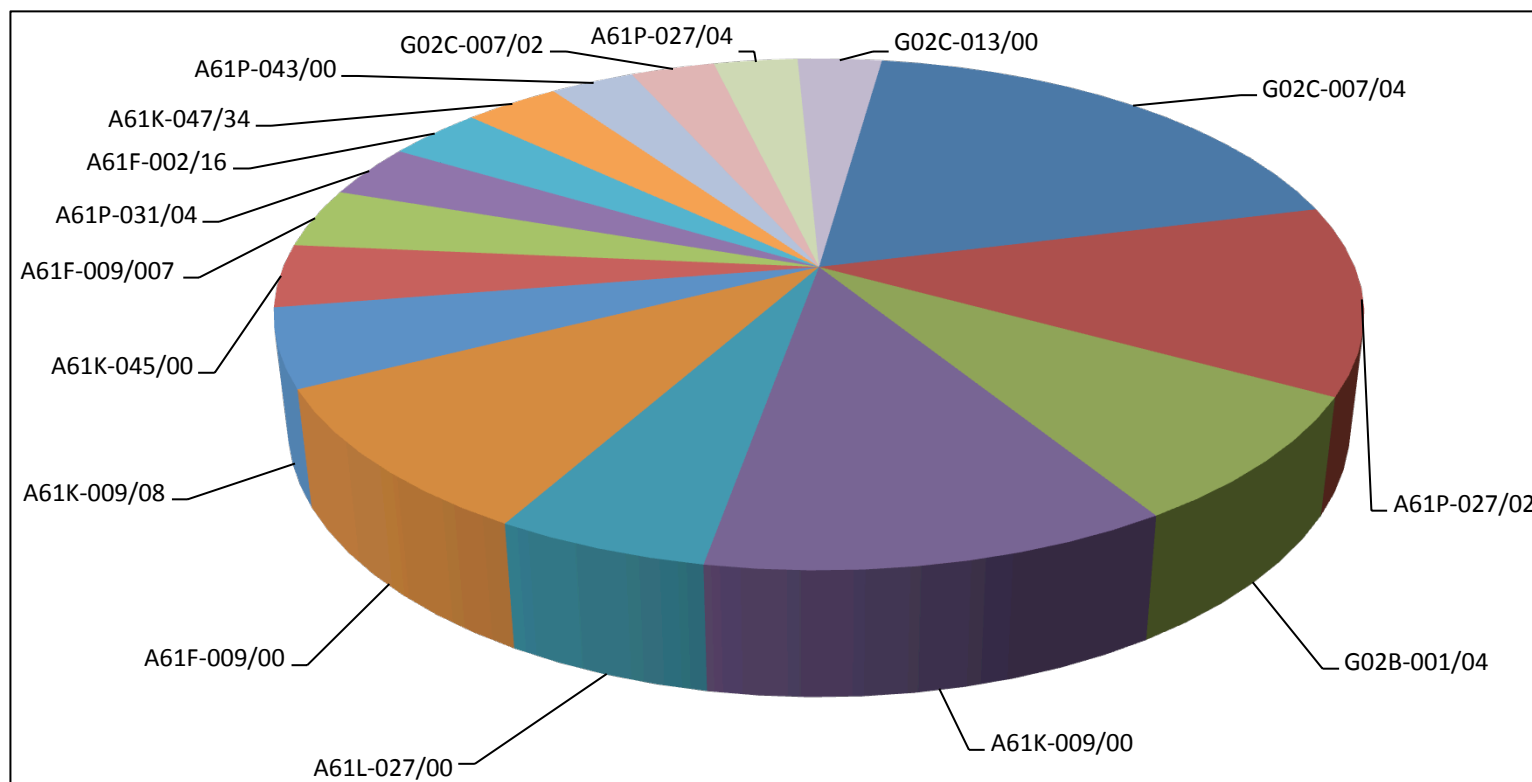


Exhibit 6. Top International Patent Classification

Exhibit 6 shows top international patent classification. It is evident from the Exhibit that classes G02C-007/04 and A61P-027/02 dominate the graph, followed by G02B-001/04 and A61K-009/00.

International Patent Classifications (IPCs) Definitions

IPC	Definition
G02C	Spectacles; Sunglasses or goggles insofar as they have the same features as spectacles; Contact lenses
G02C-007/04	Contact lenses for the eyes
G02B-001/04	Made of organic materials, e.g. plastics
A61K	Preparations for medical, dental, or toilet purposes
A61P-027/02	Ophthalmic agents
A61L-027/00	Materials for prostheses or for coating prostheses
A61F-009/00	Methods or devices for treatment of the eyes; Devices for putting in contact-lenses; Devices to correct squinting; Apparatus to guide the blind; Protective devices for the eyes, carried on the body or in the hand
A61K-009/00	Medicinal preparations characterised by special physical form
A61F-009/00	Methods or devices for treatment of the eyes; Devices for putting in contact-lenses; Devices to correct squinting; Apparatus to guide the blind; Protective devices for the eyes, carried on the body or in the hand
A61K-045/00	Medicinal preparations containing active ingredients

Exhibit 7. Top International Patent Classification with their Definitions

Claim Analysis

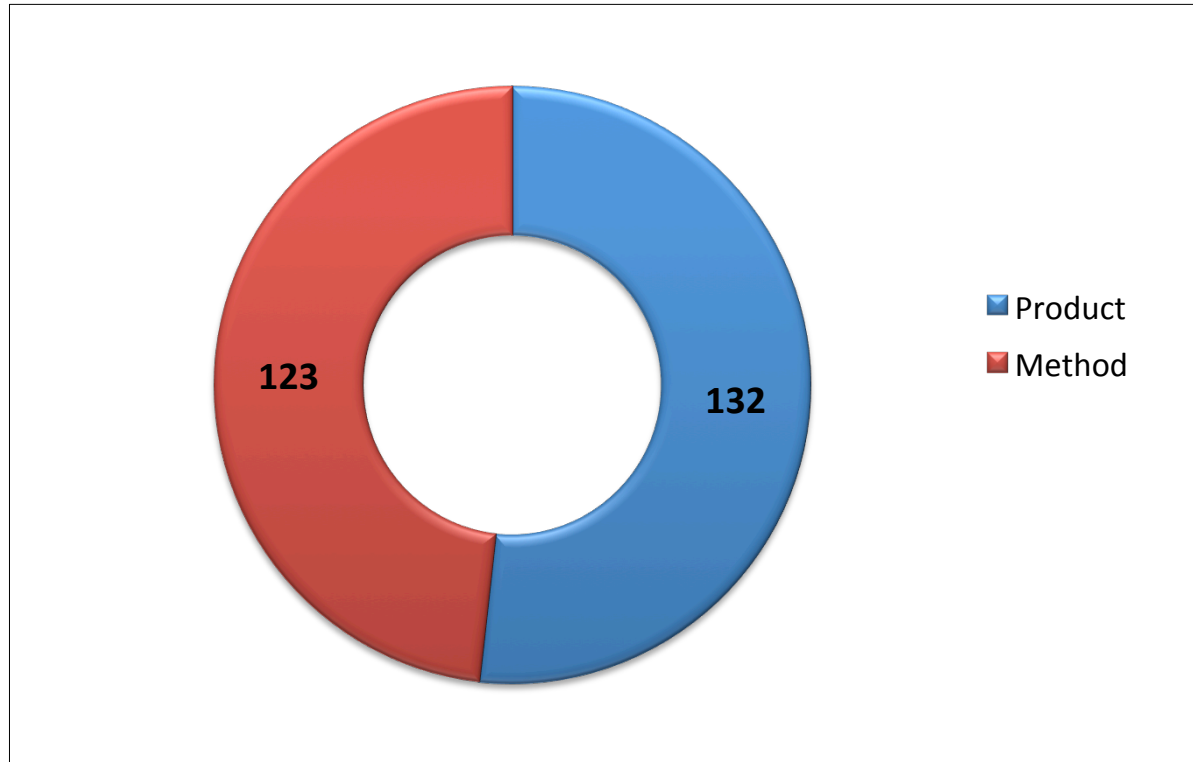


Exhibit 8. Categorized Distribution of Patents

Exhibit 8 shows patent distribution based on claims pertaining to Therapeutic Contact lens technology. The key focus in the patents has been on method claims with 132 patents in total. Further, 123 product claimed patent applications that have been filed during last ten years.

Top Assignee V/S Types of Patents

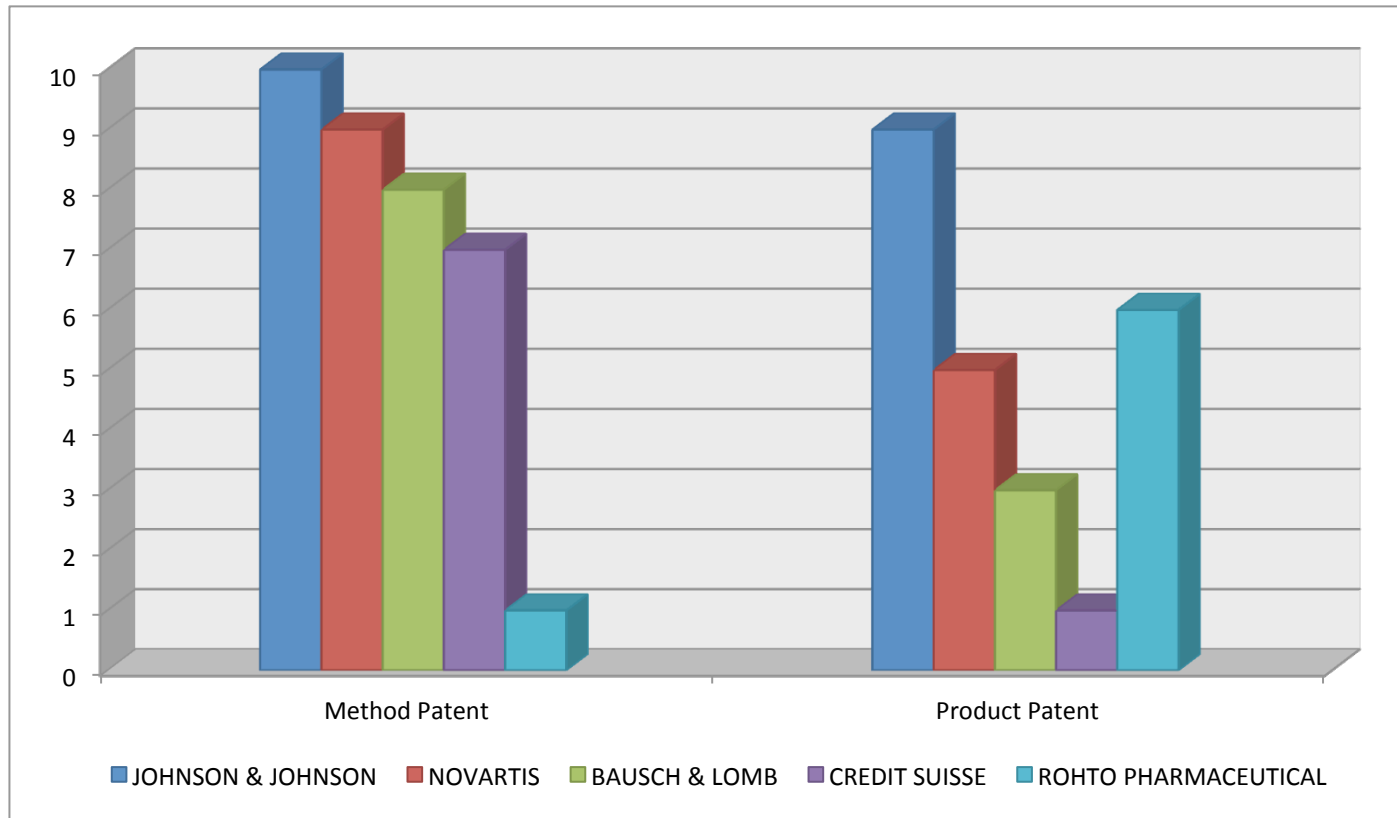


Exhibit 9. Categorized Distribution of Patents

As evident from Exhibit 9, all assignees are very active in filing for method claims in patent applications. Johnson & Johnson is leading assignee for method as well as product claimed applications.

Top materials for preparing TCL

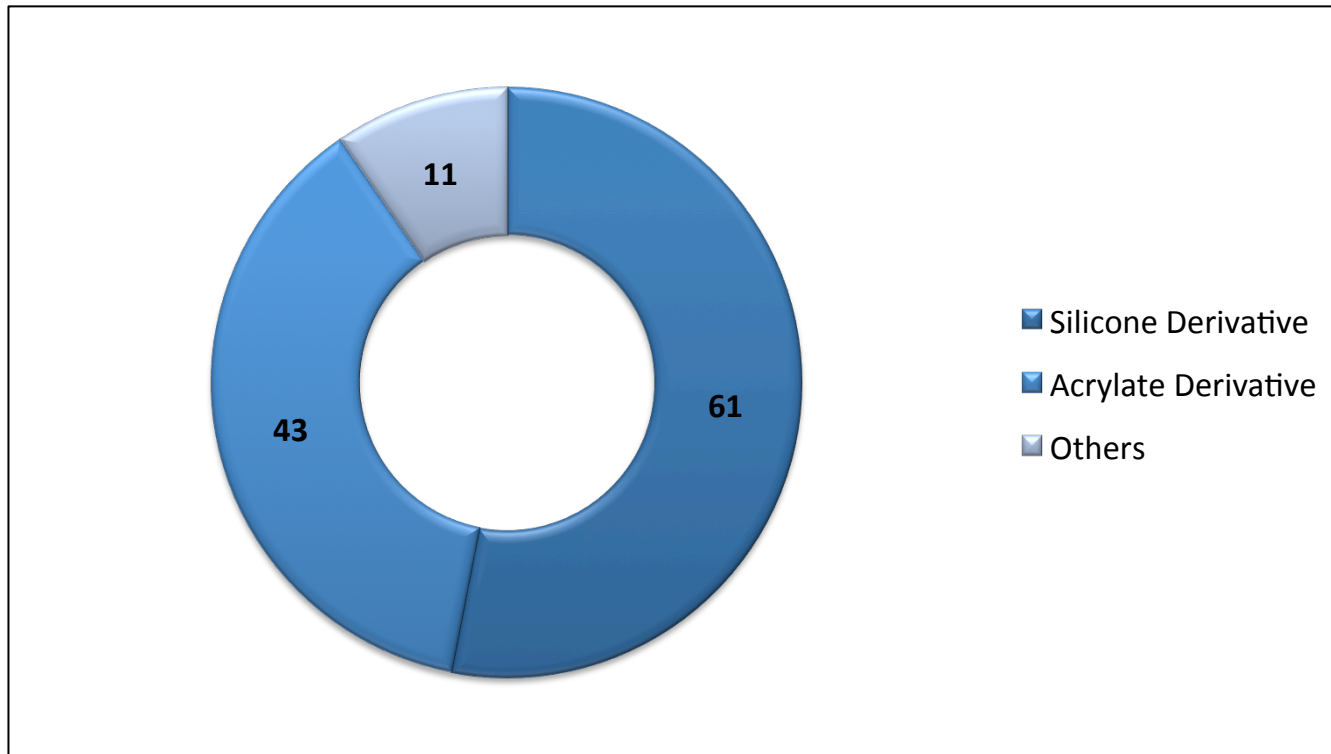


Exhibit 10. Top Materials for Preparing Contact lens

Exhibit 10 shows that Silicone derivatives are widely used materials for Therapeutic Contact Lens followed by Acrylate derivatives. Others such as Polystyrene, Fluorine, Polyamide are relatively lower for their application.

Categorized Distribution Of Patents based on Target organ

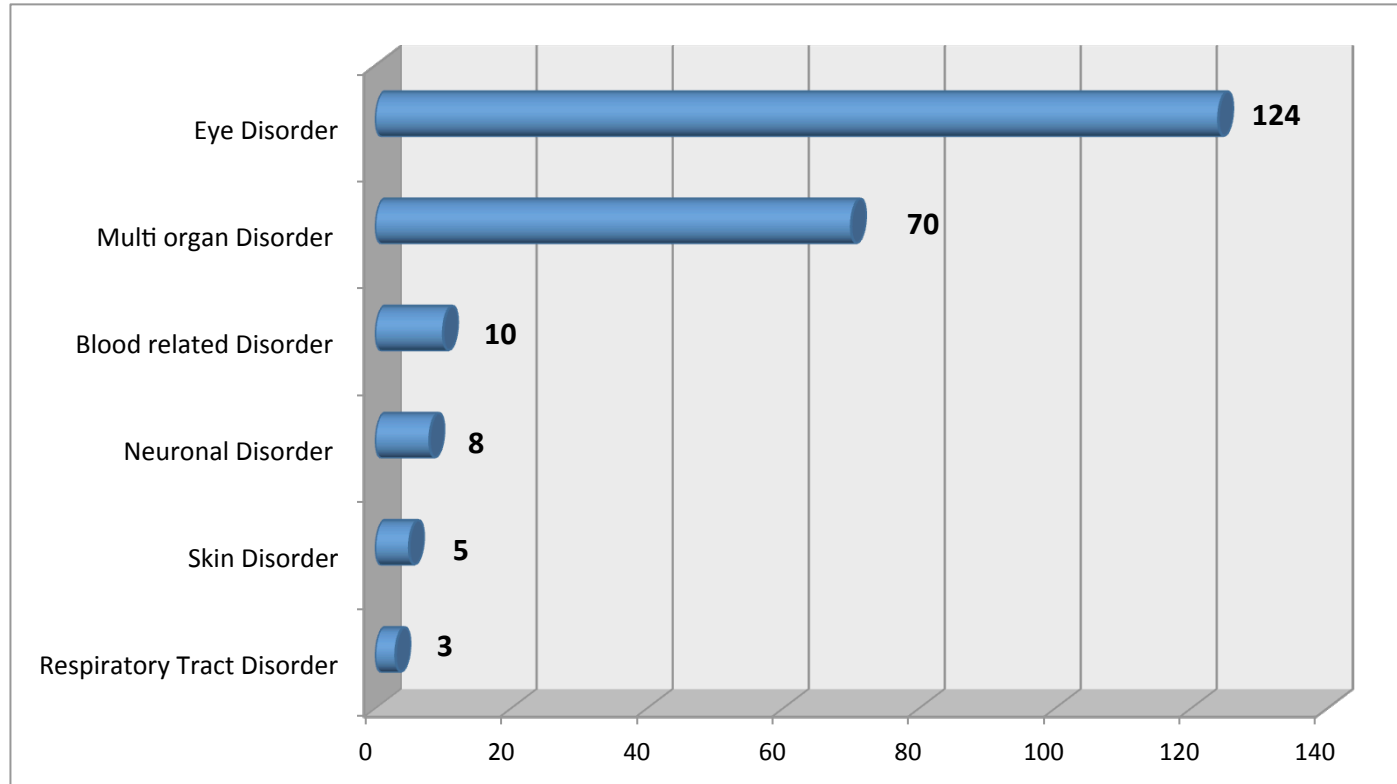


Exhibit 11. Categorized Distribution of Patents

Exhibit 11 displays patent distribution based on various target organs pertaining to Therapeutic Contact lens technology. Use of Lens for treating Eye disorder is most common area with 124 patents followed by treatment of Multi organ disorders having 70 patents.

Categorized Distribution of Patents based on Use of TCL

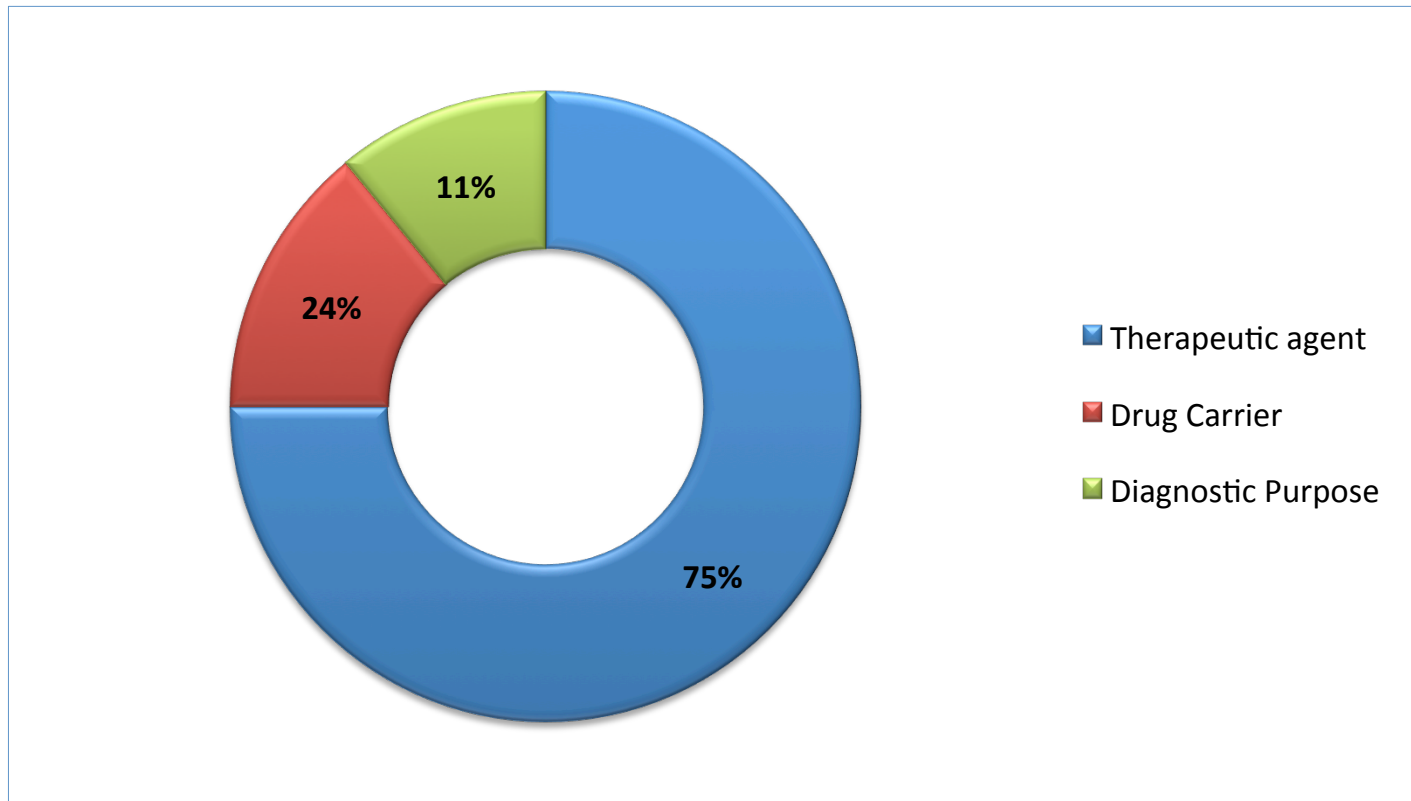


Exhibit 12. Use of TCL

Exhibit 12 displays category of patents based on major use of Therapeutic Contact lens. Contact lenses are mostly used as therapeutic agents in about 75% of patents.

Categorized distribution of Patents based on Medication Indication of TCL during 2013-14

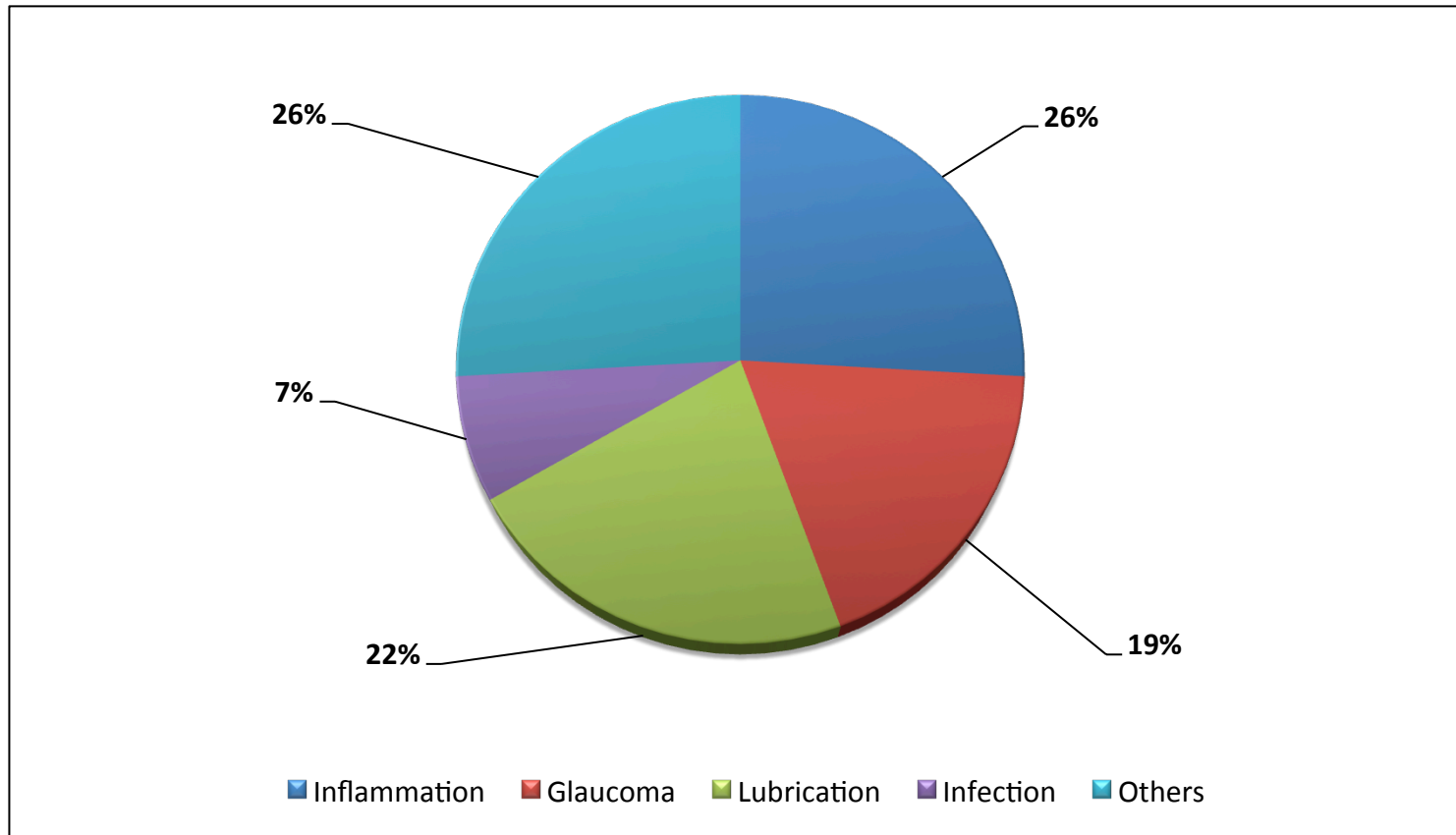


Exhibit 13. Medical Indications

Exhibit 13 displays category of patents based on medical use of Therapeutic Contact lens in last 2 years. Contact lens are mostly used for Inflammation and Lubrication purposes.

Exemplary Patents Using TCL as Therapeutic Agent

Patent No.	Title
WO2013158892	Thioredoxin protein inhibitors and uses thereof
EP2849749	Histatin for corneal wound healing and ocular surface disease
US20090324691	Methods and ophthalmic devices used in the treatment of ocular allergies
US20090318545	Mast cell inhibition in diseases of the retina and vitreous
US8388995	Controlled and extended delivery of hyaluronic acid and comfort molecules via a contact lens platform
US20120027812	Intraocular lenses treated with alkylphosphocholines for pharmacological after cataract prophylaxis
US8349352	Therapeutic contact lenses with anti-fungal delivery
US8404265	Contact lenses for extended release of bioactive agents containing diffusion attenuators
US20110202114	System and method for treatment of lens related disorders
US20050222085	Quaternised ammonium cyclodextrin compounds

Exhibit 14. Exemplary patents

Exhibit 14 displays exemplary patents describing use of contact lens as therapeutic agent



Exemplary Patents using TCL as Drug Carrier

Patent No.	Title
US20060216329	Drug delivery system and method
US8877705	Biomaterial for the controlled delivery of ingredients
US20100196435	Materials and methods for delivering compositions to selected tissues
US20060206173	Devices, Methods and Kits for Radiation Treatment via a Target Body Surface
US20040096477	Ophthalmic drug delivery system
US20060216328	Topical composition comprising a cyclofructan, a carrier and a drug
US20030219909	Materials containing multiple layers of vesicles
CN203389001U	Posterior eye segment transcleral controlled-release administration apparatus
US20100315588	Biomedical devices
CN102344523	Preparation method of hydrogel for drug-loaded contact lens

Exhibit 15. Exemplary Patents

Exhibit 15 shows exemplary patents describing contact lens as Drug Carrier.

Exemplary Patents Using TCL as Diagnostic Agent

Patent No.	Title
US20120177576	Optical device and method for non-invasive real-time testing of blood sugar levels
US8334140	Boronate complex and its use in a glucose sensor
US20110288395	Pressure Measurement Device
US8061843	Diagnostic and corrective apparatus and method
WO201474477	Magnetic contact lenses and methods of treatment and diagnosis using the same
US7998412	Ophthalmic device comprising a holographic sensor
US7478910	Liquid diagnostic contact lens
WO2014186368	Ophthalmic lens with a microfluidic system
EP1565750	Methods and kits for assays of rapid screening of diabetes
CN102798619	Kit for rapidly detecting diabetes mellitus by using human tears

Exhibit 16. Exemplary Patents

Exhibit 16 shows exemplary patents describing contact lens as Diagnostic agent

Study of the Novel Features in Granted Patents (1/2)

Patent No.	Assignee	Novelty/Inventive Step in Patent
US8979271	Google	A sensor to sense a biological feature and to provide a sensor output indicative of a sensed value of the biological feature; and a compensation circuit disposed on or within the substrate comprises a temperature component configured to sense the temperature of the sensor.
US8821811	Google	A housing configured to hold one or more contact lenses; and a testing component disposed within the housing that is configured to test for presence of one or more biomarkers bound to one or more receptors
US8568626	Novartis	A method for making a silicone hydrogel contact lens, comprising a step of: polymerizing a prepolymer mixture in a lens mold in an atmosphere having less than about 10000 ppm oxygen to form a silicone hydrogel contact lens suitable for extended wear wherein the prepolymer mixture comprises (a) at least one oxyperm material which is a siloxane-containing macromer or monomer; (b) at least one ionoperm material and (c) a cross-linking agent
US6951894	Novartis	An extended wear contact lens comprising a core polymeric material material having an oxygen permeability equal to or greater than 77 barrers; wherein said surfaces are hydrophilically modified by a treatment process; and wherein said extended wear contact lens can be continuously worn for at least four days on a human eye without substantial corneal swelling
US8784867	Novartis	A method for preparing a contact lens, comprising the steps of immersing the contact lens in a solution containing a carotenoid and a vitamin E material; for a period of time sufficient to load a desired amount of a carotenoid and a vitamin E material; and autoclaving the contact to sterilize the contact lens, wherein the contact lens has a lower oxidative degradation of carotenoids during lens autoclave and/or lens storage by at least about 30% in comparison to an identical contact lens without the vitamin E material

Exhibit 17. Exemplary patents

Exhibit 17 displays exemplary patents describing novel features in granted patents.

Study of the Possible Novel Features in Granted Patents (2/2)

Patent No.	Assignee	Novelty/Inventive Step in Patent
US8865685	JOHNSON & JOHNSON	Composition comprising: an ester of an anti-inflammatory lipid mediator comprising about 0.025 to 5.0% of alpha-linolenic acid inositol ester; and an aqueous delivery system; wherein the ophthalmic composition is suitable for administration to the eye or ocular environment and is substantially free from an acid form of the anti-inflammatory lipid mediator
US8940318	SENJU PHARMA	The amount of initial release in a time period of about 4 hours after the start of wearing the hydrogel contact lens is not more than 50% of the dose of the anionic drug contained in the hydrogel contact lens, and not less than 80% of the dose of the anionic drug contained in the hydrogel contact lens is released at least in 14 hours after the start of wearing the hydrogel contact lens
US8043369	BAUSCH & LOMB	A siloxane-containing homopolymer comprising a thio carbonyl thio fragments of a RAFT agent; and (b) a hydrophilic monomer
US8133960	BAUSCH & LOMB	A biomedical device comprising a polymerization product of a mixture comprising a random copolymer comprising hydrophilic units and hydrophobic units, wherein the random copolymer has at least one thio carbonyl thio fragment of a reversible addition fragmentation chain transfer ("RAFT") agent
US8083348	BAUSCH & LOMB	A biomedical device which is a polymerization product of a mixture comprising an ethylenically unsaturated-containing non-amphiphilic macromonomer reversible addition fragmentation chain transfer agent and a biomedical device-forming comonomer

Exhibit 18. Exemplary Patents

Exhibit 18 displays exemplary patents describing novel features in granted patents.

Exemplary/Indicative Product to Patent Mapping

Applicant	Products with Description	
Novartis Ag	1.	FOCUS® DAILIES® Toric is available in a toric design and is used for the treatment of astigmatism
	2.	DAILIES® AquaComfort Plus® Toric is available in a toric design and is used for the treatment of astigmatism

Patent No: US7625085
Publication Date: 1 Dec 2009
Inventors: Ming Ye, Curtis Dean McKenney
Cited portion and analysis :

Cited portion:
[Col.1, Lines-8-12]
TECHNICAL FIELD
 The present invention relates generally to the field of ophthalmic lenses and, more particularly, to toric contact lenses for correcting for astigmatism.

Analysis:
 The invention of US8215771, which allows manufacturing of contact lenses with toric design for the treatment of astigmatism, may be useful in FOCUS® DAILIES® toric and DAILIES® AquaComfort Plus® toric available from (Alcon) Novartis Ag.

Exhibit 19. Product to Patent Mapping

Exhibit 19 shows exemplary product to patent mapping for US 7625085.



Exemplary/Indicative Product to Patent Mapping

Applicant	Products with Description	
Johnson & Johnson Vision Care, Inc.	1.	ACUVUE® OASYS™ having UV blocking feature
	2.	ACUVUE® ADVANCE™ having UV blocking feature

Patent No.: US7364291

Publication Date: 29 Apr 2008

Inventors: James W. Haywood, Larry G. Jones, Jerry W. Dukes

Cited portion and analysis :

Cited portion:

Claim 1:

A contact lens, comprising an optic zone having a central circular area and first, second, third, fourth, fifth and sixth concentric rings there around, wherein the central circular area and second, fourth, and sixth rings are capable of substantially blocking the transmittance of UV light, blue light, or both.

Analysis:

The invention of US7364291, which allows manufacturing of contact lenses with UV absorbing capacity, may be useful for use in ACUVUE® OASYS™ and ACUVUE® ADVANCE™ available from Johnson & Johnson Vision Care, Inc.

Exhibit 20. Product to Patent Mapping

Exhibit 20 displays exemplary product to patent mapping for US 7364291



Disclaimer

IIPRD has prepared this sample report as an exemplary report, wherein the content of the report is based on an internal evaluation of Patents and Non-Patent Literature that is conducted based on Databases and Information sources that are believed to be reliable by IIPRD. A complete list of patent documents retrieved is not disclosed herein as the report is exemplary, but can be shared if desired based on terms and conditions of IIPRD. IIPRD disclaims all warranties as to the accuracy, completeness or adequacy of such information. The above sample report is prepared based on the search conducted on the keywords and other information extracted from the understanding of the Patent Analysts of IIPRD, and subjectivity of the researcher and analyst. Neither IIPRD nor its affiliates nor any of its proprietors, employees (together, "personnel") are intending to provide legal advice in this matter.



Summary

- This presentation has categories and graphical representations of research trends around therapeutic contact lens and processes involved and its applications from various perspectives and highlights the key companies involved.
- Further, growth prospects of TCL have been included, wherein the market analysis (in terms of growth percentage rate over time) is shown.
- Analysis and representation of data of the major patent holders, geographical distribution of patents, top sub technologies based on the international patent classification code, claim analysis among others.
- Also, study of possible novel features in granted patents and indicative product to patent mapping has been included.

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